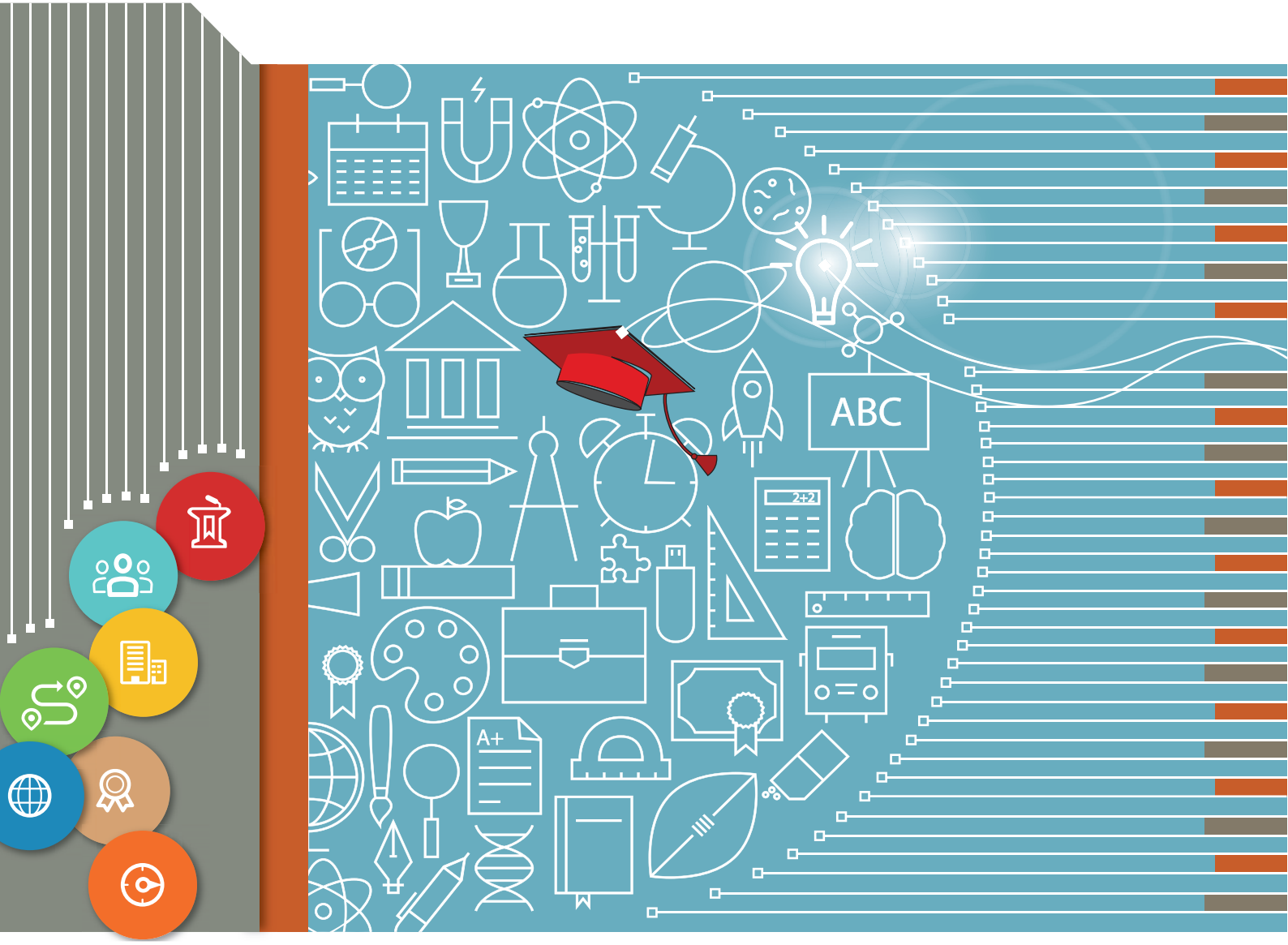
OECD Skills Studies

Supporting Entrepreneurship and Innovation in Higher Education in Italy



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European Commission

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Please cite this publication as:
OECD/EU (2019), *Supporting Entrepreneurship and Innovation in Higher Education in Italy*, OECD Skills Studies, OECD Publishing, Paris, *https://doi.org/10.1787/43e88f48-en*.

ISBN 978-92-64-62081-0 (print)
ISBN 978-92-64-87742-9 (pdf)

OECD Skills Studies
ISSN 2307-8723 (print)
ISSN 2307-8731 (online)

European Union
Catalogue number: NC-04-19-701-EN-C (print)
Catalogue number: NC-04-19-701-EN-N (PDF)
ISBN 978-92-76-12953-0 (print)
ISBN 978-92-76-12952-3 (PDF)

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Preface by Italian Minister

Italian Higher Education (HE) is facing some crucial challenges and actions are essential to unleash its full potential within the European context. Promoting an entrepreneurial and innovative agenda and a new sustainable development model should become pivotal in every education policy. Furthermore, a long-term national strategy should encompass engagement and the so called 'third mission' (that is to say, generating knowledge outside academic environments to the benefit of social, cultural and economic development).

The Higher Education Innovate Country Review for Italy shows how Italian universities share this vision and are committed to excellence in research and positive social impact. We are well aware of the central role education plays in fully developing the country's potentials. As a relevant player, the Ministry of Education, University and Research is aware that engaging various ministries in common actions ensures high impact reforms, whose benefits go far beyond education and research. Stronger cooperative relationships can generate value not only for a single network, but for much wider ecosystems. Indeed, in designing and implementing a policy, institutions have to take into consideration all stakeholders' demands – universities and research institutes, professors, researchers, students, administrative staff – as well as local communities, enterprises or international players.

From an international point of view, Italian universities and research institutes can play a key role, provided that national policies integrate with the European Education Area and the European Research Area. It gives us the opportunity to learn good practices from other countries and improve. In 2018, Italy participated in the Higher Education Innovate Country Review and, since then, we have had the opportunity to assess our higher education system. We were also able to identify new ways to enhance the quality of Higher Education. The new focus of the strategy is based on four essential pillars: knowledge exchange and collaboration; internationalization; digital transformation and capability; organisational capacity. We relied on the win-win collaboration provided by the main stakeholders of the system taking part in the Steering Group. Eleven higher education institutions from all over the country hosted international experts for a study visit and many more provided their inputs through the answers to the Leaders' survey. In addition, this Report highlights the results of a stakeholders' workshop held in Milan in May 2018. Universities and enterprises shared their views on knowledge exchange and collaboration.

I would like to express my deep gratitude to the Chair and the members of the Steering Groups, all Universities hosting visits and the stakeholders' workshop, those filling in the Leaders' survey and, last but not least, the European Commission, OECD, their staff and the international experts for an empowering and unique experience.

The High Education Innovate Country Review offers relevant suggestions for policy actions at both national and institutional level. Policy initiative for the upcoming years, such as the "Research Pact", the Guidelines for Strategic planning 2019-2021, the Research Evaluation Exercise promoted together with the National Quality Assurance Agency (ANVUR), are developed so that Institutions are empowered to fully contribute to the

advancement of our system. Together with institutions and stakeholders, we will keep on ensuring sustainable development through education and research.



Lorenzo Fioramonti

Italian Minister of Education, University and Research

Preface by OECD and European Commission

Entrepreneurship and innovation are key drivers of inclusive growth and social cohesion. This is why it is important that higher education systems and institutions strategically develop innovative and entrepreneurial approaches towards education, research and engagement with stakeholders, and act as catalysts of these processes.

Many higher education institutions have a solid foundation on which they can build and develop new initiatives, often due to the pioneering role of individuals. However, scaling up entrepreneurial and innovative initiatives, and promoting and sustained change at institutional level, is a multi-dimensional effort. It requires adopting new rules and practices on resource allocation, staff incentives, continuous professional development, and the creation of strategic partnerships – locally, nationally and globally. It cannot happen unless higher education institutions include engagement with business and communities in their core functions.

The HEInnovate guiding framework offers policy guidance and advice by identifying and analysing institutional and national practices, and by making information available at international level, to help new initiatives evolve and grow. The framework encompasses a self-assessment tool for higher education institutions, a series of country reviews, and a peer-learning network facilitating exchanges of experiences and best practices among relevant stakeholders.

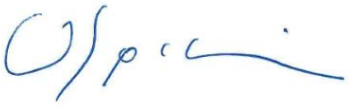
The HEInnovate country review of Italy shows that policy practices related to the entrepreneurial and innovation agenda in higher education are developing all over the country. Italy's strong and international business sector as well as natural and cultural amenities provide vast engagement opportunities for higher education institutions. A strategic approach at system level should capitalise on existing institutional initiatives and help develop them to generate more value for the economy and society. Recent reforms go in the right direction. Based on field analysis and international good practices, this report provides policy guidance to help Italian policy makers and stakeholders define a long-term national strategy to support higher education engagement with the society and with the business and economic sectors.

The HEInnovate review provides a number of learning models contributing to the current discussion in Europe and the wider OECD area on policy practices to support entrepreneurship and innovation in higher education. The OECD and the European Commission are grateful to the Italian government for the effective and lasting partnership created through this review, and look forward to continued collaboration.



Ulrik Vestergaard Knudsen

Deputy Secretary-General of the OECD



Themis Christophidou

Director General for Education, Youth, Sport and Culture, European Commission

Preface by Italian Universities

For years now, universities and companies have undergone significant transformations that have led to new forms of collaboration to help face the challenges of the current economic and technological context. Bearing in mind that collaboration between academic and business worlds is a driver of success with mutual benefits for all actors involved – and more generally for society, in 2014 the Fondazione CRUI (Foundation of the Italian Rectors Conference) established the University-Business Observatory.

The University-Business Observatory aims to promote partnerships, support synergies, and foster mechanisms that enable cooperation between the labour world, research institutes and youth. To reach its objective, the Observatory has set up six Working Groups that handle issues of particular interest to Italy: Apprenticeship in Higher Education and Research; Industrial Doctorates; Professional-oriented Degree Courses; Transversal Skills; Life and Health Sciences and Agri-food Systems. Each of these topics undergo in-depth analysis so as to provide concrete solutions to help face both the challenges identified as well as bureaucratic red tape that can often hinder the implementation of joint university-business projects.

In view of its activities the University-Business Observatory is delighted to be part of the HEInnovate Country Review which aims to sustain and enhance the entrepreneurial and innovative capacity of the university system in different European countries. In June 2018, representatives of the OECD and the European Commission presented the objectives and methodology of their project to all Italian Rectors in CRUI. Over that year, the Observatory provided its support to the Italian Ministry of Education, University and Research (MIUR) by contributing to the drafting of the Italy Background Report and, with the involvement of academics and business representatives, providing feedback on the Final Report.

Looking ahead, the Observatory aims to continue its engagement in all activities promoted by the European Commission through HEInnovate. In this way, innovative activities can be implemented within universities (digitalisation), entrepreneurship can be developed for students and staff, collaboration with stakeholders (public authorities, companies and civil society) can be strengthened to seize new opportunities, and the role of universities in the exchange of competitive knowledge can be recognised and enhanced.

On this occasion we would like to thank the MIUR and, in particular, Daniele Livon for involving us, and we would also like to thank the Steering Group and all those who supported the Observatory in this initiative. We would also like to express special thanks to Marzia Foroni and Francesca Trovarelli for their precious competence and enduring commitment.



Gaetano Manfredi

President of CRUI



Alberto Felice De Toni

President of CRUI Foundation



Angelo Riccaboni

Coordinator of the University-Business Observatory

Foreword

This publication presents the findings and recommendations of the HEInnovate review of the impact of higher education institutions (HEIs) on entrepreneurship and innovation in Italy. The review assesses the strategies and practices of HEIs in Italy in supporting entrepreneurship and innovation, along with the government policy context. It highlights many good practices put forward by Italian HEIs to engage with businesses and communities at the local and international level and to capitalise on cultural and natural amenities, in the country. The review further discusses the need for a strategic approach to the entrepreneurial and innovation agenda in higher education.

The review was undertaken by the OECD in partnership with the European Commission, as part of the programme of work of the OECD Local Economic and Employment Development (LEED) Committee. The review is part of the HEInnovate collaboration between the European Commission's Directorate-General for Education, Youth, Sport and Culture and the OECD Centre for Entrepreneurship, SMEs, Regions and Cities.

Investing in innovative and entrepreneurial HEIs is one of the highest return investments that we can make. Innovators and entrepreneurs are not born with all the necessary competencies. Rather, underlying attitudes, skills and knowledge are developed over time in society and through education.

More needs to be done to ensure that these competencies are developed through education, and to ensure that there are the right incentives and support structures to encourage staff and students in HEIs to get more involved in entrepreneurial ventures and engagement with business and society.

HEInnovate is a starting point for governments and HEIs to identify areas for action. It is a guiding framework for supporting entrepreneurship and innovation in higher education. HEInnovate offers an online self-assessment tool for higher education institutions (www.heinnovate.eu), available in 24 languages, a series of country review assessments, including this report on Italy, and a Policy Learning Network that facilitates cross-country exchange and peer learning amongst the countries participating in the country reviews.

Acknowledgements

This review was a collaborative effort between the OECD's Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) led by Lamia Kamal-Chaoui, Director, and the European Commission's Directorate for Innovation, International Cooperation and Sport in the Directorate-General for Education, Youth, Sport and Culture, led by Antoaneta Angelova-Krasteva, Director. It was undertaken in partnership with the Ministry of Education, University and Research of Italy, led by Lorenzo Fioramonti.

Raffaele Trapasso, Coordinator of HEInnovate, and Giulia Ajmone Marsan, former CFE staff, prepared the report under the supervision of Lucia Cusmano, Acting Head of the SMEs and Entrepreneurship Division, CFE. Andrea Capaccioli, former OECD staff provided substantive inputs and comments to the review. Maria Sobron Bernal, CFE, provided assistance. A team of experts also contributed to the drafting of this report, Professor Magnus Klofsten and Eloïse Germain of the University of Linkoping Sweden, Wolfgang Polt and Maximilian Unger from Joanneum Research Austria. Professor Pedro Teixeira form the University of Porto and Maria Manatos from the University of Aveiro in Portugal. Christopher Cripps, Director, international development, Sorbonne University, France, participated in one mission as peer reviewer.

The OECD wishes to thank the European Commission for its support and in particular Begoña Arano and Maria Palladino from the Directorate General for Education and Culture of the European Commission who actively contributed to the realisation of the review.

The review team is also grateful to the Ministry of Education, University and Research for its contribution to the review. In particular, we are grateful to Fulvio Esposito, Vania Virgili, Elena Lo Fiego, Technical Secretariat of the Minister, Giuseppe Valditara and Luigi Pievani of the Department for Higher Education and Research; Angelo Siddi, Marzia Foroni and Francesco Olivanti of the General Directorate for Planning, Coordination and Financing of Higher Education Institutions and the Support Office.

Site visits to Higher Education Institutions were instrumental to the production of the report. The review team extends its gratitude to the rectors and coordinators and staff members of Higher Education Institutions who provided fundamental assistance to organization of site visits. The OECD team thanks in particular Maria Del Zompo, Simonetta Negrini from the University of Cagliari, Giuseppe Novelli and Corrado Cerruti from University of Rome Tor Vergata, Gaetano Manfredi and Piero Salatino from the University of Naples "Federico II", Fabrizio Micari and Livan Fratini from the University of Palermo. The OECD also thanks Antonio Felice Uricchio and Silvana Sirico from the University of Bari, Guido Saracco and Antonio Messeni Petruzzelli of the Polytechnic of Torino, Ferruccio Resta and Paola Bertoli of the Polytechnic of Milan, Francesco Ubertini and Elena Consolin from the University of Bologna. Francesco Frati and Moira Centini of the University of Siena, Pierdomenico Perata and Andrea Piccaluga from the Scuola Universitaria Superiore S. Anna di Pisa, and Vincenzo Barone and Andrea Ferrara of the Scuola Normale Superiore in Pisa. We are also grateful to Cristina Messa, Danilo Porro, Luca Beverina, Michele Nicolosi for their contribution to the Stakeholders' Seminar, held in the University of Milan Bicocca, in May 2019.

Members of the steering group of this review, which was chaired by Angelo Riccaboni from the University-Business Observatory, also provided key insights and comments reflected in this review. Theses members include Maria Letizia Melina, Federico Cinquepalmi and Paola Castellucci from the Department for Higher Education and Research, Directorate General for Students and Internationalization, Vincenzo Di Felice and Luciano Catani from the Directorate General for Research of the Ministry of Education, University and Research, Gaetano Manfredi, Cristina Messa and Michele Nicolosi, Italian Rectors' Conference, Paolo Miccoli, Sandro Momigliano, Alessio Ancaiani, Marco Malgarini, Carmen Nappi and Brigida Blasi, Italian Quality Assurance Agency, Andrea Piccaluga and Sabrina Corrieri Network of Centres for Technology Transfer, Giovanni Perrone, Italian Association of University Incubators, Francesca Trovarelli, University-Businness Observatory. Thanks are also extended to the Ministry of Economic Development, represented in this process by Stefano Firpo, and Confindustria, Nicoletta Amodio and Alfonso Balsamo, for the contributions received on the material produced by the Steering Group.

The project would not have been started and successfully completed without the support of Marco Mancini, former Head of Department for Higher Education and Research, and Daniele Livon, former General Director for Planning, Coordination and Financing of Higher Education Institutions.

Thanks are also due to Eleonore Morena for editing and formatting the report and to Pilar Philip, CFE, who prepared the final publication.

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Abbreviations and acronyms

ABS	Anti-lock braking system
AE	Academic entrepreneurship
AFAM	*Alta Formazione Artistica Musicale e Coreutica*, Institutes for Art, Music and Dance
AgID	*Agenzia per l'Italia Digitale,* Agency for Digital Italy
AI	Artificial Intelligence
AISA	Italian Association for the Promotion of Open Science
AMT	Automated mechanical transmission
ANVUR	National Agency for the Evaluation of University and Research
API	Application programming interface
ATT	Open Science and Research Initiative
AVA	*Autovalutazione – Valutazione periodica – Accreditamento,* National System of Quality Assurance of the Universities
AvH	Alexander von Humboldt German Academic Exchange Service
B2B	Business-to-business
BERD	Business expenditure on R&D
BMBF	German Federal Ministry of Education and Research
BMVIT	Federal Ministry for Transport, Innovation and Technology
CAP	*Centro per l'Apprendimento Permanente*, Centre for Lifelong Learning
CEFRL	Common European Framework of Reference for Languages
CEO	Chief executive officer
CFU	*Credito Formativo Universitario*, European Credit Transfer and Accumulation System
CIFRE	*Conventions industrielles de formation par la recherche*
CIMEA	Italian NARIC Centre
CIMO	Finnish Centre for International Mobility
CIPE	Inter-ministerial Committee for Economic Planning
CNR	National Research Council
CNSU	National Council of University Students
COMET	Competency Centres for Excellent Technologies
CPD	Continuing professional development
CREA	Centre for Innovation and Entrepreneurship Activities
CRUI	Conference of Italian University Rectors
CSTD	Standard cost per student
CTN	National technological cluster
CUN	National University Council
DAAD	German Academic Exchange Service
DB	Data base
DFG	German Council of Science and Humanities
DIH	Digital Innovation Hub
EAIE	European Association for International Education
ECA	European Consortium for Accreditation
ECTS	European Credit Transfer Scale
EFSA	European Food Safety Authority
EI	Engagement and impact assessment
EOS	Emerging organisation

ERA	European research area
ERC	European Research Council
ERDF	European Fund for Regional Development
ESFRI	European Strategy Forum for Research Infrastructures
ESIF	European Structural and Investment Funds
EU	European Union
FFG	Austrian Research Promotion Agency
FFO	Fund for Structural Resources to State Universities
FIRST	Fund for Investments in Scientific and Technological Research
FIS	State Supplementary Fund
FOE	Fund for the Ordinary Financing of Research Entities and Institutions
FWF	Austrian Fund for Scientific Research
GDP	Gross domestic product
HE	Higher education
HE-BCI	Higher Education Business and Community Interaction
HEFCE	Higher Education Funding Council for England
HEI	Higher education institution
HEIF	Higher Education Innovation Fund
HERD	Higher education expenditure on intramural R&D
HRK	German Rectors Conference
IAU	International Association of Universities
ICT	Information and communication technology
IDOA	Immediate-deposit and optional-access
ILO	Industrial liaison office
IoT	Internet of Things
IP	Intellectual property
IPR	Intellectual property rights
IRIS	Institutional Research Information System
ISCED	International Standard Classification of Education
ISPD	Standardised Indicator of Departmental Performance
ISPIM	International Society for Professional Innovation Management
IT	Information technology
ITS	*Istituti Tecnici Superiori,* Technical Institutes for Post-secondary Education
IUSS	*Istituto Universitario di Studi Superiori di Pavia*, University Institute of Advanced Studies, Pavia
KEF	Knowledge exchange framework
KET	Key enabling technology
M2M	Machine-to-machine
MAE	*Ministero degli Affari Esteri*, Ministry of Foreign Affairs, of Italy
MiSE	Ministry for Economic Development
MIUR	Ministry of Education, University and Research
MOOC	Massive open online course
MOU	Memorandum of understanding
NEET	Not in education or training
NGO	Non-governmental organisation
NVAO	Dutch-Flemish Accreditation Organisation
OECD	Organisation for Economic Co-operation and Development
PA	Public Administration
PBL	Problem-based learning
PDO	Protected designation of origin
PGI	Protected geographical indication
PLN	Policy learning network
PLS	*Piano Lauree Scientifiche*, Plan for Scientific Degrees
PMR	Product market regulation

PNI	*Premio Nazionale Innovazione*
PNIR	National Plan for Research Infrastructures
PNR	National Research Plan
PoliMi	Politecnico di Milano
POT	*Piano Orientamento e Tutoraggio*, Plan for Tutoring and Career Guidance
PRIN	Research Projects of National Interest Scheme
QA	Quality assessment
R&D	Research and development
RCN	Research Council Norway
RUS	University Network for Sustainable Development
SCL	Santa Chiara Lab
SDG	United Nations Sustainable Development Goals
SIF	Italian Society of Pharmacology
SME	Small- and medium-sized enterprise
SNF	Swiss National Science Foundation
STEM	Science, technology, engineering and mathematics
TACRI	*Tavolo di Coordinamento Della Ricerca Indistriale di Ateneo*
TECO	*Test sulle Competenze*, Competence test
TECON	*Test sulle Competenze*, Competence test
TKI	Top consortia for knowledge and innovation
TM	Third mission
TRL	Technology readiness levels
TSG	Traditional specialities guaranteed
TTO	Technology transfer office
TUAS	Tampere University of Applied Sciences
TUT	Technical University Tampere
UAS	University of Applied Sciences
UniBa	University of Bari
UniBo	University of Bologna
UniCa	University of Cagliari
UTA	University of Tampere
VET	Vocational education and training
VQR	National Research Quality Assessment
VQR	*Valutazione della Qualità della Ricerca*, Periodical Evaluation of Research Quality
WoX	Web of Topics

Executive summary

Universities' entrepreneurship and innovative practices are burgeoning all over Italy. Some of these practices resonate at the international level, while others have a strong local dimension. Recent policy initiatives, including outside the higher education domain, have helped promote the "entrepreneurial and innovation agenda" in higher education. Strategic support from the central government could catalyse these engagement practices, with an impact on Italy's innovation capacity, human capital endowment and sustainable growth.

Italian higher education (HE) faces some crucial challenges and actions need to be taken to unleash its full potential. Italy's expenditure on tertiary education is about 30% lower than the OECD average. The share of 25-34 year-old Italians holding a tertiary degree is much lower than in most OECD countries. Italy's national economy suffers from large skills mismatch. Significant regional disparities in household income represent an additional factor of complexity that policy actions must take into account. Promoting an entrepreneurial and innovation agenda can help Italy improve the overall performance of the HE system and individual higher education institutions (HEIs) in all regions.

Within this context, some successful practices, mirroring international approaches, have emerged. A good example is the 3-year strategic plan, through which the Ministry of Education, Universities and Research of Italy agrees with HEIs on the main priorities and goals of the system, including actions to generate economic and societal value. To leverage on new practices, it will be important to improve strategic co-ordination between policy objectives and funding, and to give HEIs a new status recognising their specific function and role within the public administration, thus reducing red tape and bureaucratic requirements. Properly equipped HEIs can engage with the private sector to promote innovation capacity in all firms, including small- and medium-sized enterprises (SMEs), which dominate the economic landscape in most Italian regions. In addition, HEIs promoting students' entrepreneurial capabilities may contribute to reduce skills mismatches in labour markets and, ultimately, positively affect productivity.

Exchanging knowledge and collaborating with businesses and communities is an emblematic way in which HEIs can generate societal and economic value and improve their research and teaching activities. All Italian HEIs have been networking with new stakeholders, yet regional disparities affect the scope of these collaborations. Universities active in territories hosting business clusters and urban hubs have an advantage in engaging with firms, over HEIs located in regions where there are fewer resources and research and development-intensive firms. However, by assessing academic engagement from an ecosystemic point of view, one can see that Italian HEIs have developed a broad understanding of knowledge exchange, which goes beyond the traditional emphasis on technology and research linkages with the business sector, start-ups and spin-offs. Several case-study HEIs have put emphasis on Sustainable Development Goals (SDGs) and initiatives training refugees to facilitate their social inclusion, and have developed collaborations and partnerships with museums, theatres, opera houses, archaeological sites and other cultural institutions, capitalising on Italy's outstanding cultural heritage.

Policies to promote knowledge exchange and collaboration in HE could operate both at the systemic level and at the level of individual HEIs. There is a need for generating complementarities between HE policy and other portfolios such as industrial policy, regional development and regional accessibility. The experience of *Impresa 4.0*, which aims to boost the investment in new technologies, research and development and revitalise the competitiveness of Italian companies, and, in particular, of the upcoming "competence centres" illustrates that it is possible to create new opportunities for collaboration between universities and firms. HEIs, including universities and professional/vocational tertiary education institutions – the *Istituti Tecnici Superiori* – need to mobilise all their potential to provide students with disciplinary and transversal skills that can help them be active citizens, perform on the labour market and promote the competitiveness of the Italian economy as a whole. Finally, Italian authorities could capitalise on the well-developed efforts in monitoring and evaluating knowledge exchange, led by the national evaluation agency, ANVUR, to provide strategic resources for knowledge exchange and collaboration activities. Going forward, the evaluation of the "third mission" could involve international experts promoting pilot evaluations and experiments featuring leading best practices at the international level.

"Internationalisation" and "digital technologies and capabilities" are important factors to enhance the quality of HE's and HEIs' capacity to engage with society. International collaborations can support research and teaching, and magnify the capacity of HEIs to generate ecosystems encompassing local and global networks. Digital transformation affects all HEI missions and activities; it can enable new services, such as online learning, and provide new opportunities for innovation and entrepreneurship. HEIs embracing digital technologies can disseminate innovations within their own ecosystems and networks.

Italian HEIs are well aware of these potentials, which need to be fully developed. The internationalisation of the HE system has been significantly encouraged by both external (European) and internal (systemic and institutional) drivers for change. Some case-study HEIs have become visible hubs in the global arena. However, such efforts and initiatives for internationalisation often face a context of economic and political instability and internal resistance from the academic community. As a result, a systematic and comprehensive approach to internationalisation is often lacking. Furthermore, as is common in most OECD countries, including Italy, there is a strong dynamism in terms of actions and initiatives promoting the digital agenda. Some HEIs are investing in digital infrastructure, some are leaders in the development of new digital services for students and staff, and others are devoting efforts to the development of online learning through massive open online courses (MOOCs). However, some "building blocks" of the digital transformation in HEIs, such as open science and open data, and the skills required to maximise the benefits of digital transformation are not embedded in digitalisation strategies.

Going forward, Italy's HE system, including university leaders, needs to elaborate strategies and synergies to promote internationalisation and digital transformation. With the support of systematic benchmarking, stakeholders need to develop a realistic view of the current positioning of Italian institutions within international networks and rankings. In addition, to go beyond the current bottom-up dynamic supporting internationalisation, ministries, national agencies and the Association of Italian Universities (CRUI) need to develop a greater capacity to steer and co-ordinate the system. Italian universities should integrate internationalisation in various activities across the different missions, disciplines, levels of decision-making. A similar co-ordination effort is needed to implement a broad digitalisation programme and go beyond the current emphasis on MOOCs, digital

infrastructure and digital services to develop a common strategy for open science and open data. A first step would be to map and monitor recent developments to identify good practices of digital technologies supporting internationalisation and collaboration with the business sector, through academic entrepreneurship. The following step would be to define overarching strategic goals vis-à-vis the digitalisation of the HEI system, considering that, despite being part of the public administration, HEIs nevertheless represent a specific typology of public actors, requiring more flexibility and ad hoc approaches.

All efforts to promote the capacity of HE to generate societal and economic value will be lost without improving the organisational capacity of the Italian HE system and of the individual HEIs. Recent reforms targeting the governance of the HE sector and its funding mechanisms have positively affected the entrepreneurial and innovation agenda in HE, but there is room for further improvements. Italian authorities need to define a long-term national strategy that uses a broad definition of "engagement" and "third mission", and focuses on the quality of research and on the capacity to generate societal and economic value: excellence and impact should become two sides of the same coin. Based on this strategy, national and institutional stakeholders would set their strategic objectives and activities, as well as a coherent and innovative evaluation and funding system, broadening the emphasis on bibliometric indicators with other indicators capturing different activities. Importantly, the overarching strategy would represent an enabling condition, supporting other sectoral strategies concerning engagement, internationalisation and digital transformation, for example.

Improved organisational capacity would also reduce the current fragmentation of the incentive structure for entrepreneurship and innovation by better aligning initiatives co-ordinated by different ministries. As a result, HE could interact with other policy sectors supporting innovation in the business sector, internationalisation, regional development and sustainable growth. In turn, policy synergies may help reduce the heterogeneity that characterises the system, for instance by developing policy initiatives to improve the absorptive capacity of the business sector surrounding HEIs, as well as partnerships with local and regional authorities.

HEIs could actively participate in this reform effort by improving their internal organisational capacity and generating a student-centred system. For instance, they could innovate the process for the selection of the university leadership and consider opening it to external stakeholders. This may benefit the innovation capacity of new leaders. In addition, stakeholders could consider gender aspects as criteria for the appointment process. Italian HEIs should be involved in the development of a regulatory framework that is conducive to academic entrepreneurship by tackling specific aspects, such as the so called "professor's privilege", in transferring innovation actions. These institutional innovations would dramatically improve HEIs' capacity to generate economic and societal value for their own ecosystems and networks.

Chapter 1. Overview of the higher education system in Italy

This introductory chapter provides an overview of the higher education (HE) system in Italy. The aim is to presents the main actors and institutions of the system and to discuss the framework conditions of the "entrepreneurial and innovation agenda" in Italy. In addition, the chapter assesses some recent policies that aim at strengthening Italy's innovative potential.

Introduction

The Italian higher education has a great potential to contribute to the cultural, societal and economic development of the country. Italy is home to a dense network of universities. Higher education institutions (HEIs) have put in place initiatives in all missions, including teaching, research and "engagement". This flourishing of activities depends on two subsequent reform phases started in 2010.[1] In the first phase, national authorities defined regulatory frameworks and incentives to steer HEIs towards improvements in the quality of teaching and research, and towards an increase in the efficiency of the system (i.e. a decrease in funding allocation). In the second phase, the regulator encouraged HEIs to diversify their strategies and missions, taking into account the expectations and needs of their "ecosystems", which encompass local, national and international stakeholders.[2] To help the diversification, the government has put in place a steady, albeit small, increase of funds, which have been allocated to HEIs based on an assessment exercise.

Despite these recent improvements, the Italian higher education system faces some important challenges and actions need to be taken to unleash its full potential. For instance, the share of 25-34 year-old Italians holding a tertiary degree is still much lower than in most OECD countries, notwithstanding recent improvements.[3] For all levels of education, expenditure per student is below the OECD average and the gap increases along with the educational level. Italy's expenditure on tertiary education is about 30% lower than the OECD average (2015) (OECD, 2018).

Excluding mobility exchange programmes, Italian universities attract fewer students from abroad, compared with other OECD countries. The share of foreign students in Italy is 5% (compared with 9% in EU23 countries). Recent improvements in the capacity to attract foreign students – the number of foreign students has increased by 12% between 2013 and 2016 – have been offset by the large number of Italian nationals studying abroad, which has increased by 36%, over the same period.

The country faces some structural challenges that affect, indirectly, the performance of higher education. The employment rate in Italy is lower than for the OECD, but the gap between Italy and the OECD average increases with educational levels and it reaches 18 percentage points for tertiary-educated young adults (OECD, 2017a). The employment rate for young adults with tertiary education (66% for 25-34 year-olds) is lower than for older age groups, with 81% of 25-64 year-olds employed overall. In 2017, approximately 30% of 20-24 year-olds in Italy were neither in employment nor in education or training (NEET), compared to 16% on average across OECD countries.

Table 1.1. Basic facts and numbers on higher education and research and development (R&D) in Italy

Population (1 January 2018)	60 483 973
Gross domestic product (GDP) in EUR per capita (2018)	29 071
Total government expenditure on tertiary education as % of GDP (2017)	0.3
Tertiary attainment in population aged 25-64 (2017, %), of which:	18.7
Short cycle tertiary education (%)	0.0
Bachelor's (first-cycle degree) (%)	4.3
Master's (second-cycle degree) (%)	13.9
Doctoral (%)	0.5

Expenditure on tertiary education institutions as % of GDP (2015)	0.6
Expenditure (from public and private sources) on R&D as % of GDP (2018)	1.35
Direct government budget for R&D as % of GDP (2015)	0.6
Number of students in publicly funded HE institutions (all levels, all modes; 2017/18), of which:	1 713 351
State universities	1 523 994
State-recognised universities	106 660
State-recognised telematic universities (offering on-line degrees)	82 697
Tertiary degrees conferred (2017/18), of which:	263 979
Degrees by state universities	236 659
Degrees by state-recognised universities	23 157
Degrees by state-recognised telematic universities	4 163
R&D personnel per thousand, total employment (2016)	19.1
Higher education researchers as % of national total (2015)	12.4
Number of citable research documents (2017)	97 516
Citations per document (2017)	0.76

Source: Authors' own compilation based on information provided by Eurostat, OECD, Scimago Lab, Ministry of Education, Universities and Research (MIUR) and National Statistical Institute (Istat).

Recently, government policies have focused on two main pillars: promoting research quality and opening to students' demand. After a long period during which almost all funds were distributed based on the "historical cost", the government decided to allocate funds taking into account the quality of research and the capacity of a given HEI to accommodate students' demand. These have become the two main drivers of funds allocation to HEIs.

The focus on the quality of research and student has produced some positive outcomes. The Ministry of Education, Universities and Research (MIUR) of Italy, supported by the National Agency for the Evaluation of University and Research (ANVUR), has designed and implemented several policy initiatives such as the periodical Research Quality Assessment exercise (*valutazione della qualità della ricerca* or VQR, in the Italian acronym), the *Dipartimenti di Eccellenza* initiative and the implementation of the Standard Cost per Student (CSTD). The response of HEIs has been positive. Universities have reviewed their internal strategies and practices to improve their results and adapt to the new policy guidelines. Due to these innovations, the interactions between universities and external stakeholders has increased and so the number of students enrolled.

Regarding the third mission, which refers to activities carried on by HEI that go beyond teaching and research functions, the National Agency for the Evaluation of Universities and Research Institutes (ANVUR) shows that activities are carried out mainly by medium and large universities, and tend to be more frequent in the north of the country (ANVUR, 2016). There is, however, ample heterogeneity both in size of HEIs and in geographic location. Illustrating an important link between research activities and "engagement", ANVUR (2016) underlines that the number of technology transfer offices (TTOs), placement offices and other institutions interfacing HEIs with their external stakeholders has been increasing, paralleling HEIs' efforts to promote their research activities.

Another survey-based report on knowledge exchange (Netval, 2018) discusses the increasing activity in technology transfer of Italian HEIs. According to the report, a growing number of HEIs are now equipped with TTOs and related competencies. Expenditures for intellectual property (IP) protection has been increasing almost everywhere. Patents, however, are still highly concentrated: approximately 12 Italian HEIs (out of approximately 90 HEIs) generate some 50% of total patents, which concentrate, in

turn, into 4 scientific disciplines, namely: industrial and information engineering; chemistry; medicine; and biology.[4] In addition, the revenues from the valorisation of patents are typically concentrated: 50% of the revenues are concentrated in only 3 universities and 10 patents.

The great majority of Italian HEIs are active also in public engagement, while a relatively high number of institutions is involved in the production of public goods, through the management of cultural heritage and the protection of health (including clinical trials, bio-banks, etc.).

Science, innovation and knowledge economy

Italian HEIs operate in an internationally competitive framework of science, innovation and knowledge economy, which, however, faces some challenges. For example, among G20 economies, Italy had the 5th-highest penetration of machine-to-machine (M2M) subscriptions in 2017, the same as in Germany and just behind China (OECD, 2017b). Italy also accounted for almost 4% of the world's top 10% most-cited scientific publications in 2016, right behind the United States, China, the United Kingdom and Germany. Yet, Italy's international competitiveness also faces challenges. In particular, Italy has been displaying modest gains in labour productivity since 2001. Gender equality is another issue in the country. Women in Italy earn about 13% less than men, even after individual and job-related characteristics are taken into consideration and about 10% less when skills differences are also taken into account. Finally, data on the international mobility of researchers for 2002 to 2016 shows that Italy has lost more individuals than it has attracted. Over the past 15 years, the number of researchers that left Italy exceeded by 11 000 the number of researchers that entered the country, making the country the largest relative net donor among economies, with high levels of scientific output.

Issues on skills and firm profile

Italy also faces challenges related to its skills, the performance of the labour market and the product market regulation (PMR). For instance, Italy's national economy suffers from a large skills mismatch, with values above the OECD average both in terms of under-skilled and over-skilled workers (8% and 12% respectively) (OECD, 2017c). The frequency of mismatch in Italy may be related to the use of informal selection procedures among companies, especially small- and medium-sized enterprises (SMEs) (European Commission, 2016).

Second, small and micro firms dominate the Italian productive sector. Over 90% of firms in Italy employ less than 10 employees, more than any other OECD country. The vast majority of SMEs operate far from the productivity frontier. This has generated a situation in which innovations do not percolate from the most productive firms to the others (Criscuolo, Gal and Menon, 2014). In addition, SMEs are quite old, on average. This means that SMEs firms remain small throughout their activity. According to Bobbio (2016), SMEs in Italy may not invest in innovation because this implies growing in size and, as a consequence, being subject to more taxation and auditing.[5] Lastly, the Italian context is characterised by a high proportion of family-owned companies, a feature that is typically negatively associated with firm performance.

Key actors and elements of the Italian higher education system

The Italian higher education system includes different types of institutions: universities, Institute for Art, Music and Dance (the so-called AFAM sector, see below), private institutions awarding recognised qualifications, and technical institutions providing short-term tertiary education (ITS, *Istituti Tecnici Superiori*).[6]

The university system

The university system encompasses:

- 68 state universities – of which 6 institutions awarding only doctoral qualifications[7]
- 20 state-recognised universities
- 11 state-recognised online universities (*università telematiche*).

Since 1989, universities are autonomous within the regulatory framework foreseen by the law and the strategies promoted by the MIUR. Autonomy provides universities with the possibility to define their own governance structure and internal organisation, develop their own mission and strategy, plan programmes and award degrees, develop their own research activities, and "engage" in activities related to the so-called "third mission".

Other institutions of tertiary education

The *Alta Formazione Artistica Musicale e Coreutica* (AFAM, Institutes for Art, Music and Dance – based on the degree structure of the European Qualifications Framework, levels 6-8), accounts for 13 778 teachers and 2 413 administrative staff (2016-17) distributed in:[8]

- 59 State Music Conservatories, for a total of 21 616 students
- 20 State Academies of Fine Arts, for a total of 25 901 students
- 19 Higher Institutes for Musical Studies, for a total of 2 655 students
- 18 State-recognised Academies of Fine Arts, for a total of 9 574 students
- 4 Higher Schools of Design (ISIA), for a total of 943 students
- 1 National Dance Academy, for a total of 304 students
- 1 National Academy of Drama, for a total of 146 students
- 24 institutions authorized to award AFAM diplomas, for a total of 6 315 students.

In addition to universities and AFAM institutes, a number of institutions are allowed to award recognised higher education qualifications: Higher Schools for Language Mediators – awarding the *Diploma di mediatore linguistico* (1st-cycle qualification, EQF 6) – and Specialisation Institutes/Schools in Psychotherapy – awarding the *Diploma di specializzazione in psicoterapia* (3rd-cycle qualification, EQF 8).

In recent years, efforts were also put into developing a new, professionally-oriented stream of tertiary education, planned in co-operation with enterprises and local administrations. Italy's new ISCED level-5 tertiary professional/vocational education institutions (*Istituti Tecnici Superiori*, ITS), although still with a limited number of students (13 381 in 2019) and producing few graduates (2 601 in 2017) (INDIRE, 2019), provide for a system of diplomas that can be obtained after 2 or 3 years. The programmes, co-designed with firms,

are intended to allow young people and adults to operate as high-level technicians in innovative work processes that require specific skills in applied technologies.

There are currently 103 ITS foundations[9] scattered across Italy (mainly in the north), providing tertiary vocational education and training (VET) in different sectors, including: new technologies for the "Made in Italy" sectors;[10] logistics and mobility; energy efficiency; new technologies for cultural and tourism activities; information and communication technology (ICT); and medical technologies.

An assessment of the ITS system found that in some ITS sectors, more than 80% of students find a job within 1 year after graduating (AlmaLaurea, 2016). The employability rates of ITSs tend to be higher if the fields in which the ITS provides training matches the local sectoral specialisation of firms (OECD, 2017c). To promote the alignment between ITS training and demand for skills on the labour market, MIUR is providing additional funding to ITS with the highest employability rates.

Public research organisations

Three main actors conduct research in Italy: universities, public research entities (*Enti Pubblici di Ricerca*) and firms. These actors are complemented by numerous public and private entities. They operate within the framework of the *National Research Plan*, promoted by MIUR and approved by the Interministerial Committee for Economic Planning (*Comitato Interministeriale per la Programmazione Economica* CIPE). MIUR plans and co-ordinates research at the national, European and international levels, collaborating both with other ministries in their specific sectors and with the regions, which have competencies at the territorial level.

Public research entities, in particular, are national entities with the task of performing research activities in the main scientific fields, both in terms of knowledge creation and in terms of technical-scientific application. A total of 20 institutions have been recognised as public research entities: 14 are supervised by MIUR,[11] while another 6 are supervised by other ministries[12] and perform instrumental functions (e.g. the National Statistical Institute provides data for legislative purposes) as well as basic and applied research.

Ministries and institutional bodies

The Ministry of Education, Universities and Research (MIUR)

MIUR is responsible for the development and implementation of education and research policies within the Italian system. The Department for Higher Education and Research is the main ministerial department acting in the realm of higher education and research. Its competencies include: steering and funding higher education and research institutions; monitoring and evaluating institutions, and providing performance-based incentives; accrediting study programmes in all cycles, and implementing students' access and support policies; ensuring the participation of the Italian system at the international level and within European Union (EU) institutions.

MIUR strongly co-operates with ANVUR and all the other academic stakeholders. It also co-operates with regional governments for the students' welfare system and for the management of structural funds.

The National Agency for the Evaluation of Universities and Research Institutes (ANVUR)

ANVUR was established in 2010 and started operating the following year. Its evaluations span the whole range of university activities (research, third mission/impact, quality assurance, performance of administrative staff) and extend to AFAM institutions and research entities. Concerning research and third mission/impact, the agency has run two National Research Quality Assessment exercises: VQR 2004-10 and VQR 2011-14.

The Conference of Italian University Rectors (CRUI)

The Conference of Italian University Rectors (CRUI) is the association of state and state-recognised universities. Established in 1963 as a private association, the CRUI has acquired over time an institutional and representative role for the whole university world. Since 2001, the CRUI has been supported in its functions by the CRUI Foundation, which is entrusted with developing projects and services in conformity with the strategies of the conference. In 2014, the CRUI Foundation created the University-Business Observatory, with the participation of university experts and representatives of the economic and business worlds. The observatory has the aim of fostering co-operation and dialogue between the labour market, the research system and young people. On a yearly basis, it publishes its national report on activities carried out and main recommendations to improve the system (Fondazione Crui, 2018).

The National University Council (CUN) and National Council of University Students (CNSU)

The National University Council (CUN) is an elective body representing the whole university system. It serves as an independent advisory body to MIUR on relevant topics such as national programmes, policies and administrative practices affecting higher education, classification and definition of academic fields and disciplines, funding and teaching regulations.

The National Council of University Students (CNSU) is an advisory body representing all students enrolled in Italian universities, including third-cycle and doctoral students. It formulates proposals to MIUR on programme accreditation, the student welfare system and student services, policies on the strategic development of the university system and funding allocation. On a two-year basis, the CNSU also publishes a report on the conditions of students.

Networks of universities

AlmaLaurea

AlmaLaurea is an interuniversity consortium founded in 1994, which currently brings together 75 universities and accounts for approximately 90% of Italian graduates. The consortium is financially supported by the member universities, by MIUR and by the firms and organisations that use its services.

AlmaLaurea conducts an annual survey of graduates' profile and occupational condition one year, three years and five years after graduation. The survey monitors the students' academic careers and reviews the graduates' features and achievements.

Network for the valorisation of university research (Netval)

Netval is a network of Italian universities and public research organisations, representing over 80% of the Italian public research system.

Its mission includes: disseminating and strengthening the skills of Italian universities and public research organisations in the field of the valorisation of research results; providing an interface with industry; consolidating expertise in the area of commercial projects and intellectual property management; and developing international contacts.

PNICube

Since 2004, the PNICube association is committed to supporting Italian universities and university incubators in activities to stimulate academic entrepreneurship and has been a leading player in the field of start-up support at the national level.

Over the years, PNICube has started several thousands of students and researchers on the path towards entrepreneurship: it is estimated that, in Italy, at least 20% of innovative start-ups have been set up thanks to the work carried out by the universities and PNICube university incubators. Furthermore, PNICube has built, during the years, an ecosystem able to support academic entrepreneurship through venture capital, corporate venture capital, business angels, companies interested in open-innovation activities and foreign bodies such as trade department of foreign countries.

Funding policies in Italian higher education

Strategic planning and indicators for periodic evaluation

The funding policies and mechanisms that characterise the Italian university system mirror the main steering tool used by the Ministry of Education, University and Research: the three-year strategic planning act (*Programmazione triennale)*. Indeed, on a three-year basis, MIUR sets the strategic priorities of the university system in terms of requirements for study programmes, research, student support, internationalisation and recruitment. These priorities are discussed with ANVUR, CUN, CRUI and CNSU.

On the basis of these priorities, each university develops its own strategic plan and presents to MIUR a co-funding application for its implementation. External stakeholders (firms, local authorities, civil society, etc.) also co-operate with the universities to elaborate the strategies.

Each strategic action – both at the system and institutional levels – is monitored through a set of indicators defined by MIUR. The co-funding applications are evaluated *ex ante* on the basis of the target set for each indicator; at the end of the period, the funds are confirmed if the university achieves its targets.[13]

For the period 2019-21, after an improvement of the mechanism applied for the period 2016-18, part of the budget allocated by the ministry on the basis of the results achieved by HEIs will follow two of the key indicators used to monitor actions undertaken in research, teaching, student services, internationalisation and recruitment. The resources allocated with this mechanism are approximately EUR 340 million per year for state universities. All in all, the strategic planning will be supported with EUR 405 million per year for state universities. A similar increase will be ensured for state-recognised universities as well.

Funding policies for teaching and research in Italian universities

University system funding from the central government amounted in 2018 to EUR 7.7 billion and encompasses the following items (ANVUR, 2018):

- Fund for Structural Resources to State Universities (FFO), the main line of funding (EUR 7 335.4 million)
- State Supplementary Fund (FIS), to integrate the regional funds dedicated to study grants (EUR 234.2 million)
- contribution to state-recognised universities (EUR 68.2 million) and to the University of Trento[14] (EUR 16.4 million)
- contribution for capital charges and interests on loans (EUR 34.2 million)
- contributions for university colleges (EUR 16.8 million), university residences (EUR 18.1 million) and sports activities (EUR 6 million).

Since 2009, the yearly FFO allocation is divided into three main strands:

1. a basic quota (*Quota base*), allocated on the basis of previous allocations and the Standard Cost per Student (CSTD – EUR 1.38 million), calculated taking into account the programmes offered, the number and qualification of academic staff, the number of non-academic staff and the services offered, the socio-economic conditions of the students and the availability of public transport
2. a performance-based quota (*Quota premiale*), allocated on the basis of the results of the National Research Quality Assessment Exercise (VQR, EUR 1 693.5 million), of the quality of recruitment, and of the improvement with respect to 2 indicators chosen by universities themselves. This quota is equal to 23% in 2018 and will be increased annually between 2% and 5% to reach 30% of the overall funding in the next few years
3. a residual quota providing for compensations to avoid "shocks" in state transfers and for targeted measures such as strategic planning, student welfare and student services, doctoral grants, incentives for the recruitment of academics and young researchers (*Quota interventi specifici* – EUR 145 million).

Within the three-year strategic planning act, the Ministry of Education Universities and Research (MIUR) defines the share of funding allocated to each strand, also to help universities in their financial planning. The same model – excluding CSTD – is used for the funding of state-recognised universities. In the coming years, the CSTD should become the only criteria in allocatinMIRUg the basic quota, i.e. up to 70% of the overall funding. The CSTD share has been gradually increasing every year so that institutions can progressively adapt to the new system.

After suffering from a reduction of financial allocations, partially buffered by increased efficiency, Italian HEIs are now benefitting of a positive trend. Between 2009 and 2015, there was a constant decrease in public funds allocated to universities. This trend was mirrored by the reduction of students' enrolment and, consequently, of the revenue generated by students' fees. In addition, the economic crisis had negatively affected HEIs' capacity to collect resources, from external stakeholders. Since 2016 the trend has inverted and financial resources have been increasing. However, funds allocation has not yet reached the same levels of 2009.

Box 1.1. Excellence department (*Dipartimenti d'Eccellenza*)

The so-called "Excellent Departments", which are designed following European good practices, are an initiative to support innovation in universities. This initiative puts special focus on strategic planning in research.

180 excellent departments obtain extra financial support for 5 years (EUR 1.35 million per department, on average). The government selects these based on a two-step procedure:

1. Their performance, as assessed by ANVUR (which ranked the best 350 departments on the basis of the VQR 2011-14, as measured by the Standardised Indicator of Departmental Performance, ISPD).
2. The result of an independent evaluation carried out by a committee, appointed by MIUR. This committee selects the best 180 departments on the basis of the ISPD (weight 70%) and of a strategic development programme proposed by the department (weight 30%), evaluated on the basis of coherence and feasibility criteria. These programmes include recruitment of academic and non-academic staff, infrastructures for research, financial incentives to the personnel, development of 2nd- and 3rd-cycle study programmes.

In order to ensure participation of as many state universities as possible, Law 232/2016 limits in the number of applications per university and gives each university the opportunity to select its "best performer" (usually the one with the highest ISPD) to be evaluated only on the basis of its strategic development programme.

Funding for research institutes and research projects

The Fund for the Ordinary Financing of Research Entities and Institutions (FOE) is the main source of funding for Italian research entities. MIUR allocates FOE every year, with the following objectives:

- ordinary assignments (FOE) for the ordinary functioning of research entities, including recruitment procedures
- internationally-relevant research activities, to comply with the commitments undertaken by the government on the basis of international agreements
- development of extraordinary projects, linked to specific activities identified by law or on the basis of dedicated agreements
- Flagship Projects and Projects of Interest (PRIN; see below).

Also, funding for research has decreased in real terms in the last few years (-5.4% between 2011 and 2018). The following paragraphs illustrate the other main funding channels for research and research entities.

Research Projects of National Interest (PRIN)

PRIN funds are targeted to research projects that can potentially achieve a significant advancement in knowledge and increase opportunities for the national research community to benefit from international and European co-fund initiatives.

The PRIN programme, in fact, funds projects which require the collaboration of several researchers and whose financial needs exceed the means available to single institutions. The research group can either be composed by multiple research units from different universities or research entities or, in some specific research fields (e.g. humanities or mathematics), by single individuals.

The main characteristics of PRIN calls are the following: i) only universities and public research entities can apply; ii) projects are portable (in case of principal investigators, or PIs, who move to another institution); iii) funds are entirely transferred in advance, at the beginning of the project; iv) reports are expected only at the end of the project.

FIRST and National Technological Clusters (CTN)

MIUR supports research activities mainly with the Fund for Investment in Scientific and Technological Research (FIRST), including also additional PRIN financing dedicated to infrastructural investments and funds targeted at under 40 researchers.[15] FIRST resources have been cut substantially; more than 50% from 2010 to 2018, when it totalled EUR 83 million. However, starting from 2017, part of the FIRST has been allocated to national technological clusters (CTN), identified as the main tool to reach the targets in terms of public-public and public-private collaboration.

CTNs are given the task to recompose and integrate research strategies and technological roadmaps at the national level. Consistently with Horizon 2020, their objective is to put together critical competencies to mobilise the industrial system, the research system and the public system – both at the national and regional levels – in order to set common research agendas and share roadmaps for technological development.

Study fees and study grants

Student fees are the second most important source of funding after FFO provided by the central government. Access to university in Italy requires the payment of two different fees:

- A general fee to the university, covering the cost of teaching, research and administrative services.
- A targeted fee for the student support system, paid to the regional agencies for students support. Also, smaller administrative fees can be charged.

Each university can autonomously decide the overall amount of fees, within a cap set at the national level, which equals 20% of state funding.[16] This measure has put under pressure university budgets in recent years, due to the reduction of public funding allocated to the institutions. Average tuition fees in public tertiary institutions are lower in Italy than in a number of non-European OECD countries (OECD, 2017a); they are also lower than in the Netherlands and Spain but higher than in most other European countries.

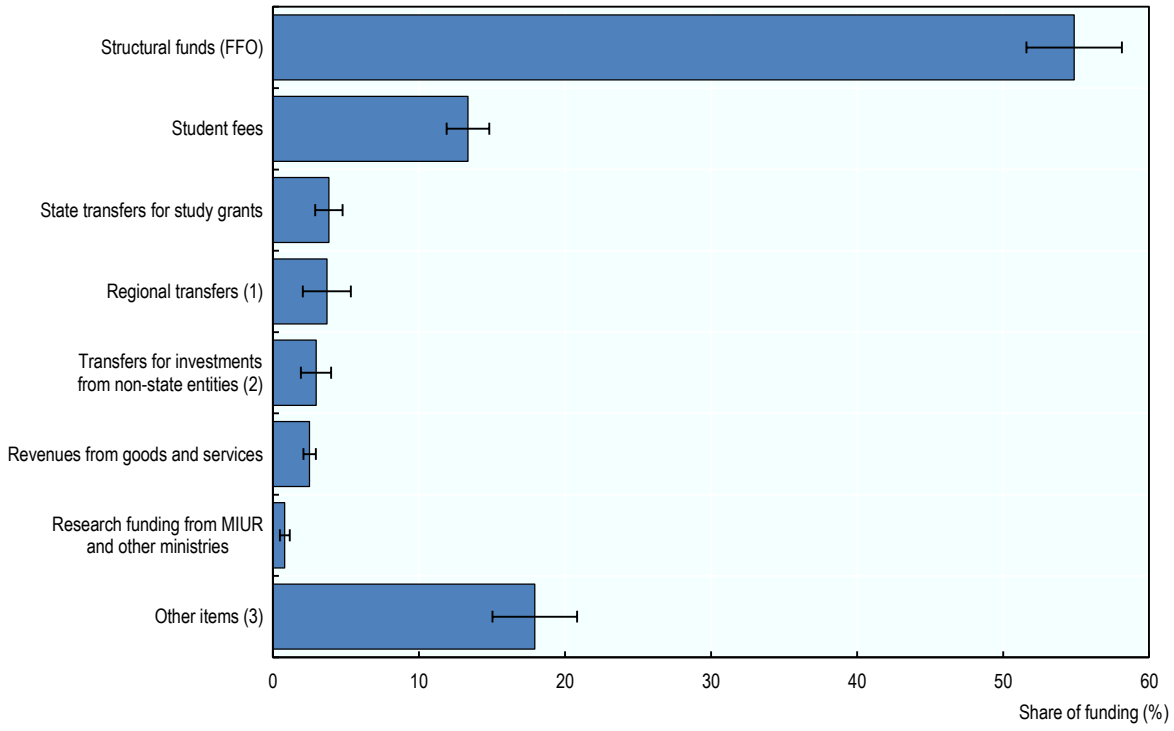
Two main measures support students coming from difficult socio-economic background:

- study grants, including the exemption from the payment of fees, which also consider merit-based criteria
- no tax area, i.e. a full fee exemption for all students below a certain threshold of equivalised income (EUR 13 000) who achieve a minimum amount of European Credit Transfer Scale (ECTS) credits per year.

The students' support system is co-funded by the state (with the State Supplementary Fund, FIS; see above), by the regions (for at least 40% of the FIS), and by students (with the

above-cited targeted fee). The FIS is allocated to regional governments on the basis of co-funding rate,[17] number of eligible students and the number of places in students' residencies. Unfortunately, the available funding is not sufficient to ensure that all students eligible for a study grant are covered. The scenario is fragmented at the national level: some regions have achieved or are close to full coverage, while others struggle in reaching that goal. However, the situation is improving, also thanks to a progressive increase in state co-funding.

Figure 1.1. Composition of the budgets of state universities – Average shares with 95% confidence intervals, 2015



1. Current transfers and revenues from contracts and agreements with regions and autonomous provinces.
2. All private and non-state public entities, including regions, Autonomous Provinces, hospitals, etc.
3. Including all other contracts and agreements, revenues from assets and loans.
Source: Authors' elaboration from MIUR – Bilanci Atenei (https://ba.miur.it/) accessed on May 2019.

International credit mobility

International credit mobility is offered to students to widen academic preparation and achieve transversal competencies and skills. Universities manage credit mobility by matching EU mobility programmes and funding with bilateral/multilateral agreements, institutional funding and support from the state.

MIUR allocates EUR 50 million every year to complement grants for international students' mobility. The criteria to allocate funds to universities include the number of registered students (potentially mobile students), the number of beneficiaries of students support services (grants and exemptions), the number of ECTS credits achieved abroad by regular students, the number of graduates with 12 ECTS credits achieved abroad in their career, the number of doctoral students who spent at least 3 months abroad. Universities are asked to ensure that mobility grants for students take into account their socio-economic situation.

Box 1.2. Recent policy developments

Recruitment

Recruitment of academic staff is at the centre of ministerial funding policies. Thanks to the resources allocated for 2019, the following provisions have been adopted:

- Recruitment of 1 500 young tenure-track researchers covered by national resources (EUR 30 million in 2019 and EUR 88 million starting from 2020).
- Elimination of turnover limitations for financially-robust universities. Institutions with salary expenditures under 80% of the budget and with a positive income/salary expenditure ratio can recruit up to 110% of retirements of the previous year.
- Career progression for existing researchers. 676 positions of associate professors are funded by the ministry to support universities in ensuring career progression to researchers in possession of the national scientific habilitation (EUR 10 million starting from 2020).
- Longer validity of the national scientific habilitation, from six to nine years.

Accreditation of doctoral programmes

Starting from the academic year 2019/20, ministerial guidelines for the accreditation of new doctoral programmes have been adopted to simplify the procedures and put more emphasis on the scientific production of the Doctoral Scientific Committee. This revision, which anticipates a wider reform of the regulations for doctoral education, safeguarded the number of innovative doctoral programmes. The overall number of accredited doctoral programmes totals 993. Most of these programmes are innovative programmes, based on interdisciplinary frameworks and on international and/or industrial collaborations.

New three-year strategic planning

At the moment of drafting this report, the new ministerial document for strategic planning and indicators for periodic evaluation was under discussion with the main stakeholder and should be published soon. The document contains the goals to be achieved by institutions for the period 2019-21 in teaching, research and its value-generating potential, student support, internationalisation and recruitment. The same document also includes the criteria to allocate 20% of the *quota premiale* (around EUR 340 million), an updated version of the indicators for periodic evaluation and criteria to allocate student support funding.

Monitoring quality and performance

Monitoring performances

As mentioned in the introduction, great effort was made by the whole university system to improve performances and use funds more efficiently. A set of tools and indicators have been used by the ministry to measure and evaluate the results achieved, to create a sort of national dashboard available for both the ministry and universities themselves to measure progress. A wide set of databases developed at the national level, in fact, cover several dimensions such as: student and graduate careers; academic and administrative personnel; study programmes, research quality, research and third mission development and

environment; budgets and financial sustainability. The existing indicators (Table 1.2) are used by ANVUR for *ex post* accreditation and by the ministry for performance-based funding.[18] In addition to these indicators, VQR results are used to allocate funding on the basis of performances and to accredit doctoral programmes.

Table 1.2. Sets of performance indicators used to evaluate Italian Universities.

Students and study programmes (for institutions and programmes):
1. Time to completion
2. Attractiveness
3. Sustainability
4. Effectiveness
5. Quality of the academic staff
Internationalisation (for institution and programmes):
1. Outgoing mobility
2. International attractiveness
Quality of research and research environment (for institutions only):
1. Evaluation of research
2. Quality of doctoral programmes
3. Attractiveness of the doctoral programmes
4. Attractiveness of the research environment
Economic and financial sustainability (for institutions only):
1. Economic and financial sustainability index
2. Index of indebtedness
3. Index of personnel costs
Additional indicators for the evaluation of teaching:
1. Time to completion
2. Effectiveness

Source: MIUR

Accreditation system

The accreditation process of study programmes is designed by the ministry – after consultation with ANVUR – on the basis of the criteria defined by the legislation and taking into account the priorities and the indicators defined within the strategic planning. On a five-year basis, accreditation is extended to whole institutions.

The main features of the accreditation process are summarised in Table 1.3.

The accreditation process is based on a robust internal quality assessment (QA) system developed by each university on the basis of the guidelines provided by ANVUR. The agency defines the main responsibility for the institutional players, proposes to MIUR criteria and indicators for accreditation and periodical evaluation, defines the guidelines for onsite visits of QA experts and defines the minimum content of QA documents to be developed. The accreditation of new study programmes takes into account also interactions with the labour market and innovation in teaching and learning, taking advantage of a dialogue with the main stakeholders of the university system, and requiring and evaluating the definition of the expected job positions for graduates. Graduate employment rates and the use of the competencies achieved, instead, are considered in the *ex post* evaluation.

Table 1.3. Synthesis of the accreditation process

	Ex ante accreditation criteria	Periodical evaluation	*Ex post* accreditation criteria	Duration of accreditation and of its formalisation
Accreditation of institutions (including new branches of existing ones)	1. Financial and structural sustainability	1. Student access and success rate	1. Confirmation of *ex ante* criteria	Lasts five years. It can be shortened if the results of the *ex post* accreditation are considered critical. Formalised through Ministerial Decree.
	2. Research profile	2. Employability of students	2. Results of periodical evaluation	
	3. Quality assessment (QA) system	3. Mobility and internationalisation	3. Results of onsite visit by QA experts	
	4. Information on programmes offered, student services, international mobility	4. Research results		
	5. Number and profile of personnel available	5. Financial management		
Accreditation of new study programmes	1. Information on programme offered, including services to students	1. Student access and success rate	1. Confirmation of *ex ante* criteria	Lasts three years. Its duration can be adapted on the basis of the results of periodical evaluation and *ex post* accreditation. Formalised through Ministerial Decree.
	2. Presence of a sustainable number of qualified teachers	2. Employability of students	2. Results of periodical evaluation	
	3. Number of learning activities and weight in terms of ECTS	3. Mobility and internationalisation	3. Results of onsite visit by QA experts	
	4. Structural resources			
	5. Number and profile of personnel			
	6. QA system at the programme level			
	7. Accreditation of existing programme			
Accreditation of existing programmes	If the presence of a sustainable number of qualified teachers with respect to the number of registered students is verified, the *ex ante* accreditation is confirmed.	Same as new programme	Same as new programme	Same duration as for new programmes. Accreditation given by responsible Director-General.

Source: MIUR

Research Quality Assessment exercises (VQR)

The National Research Quality Assessment (VQR) plays a pivotal role in strategic planning and in the evaluation of the Italian system of universities and research. The VQR, now carried out every five years, is aimed at evaluating the research outcomes of state and state-recognised universities and public research institutes – as well as those of private institutions that voluntarily submit their research outcomes – in order to promote the improvement of research quality and to allocate the merit-based share of the FFO for state institutions.

For the period 2011-14, the VQR evaluated the research outputs of all permanent scientific staff in state universities, state-recognised universities and in 39 research organisations. More than 60 445 researchers submitted their best publications, for a total of almost 120 000 research outputs submitted and evaluated.

The publications are classified by their authors in 16 research areas and, for each research area, ANVUR appoints a panel of experts. In humanities and social sciences, a pure peer review system is applied with the help of external (national and international) reviewers. In science, technology, engineering and mathematics (STEM), the same procedure is used but, in addition, ANVUR also produces bibliometric indicators to inform the panels. In each exercise, the expert panels recruited about 15 000 external referees.

Also, third mission is formally considered as an institutional responsibility that universities have and as such, the evaluation of third mission activities is part of ANVUR's objectives. Hence, this is included in both the VQRs and in the national system of quality assurance of the universities (*Autovalutazione – Valutazione periodica – Accreditamento*, AVA).

Third mission activities have been divided into two main areas respectively involving the economic valorisation of research, IP, spin-offs, third-party activities and intermediation activities – and the production of public and social goods – management of cultural activities and the cultural heritage, clinical trials, lifelong learning and public engagement. Evaluation is based on peer review, informed by the aforementioned information.

Policy actions promoting value creation and entrepreneurship

Main policy actions promoting value creation through research

The policy actions here reported are aimed at facilitating the creation of value by focusing on concrete opportunities for interactions between universities, research entities, enterprises and other societal actors.

Innovative doctoral programmes

The National Research Programme 2015-20 created innovative doctoral programmes based on the Principles for Innovative Doctoral Training, adopted by the European Commission (2011). The ministerial provision defining innovative PhDs refers to three main principles. Innovative doctoral programmes must be international, inter-sectoral and interdisciplinary.

The network approach

Italian HEIs generate network to improve their capacity and impact in research activities. Examples of HEI networks promoting research activities are the PhDITalents, the "Innovaton Flow" and the FAI Lab. Italian universities have also taken advantage of EU financial support. For instance, they have used the Erasmus Programme to promote knowledge alliances with enterprises and local players. Knowledge alliances are a successful initiative. Between 2014 and 2017, Italy has been the first country in terms of the number of applications, participating organisations and successful applications.

Since July 2015, the CRUI promoted the University Network for Sustainable Development (RUS, in the Italian acronym). The RUS focuses on environmental sustainability and social responsibility and disseminates good practices related to the Agenda 2030 and UN Sustainable Development Goals (SDGs). RUS, in addition, promotes the Italian experience at an international level.

To encourage the development and dissemination of apprenticeship contracts in the Italian university system, the CRUI Observatory has created the network for the promotion of the higher education and research apprenticeship. The network involves universities, companies, institutions, social partners (trade unions and business associations) and has the objective to improve the legislation and overcome the critical issues that are currently

hindering the diffusion of apprenticeship contracts, by sharing information and good practices.

Smart specialisation strategy

The preparatory work for the operational programmes of the European Structural and Investment (ESI) funds 2014-2020 included the elaboration of a smart specialisation strategy aimed at strengthening the innovation ecosystem and focusing innovation efforts on areas and sectors where the growth potential is higher.

The Italian RIS3 national strategy provides a reference framework for national and local innovation initiatives with an inclusive governance model promoting the involvement of local actors. The strategy identified five cross-cutting objectives and five priority sectors:

1. the enhancement, specialisation and organisation of the national public research system
2. the enhancement and strengthening of human capital
3. the implementation of public policies for innovative industries to maximise the impact of research and innovation on competitiveness and on the opportunities for industrialisation and for market investments financed by public resources
4. the implementation of policies for the engagement of industries, the financial system and the research system in large innovation initiatives
5. guidance in the transition towards new organisational models.

Five national thematic areas were identified: Intelligent and sustainable industry, energy and the environment; Health, nutrition, quality of life; Digital agenda, smart communities, intelligent mobility systems; Tourism, cultural heritage and creativity industry; Aerospace and defence. Two strategic planning documents in particular address these goals: the National Research Plan (PNR) and the National Plan for Research Infrastructures (PNIR).

The National Research Plan (PNR)

The strategic planning for research is developed within the framework of the National Research Plan (PNR). Its main goal is to create a national research system comprehensive of policies for human capital, public-private co-operation and strategic research infrastructures. The National Research Plan is adopted by the Interministerial Committee for Economic Planning (CIPE) as part of the economic policy of the country.

A special chapter of the National Research Plan is the National Plan for Research Infrastructures (PNIR), coherent with the guidelines of the European Strategy Forum for Research Infrastructures (ESFRI). These guidelines define the role of the ministry and the mission of the new National Operative Programme for Research and Innovation 2014-20 (NOP-R&I). The NOP 2014-20 is strictly related to the national RIS3 through the development of research infrastructures, the consolidation of technological clusters, the challenge brought by key enabling technologies (KETs) and the growth of human capital and competencies.

Innovative doctorates with industrial characterisation are part of the strategy, aiming at increasing the attractiveness of PhD programmes, experimenting a new way of collaboration with the business world and taking into account the development trajectories identified within RIS3.

The PNR also includes a researchers mobility initiative, consisting of two lines: researcher mobility (i.e. support in contracting young PhDs graduates to benefit from international mobility) and researcher attraction (i.e. support in contracting young PhDs graduates located outside the target regions of the NOP-R&I 2014-20).

Main policy action supporting entrepreneurship in and through higher education

The policy actions here reported are aimed at improving the entrepreneurship-related skills and competencies achieved by students and, more generally, at increasing participation and successful completion of higher education. These actions are targeted mainly at students but teachers are increasingly involved as well.

Professional bachelor's programmes

Starting in 2018, Italy has introduced professional degree programmes to reduce skills mismatches (OECD, 2017c). Universities can create professional bachelor's programmes, *lauree professionalizzanti* in Italian, tailoring teaching and learning activities to skills needs in labour markets and ecosystems. Professional bachelor's programmes allocate about 50 ECTS to "on-the-job" activities. This share is much higher than the majority of first-cycle programmes (typically limited to 12 ECTS). During this piloting period, each university is allowed to activate only 1 professional programme, enrolling a maximum of 50 students. As of academic year 2018/19, there are 14 accredited professional bachelor's programmes. These require collaboration between HEIs and businesses. Programmes are designed to provide students with a professional qualification, which can be easily identified by employers. This is possible because programmes are designed in collaboration with business associations. In addition, some HEIs have established a collaboration with individual firms.

While professional bachelor's programmes are important to reduce the skills gap in the country, they may overlap with similar initiatives, such as ISCED level-5 technical institutes (*Istituti Tecnici Superiori*) (OECD, 2017c). Italy introduced ITS in 2010 based on the same rationale that generated professional bachelor's degrees. Given the vast demand for technical skills in the country, MIUR and the CRUI are assessing solutions to integrate the two pathways, e.g. by asking universities to recognise exams taken in ITS.

Scientific degrees, tutoring and carrier guidance

MIUR, in co-operation with science departments and the Italian industrialist association created a plan for scientific degrees (*Piano Lauree Scientifiche*, PLS) in 2004. The PLS aims to ensure that students achieve the scientific competencies required to enter the labour market and contribute to sustainable socio-economic development. The plan started focussing on the "core" scientific disciplines – mathematics, physics and chemistry – but was recently extended to other STEM disciplines (except engineering). The PLS helps students develop their own academic path and promote enrolment in scientific programmes, often considered too challenging.

To achieve these goals, HEIs co-operate in national networks, organised by discipline, to:

- involve secondary school students in targeted, students-centred, learning activities to experience learning at tertiary level
- organise self-assessment exercises for students, to raise their awareness concerning their disciplinary and transversal competencies
- help secondary school teachers upgrade their skills and knowledge
- support university students in their first years of study, to reduce dropout.

As female participation in scientific disciplines is often low, project promoters are asked to implement targeted measures to enrol more women.

Since the academic year 2017/18, the government has adopted a similar approach to humanities and non-STEM disciplines. Drawing on the experience of the PLS, the ministry created a plan for tutoring and carrier guidance (*Piano Orientamento e Tutoraggio*, POT) in law, economics and management, pharmacy, engineering, architecture and industrial design, cultural heritage and humanities, arts, languages, pedagogy, social sciences, sports, and agricultural and food sciences.

Entrepreneurship and transversal skills

In the strategic planning of the university system, the ministry encouraged institutions to develop action plans to increase and strengthen transversal competencies achieved by students. Twenty universities presented strategic development projects, which explicitly included an action plan on the topic, also providing support to academics to innovate in their teaching methodologies.

In this respect, the assessments of competences (*test delle competenze,* TECO and TECON) promoted by ANVUR have certainly pressured universities to take into consideration the impact of programmes in the additional development of not strictly subject-related competencies.

In the national debate, the acquisition and valorisation of digital competencies and the promotion of training activities for teachers in teaching and learning innovation have not been forgotten. In consideration of these critical issues and promising areas of development, the CRUI Observatory (CRUI, 2018) made some proposals to be translated into operational actions, including the development of digital certificates such as OpenBadges (see Chapter 5 on digital transformation).

National awards promoting entrepreneurship teaching and learning

A great stimulus for entrepreneurship comes from a national prize, *Premio Nazionale Innovazione* (PNI), promoted by the national association of incubators, PNICube, since 2003. The PNI rewards the best projects in the development of technology-intensive enterprises resulting from research activities and the winners of regional business plan competitions, better known as the Start-Cup. To evaluate the projects, PNICube involves a jury of experts from the private sector. In 2014, a special award for the best social innovation project was created. Since 2015, another special award is devoted to equal opportunities.

In addition to the National Award for Innovation and since 2007, PNICube has been promoting the Italian Master Start-up Award, a unique event at the national level rewarding the start-up which achieves the best economic and commercial performances within 3 years from its foundation.

Between 2003 and 2016, as many as 700 ideas for enterprises made it to the final phase of the National Award for Innovation. Out of these, 337 are now active start-ups with an average budget of EUR 260 000, 5% of them with more than EUR 1 million.

Notes

[1] The law reform was n. 240/2010.

[2] "Ecosystem" is often used as synonymous with "territory" or "region"; however, the word has an ample meaning. An ecosystem may encompass activities and agents that are not located in the core territory but have great influence on what happens in the core. In the same vein, thriving ecosystems are part of extended networks that involve other ecosystems (ecosystem of ecosystems), while lagging behind regions are small ecosystems (like small ponds, for example).

[3] As in most OECD countries, tertiary educational attainment is higher for women than men in Italy: in 2017, 20% of men and 33% of women aged 25-34 had a tertiary education compared to the OECD averages of 38% and 50%. The gap is similar for recent graduates: based on 2016 data, 25% of today's young men (under 30) and 37% of young women in Italy can expect to graduate from tertiary education at least once in their lifetime.

[4] Italian HEIs operating in these four areas generate more than 80% of academic patents. This proves the actual concentration of the system in a few HEI poles.

[5] Nevertheless, in Italy, start-ups are more likely to survive than start-ups in other countries and tend to grow in their first three years at roughly the same rate as their counterparts located in other countries (Calvino, Criscuolo and Menon, 2015).

[6] Further information on the structure of qualifications in the Italian higher education system can be found in the Italian Qualifications Framework for higher education (www.quadrodeititoli.it).

[7] Scuola Normale Superiore (Pisa), Scuola Superiore S. Anna (Pisa), Scuola Internazionale Superiore di Studi Avanzati (Tri-este), Istituto Universitario di Studi Superiori (Pavia), Scuola di Alti Studi "Istituzioni, Mercati, Tecnologie" (Lucca), Gran Sasso Science Institute (L'Aquila). The two institutions based in Pisa and the one based in Pavia are also awarding second-cycle qualifications, in co-operation with partner universities.

[8] Data for academic year 2016/17.

[9] This is the legal form chosen for this type of institution.

[10] Typically the fashion industry, the construction sector and the manufacturing of machinery tools.

[11] The detailed list can be found at: https://www.miur.gov.it/enti-pubblici-di-ricerca1.

[12] These are: CREA (Council for Agricultural Research and Economics), supervised by the Ministry of Agriculture, Food and Forestry; ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), supervised by the Ministry of Economic Development; INAPP (National Institute for Public Policy Analysis, formerly ISFOL), supervised by the Ministry of Labour and Social Policy; ISTAT (National Institute of Statistics), supervised by the Prime Minister's Office; ISS (Higher Institute of Health), supervised by the Ministry of Health; ISPRA (National Institute for Environmental Protection and Research), supervised by the Ministry of the Environment.

[13] The Italian framework for strategic planning is very similar to the one used in Austria. Also in that case, universities negotiate with the ministry the strategic priorities of the system on a three-year basis and report the results of the period to parliament. In Austria, however, universities also negotiate with the ministry their individual strategic priorities, instead of presenting projects to obtain co-funding.

[14] The University of Trento was founded in 1962 as a private institution. In 1982, the university (until then private) became public, with a statute that guaranteed self-government. The Milan Agreement of 2009 provided the Autonomous Province of Trento more power over the university.

[15] The initiatives that can be covered through FIRST are: support to basic and industrial research, including pilot projects to foster specialisation; procurement contracts for R&D, in connection with relevant social challenges (e.g. environmental sustainability, technological innovation); social innovation actions; infrastructural investments, financial support to advanced training, technology transfer centres and spin-offs for the development of technological clusters in public-private partnership; national projects on basic and industrial research, included in EU and international programmes; projects for the use of research results in an industrial context.

[16] This maximum cap excludes fees from non-EU students and from students exceeding the normal duration of study programmes.

[17] The higher the share of funding taken up by regions, the higher the allocation from the government.

[18] The set of indicators has been revised with the adoption of the ministerial decree on strategic planning for the period 2019-21. The new indicators will be progressively included into the monitoring and evaluation system.

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Chapter 2. Applying the HEInnovate framework to higher education in Italy

This chapter presents the HEInnovate guiding framework and applies all its dimensions to Italy's higher education system and to Italian higher education institutions (HEIs). The aim is to have an all-round discussion of the capacity of higher education (institutions) to engage and create value for the economy and society while fulfilling their teaching and research missions. The chapter illustrates national features, and some selected case studies, in the eight dimensions of the HEInnovate framework, also explaining why Italy chose to focus in particular on a subset of four dimensions for this review. It displays some relevant results of a Leader Survey, a questionnaire that was administered to all Italian HEIs.

The HEInnovate guiding framework

In recent decades, the missions and mandates of higher education institutions have become more complex and their activities have broadened, both in OECD countries and emerging economies. HEIs have acquired a pivotal role in national innovation systems and have considerably expanded their research and development (R&D) activities since the 1980s, partly at the expense of public research organisations. In the OECD area, for instance, HEIs' R&D expenditures have increased more rapidly than R&D expenditures in the business and government sectors (OECD, 2017a).

Moreover, the increasing role of HEIs in national innovation systems and their expected contribution to economic growth and to social and cultural development has put an increasing demand on HEIs on knowledge exchange and technology transfer with economic players. This transformation has gone hand in hand with other global trends:

- In many countries, the governance of HEIs has been decentralised. This has often resulted in a greater autonomy combined with shifts in funding towards greater emphasis on performance and competition. This has allowed HEIs to autonomously allocate resources, set strategic targets and shape their own profiles in research and education. Research suggests (Aghion et al., 2010) that the shift towards greater autonomy of HEIs has had a positive impact on HEI performance.
- Globalisation has been affecting the way that HEIs interact and compete at the international level. Increasing participation in international science and innovation networks has enabled greater international exchange and mutual learning in research activities and education practices. It is also, however, leading to increased competition between institutions for attracting and retaining talented students and researchers.
- The changing context for HEIs has put more emphasis to the concepts of the "third mission" and the "entrepreneurial university" (OECD, 2017a; Etzkowitz et al., 2000; Gibb, Coyle and Haskins, 2013; www.heinnovate.eu). The third mission of HEIs refers to all the activities that go beyond the two core missions, i.e. teaching and research. These activities can be very broad and diversified and take place at different geographical scales. As mentioned above, one of the key third mission activities of HEIs is "knowledge exchange" with business, public organisations and society more broadly (OECD, 2007; Goddard, Kempton and Vallance, 2013; OECD, 2017a). This is also a key feature of what is generally known as the entrepreneurial university.

To support policymakers and HEI leaders to make the most of these transformations, the OECD and the European Commission have developed together HEInnovate, a guiding framework to support HEIs in the development of their innovative and entrepreneurial capacities (Box 2.1). HEInnovate encompasses eight dimensions defined, and detailed for Italy, in the next sections of this chapter.

Box 2.1. Components of the HEInnovate guiding framework

The HEInnovate framework includes three main components:

- **The HEInnovate self-assessment tool**. The self-assessment tool was conceived for individual HEIs who wish to explore and develop their innovative potential. It guides HEIs through a process of understanding, prioritisation and action planning in eight key dimensions (leadership and governance, organisational capacity: funding people and incentives, entrepreneurial teaching and learning, preparing and supporting entrepreneurs, digital transformation and capability, knowledge exchange and collaboration, the internationalised institution and measuring impact). HEInnovate also identifies areas of strengths and weaknesses, opens up discussion and debate on the innovative and entrepreneurial nature of individual HEIs and allows comparing trends over time. The self-assessment tool gives HEIs instant access to results, learning materials and a pool of experts. The results along with all data provided by HEIs remains confidential, the OECD and the European Commission do not access information submitted by users of the HEInnovate self-assessment tool.
- **The HEInnovate country reviews**. Reviews have been developed to provide a national systemic perspective about innovation in national higher education systems. They complement the HEInnovate tool by providing a systemic perspective and taking into account the different roles and features of different HEIs in a national system. HEIs do not operate in isolation but collaborate with their community and compete with other HEIs in the same country (and abroad) in a variety of fashions. The country reviews were developed to capture and assess these complex interactions and dynamics. At the time of writing, country reviews had been completed for the following OECD or European Union (EU) countries: Ireland, Hungary, Austria, the Netherlands, Poland, Bulgaria, Romania and Croatia (OECD/EC, 2019, 2018, 2017 a, b, c).
- **The HEInnovate Policy Learning Network (PLN)**. The PLN was established as a platform of peer-learning and policy dialogue among policymakers of the countries participating in HEInnovate country reviews. The participants of the PLN meet and discuss regularly key themes linked to the HEInnovate eight dimensions and relevant for their countries. It is a platform to learn and compare from similar experiences across OECD and EU countries.

Sources: OECD/EC (forthcoming), *Supporting Entrepreneurship and Innovation in Higher Education in Austria*, OECD, Paris/EU Brussels; OECD/EU (forthcoming), *Supporting Entrepreneurship and Innovation in Higher Education in Croatia*, OECD, Paris/EU, Brussels; OECD/EU (2019), *Supporting Entrepreneurship and Innovation in Higher Education in Romania*, OECD, Paris/EU, Brussels; OECD/EU (2018), *Supporting Entrepreneurship and Innovation in Higher Education in the Netherlands*, OECD, Paris/EU, Brussels; OECD *OECD/EU (2017a), Supporting Entrepreneurship and Innovation in Higher Education in Hungary, OECD Skills Studies, OECD Publishing, Paris/EU, Brussels. OECD/EU (2017b), Supporting Entrepreneurship and Innovation in Higher Education in Ireland, OECD Skills Studies, OECD Publishing, Paris/EU, Brussels. OECD/EU (2017c), Supporting Entrepreneurship and Innovation in Higher Education in Poland, OECD Skills* Studies, OECD Publishing, Paris/EU, Brussels. (2017b); OECD (2015a), *Supporting Entrepreneurship and Innovation in Higher Education in Bulgaria*, OECD Publishing.

The HEInnovate dimensions in the Italian context

Italy, a G7 country, is the sixth-largest economy in the OECD and the second manufacturing power in Europe. For a country in such position, knowledge, science, and HEIs play a primary role in determining both the current state and the future developments of the national system.

The *OECD HEInnovate Review of Italy*, based on the specific request of national authorities, focuses on four key dimensions, selected among the eight of the HEInnovate framework: Knowledge exchange and collaboration; the Internationalised institution; Digital transformation and capabilities; Organisational capacity: funding, people, incentives. The report discusses these four dimensions in detail in Chapters 3, 4, 5 and 6. However, the OECD has collected a broader set of information that allows generating some analysis on all the dimensions of the framework. In particular, with the support of national authorities, a Leader Survey was administered to all Italian HEIs (Box 2.2). Although the response rate has been relatively low (18 responses out of 87 HEIs), the survey provides some useful insights to discuss the performance of the higher education system and HEIs in a more holistic fashion.[1]

Box 2.2. The HEInnovate Leader Survey

The Leader Survey in Italy, 2019

As part of the HEInnovate country reviews, an online survey was administered to Italian senior management of higher education institutions (HEIs), in order to complement the information obtained from the background report and the study visits. The questionnaire reflects the eight dimensions of the HEInnovate self-assessment tool and asks questions about the leadership and governance, the organisation of the HEI, the way in which entrepreneurship education is delivered, facilities preparing and supporting entrepreneurs, and so on. The response rate is relatively low. A total of 18 Italian HEIs (approximately 21% of the total of 87 institutions) filled the questionnaire. In 11 cases, the questionnaire was filled by the central administration (rector's or president's office), in the other 7 cases, it was filled by the staff who is involved in or responsible for entrepreneurship education activities and start-up support.

Leadership and governance

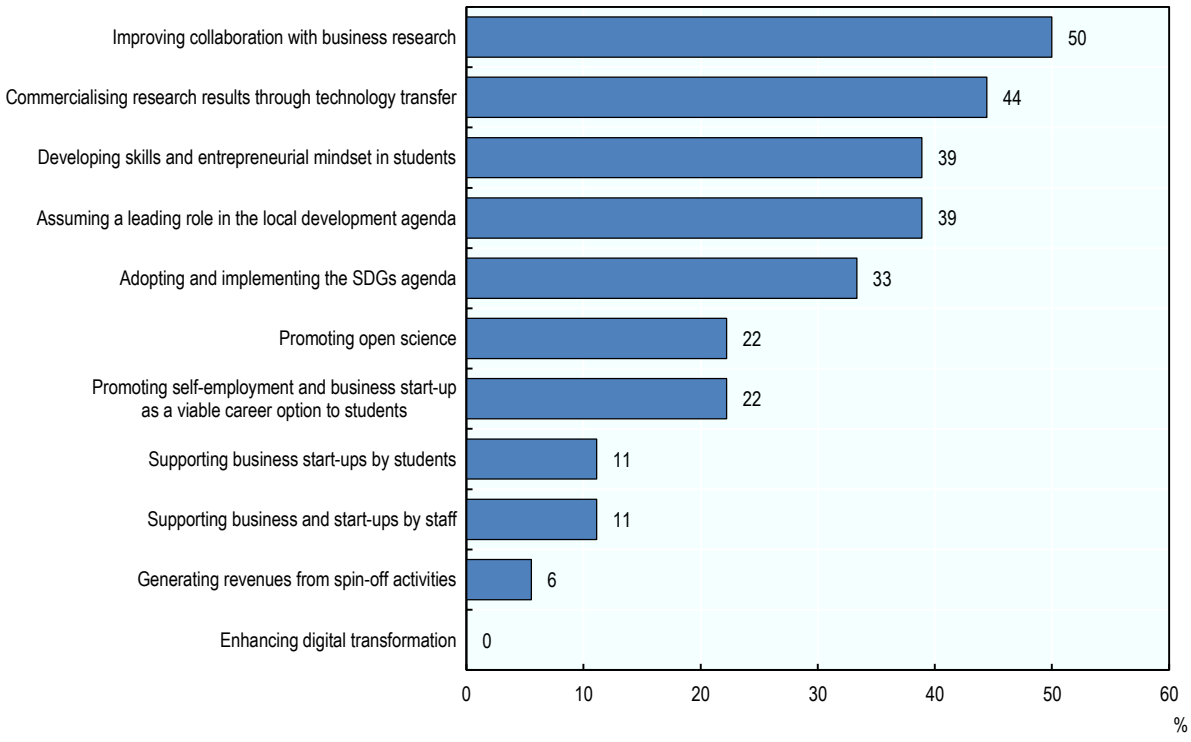
Leadership and governance arrangements are crucial to set strategic visions and goals and define the framework of incentives to promote the entrepreneurial and innovation agenda within HEIs. Many HEIs across OECD and EU countries include the words "innovation" and "entrepreneurship" in their mission statements but, in an innovative and entrepreneurial institution, this is more than a reference. Entrepreneurship should permeate the strategy of innovative HEIs and affect visions, values and missions. For example, an HEI could have a mission statement and written strategy, setting out an entrepreneurial vision for the future of the institution. This strategy could clearly emphasise the importance of entrepreneurship, culturally, socially and economically. In addition to the strategy, it is equally important to articulate a clear implementation plan with clear objectives and define key performance indicators to measure progress.

HEIs in Italy are autonomous organisations defining their own governance structure and internal organisation within the national regulatory framework. The main governance bodies are: i) the rector, who is supported by a team of vice-rectors and usually also by other delegates; ii) the academic senate, which represents the academic community; iii) the administrative board, which includes internal and external stakeholders; iv) the audit body and the evaluation body; and v) the director-general, appointed by the administrative board, who is in charge of the administration of the university.

Typically, the rector and his/her team are in charge of the university strategy to support innovation and entrepreneurship in Italy. At the administrative level, there are generally dedicated offices for research and technology transfer. Departments mostly committed to innovation and entrepreneurship generally appoint a dedicated team of people to support the innovation and entrepreneurship strategy. According to the report of the Research Quality Assessment Exercise 2011-14 (ANVUR, 2016), 69 out of 98 Italian universities have created a senior leadership role to foster entrepreneurship and innovation. The University of Urbino, for example, was one of the first to appoint a vice-rector for engagement and knowledge exchange.

More in general, however, Italian HEIs have been experimenting with different governance arrangements. Several universities, including case studies of the HEInnovate review, have developed new bodies to connect with external stakeholders and engage with the entrepreneurial and innovation agenda. Several universities have created joint laboratories or scientific parks to engage with the business sector and promote innovation. In other cases, universities have established internal working groups to promote entrepreneurship. In Lombardy, a joint foundation called University for Innovation (U4I) was established in 2018, bringing together three universities (Milano-Bicocca, Pavia and Bergamo) and aimed at increasing the entrepreneurship culture in the universities, as well as providing knowledge and competencies to promote the transfer from a discovery (patent or other) to a commercialised product. Smaller HEIs have decided to join efforts and acquire a critical mass to better support innovation and entrepreneurship. An example is the Joint Technology Transfer Office "JoTTO", established in 2015 by the IMT School of Advanced Studies in Lucca, the *Scuola Normale Superiore* in Pisa, the Sant'Anna School for Advanced Studies in Pisa and the IUSS University of Pavia (which joined in 2017).

Figure 2.1. Priorities in Italian HEIs' engagement strategies



Note: HEIs responded the following question: "Taking into account the HEInnovate dimensions/components listed below, please indicate the three that are most prominent in your strategy".
Source: OECD HEI Leader Survey Italy, 2019.

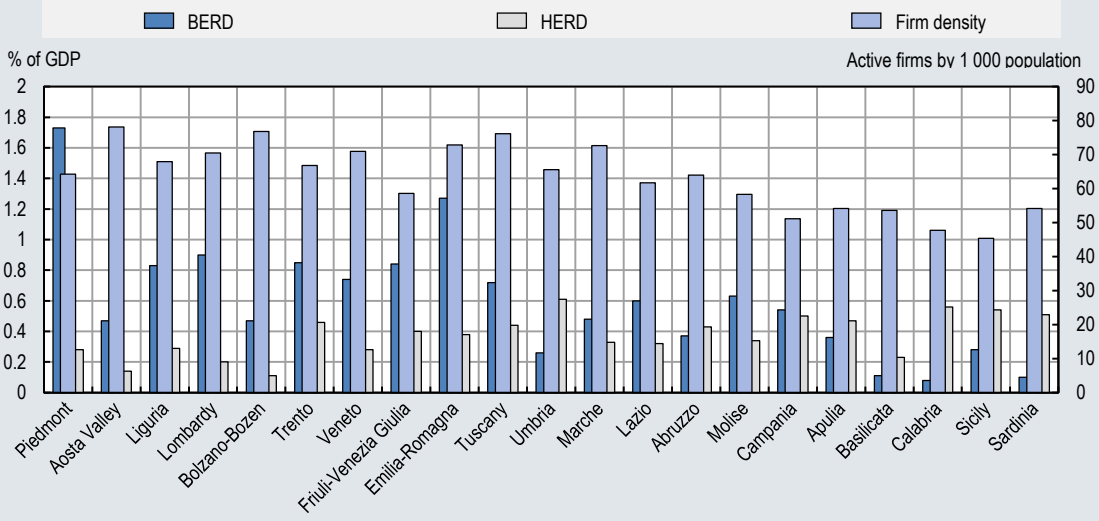
The Leader Survey provides insights into the rationale behind governance innovations. About half of the HEIs that responded to the survey put a particular focus on collaborative research (with the business community). The commercialisation of results (44%) ranks second among HEIs' strategic priorities. Two strategic objectives occupy the third place: developing an entrepreneurial mindset and skills in students (39%) and assuming a leading role in the local development agenda (39%). With the exception of the development of the UN Sustainable Development Goals (SDGs) agenda, the survey illustrates that respondent "associate" a relatively limited set of strategic priorities. For example, none of the survey respondents considers the enhancement of digital transformation as a priority for the HEI.

Unsurprisingly, regional disparities affect the way in which Italian HEIs interact with their ecosystems (Box 2.3). These differences depend on the characteristics of the region, including population dynamics and the functioning of the school system, and its economy, including expenditures on research and innovation and other factors that affect the competitiveness of the local systems, such as quality of the institutions or availability of infrastructures (Annoni, Dijkstra and Gargano, 2017).

Box 2.3. Selected characteristics of regional economies in Italy

Italy's regional innovation ecosystems illustrate some differences that may affect the way HEIs engage with business and society. For example, there are differences in terms of the share of R&D investment generated by higher education institutions and business, and the density of firms. Northern and central regions display the highest density of firms, being home to many small- and medium-sized enterprises (SMEs). Piedmont and Emilia-Romagna are important manufacturing regions and display a relatively high level of R&D investment generated by businesses, while central and southern regions, less rich in export-oriented firms, display relatively higher levels of R&D investment generated by HEIs.

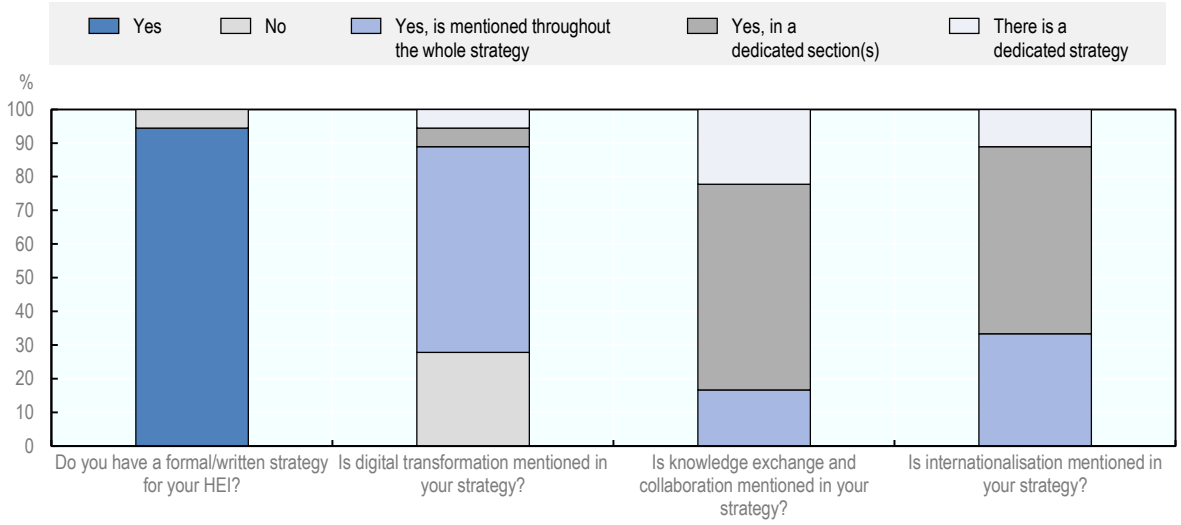
Figure 2.2. Selected regional indicators in Italy, 2015



Note: HERD (higher education expenditure on research and development) and BERD (business expenditure on research and development) represent the share of R&D investment made respectively by HEIs and by the business sector. The regional density of firms is measured with respect to the territorial level TL2.
Source: OECD dataset on Science and Technology; OECD Regional Statistics and Indicators.

The survey also asked respondents to focus more in detail on the HEInnovate dimensions selected for the Italian review (Figure 2.3). Having a formal/written strategy is now the norm – since HEIs are required by the ministry to have one. Digital transformation seems to be outside the focus of Italian HEIs, with several institutions that do not mention it among their priorities. Conversely, internationalisation and knowledge exchange and collaboration are more relevant, having either a dedicated section in the strategic document or even a dedicated strategy.

Figure 2.3. Formal strategies of Italian HEIs and the HEInnovate dimensions



Source: OECD HEI Leader Survey Italy, 2019.

Organisational capacity: Funding, people and incentives

The organisational capacity of a given HEI affects its ability to implement a strategy. In other words, a strategy alone is not enough; an HEI that is committed to carrying out innovative and entrepreneurial activities needs to fund and invest in these areas accordingly and consistently.

Concerning funding, success factors include the following: i) a strong alignment between investments in innovative and entrepreneurial activities and the HEI overall financial strategy; ii) a continuous and long-term engagement with funders and investors, also outside the academic world, to secure financial resources to deliver strategic objectives; iii) a balanced and diversified range of funding and investment sources, including in-kind contributions; and, finally, iv) the possibility to re-invest revenues generated from research, teaching and knowledge exchange activities.

People are, of course, also essential: they need to have or acquire the skills, the expertise and the knowledge to transform the HEI into a more innovative and entrepreneurial organisation. Finally, properly designed incentive mechanisms for researchers, staff, students and external stakeholders need to be in place to promote and strengthen innovative and entrepreneurial practices in the HEI.

In Italy, the "autonomy reform", implemented in 2010, represents a milestone concerning HEIs' capacity to organise themselves to promote entrepreneurial and innovation activities. For example, among others, the reform aimed to increase interdisciplinary learning and teaching. In other words, the reform has contributed to the creation of the regulatory framework that is needed to promote and implement the entrepreneurial and innovation agenda (see Chapter 6 for more details).

All HEIs adapted their organisation to the provision included in the 2010 reform. For example, the University Federico II in Naples decided to create a matrix-structure, where 26 departments in 13 disciplinary areas together provide interdisciplinary education programmes in schools, namely the School of Agriculture and Veterinary Medicine, School of Polytechnic and Basic Sciences, the School of Social Sciences and the School of

Medicine. On the one hand, students benefit from transversal and interdisciplinary knowledge; on the other hand, this architecture also allows for efficient use of inner-institutional competencies, as single departments contribute to a variety of programmes.

The Italian funding mechanism may hinder engagement and third mission activities. Compared to other OECD countries, Italy allocates a relatively large share of HEI funding based on research performance assessed by the National Agency for the Evaluation of University and Research (ANVUR). Data is collected through quality indices and peer reviews. The assessment focuses mainly on research outputs and is performed through peer review (informed by bibliometric indicators in the science, technology, engineering and mathematics [STEM] areas). The evaluation conducted by ANVUR has had a positive impact on the Italian system and it goes in the direction of the development of an evaluation culture already present in innovation-intensive OECD countries (OECD, 2017b). However, as confirmed by the Leader Survey, there may be an excessive focus on research activities (i.e. publications and venues) vis-à-vis initiatives related to entrepreneurship and innovation.[2] As a result, there is a lack of systemic incentives supporting innovation and entrepreneurship in the Italian higher education (HE) landscape.[3] In addition, any financial incentive aimed at promoting innovation should preferably be implemented with a truly rewarding modality (e.g. with extra funding) rather than re-distributive criteria.

Recognising the importance of the "entrepreneurial and innovation agenda" several HEIs have put in place a variety of incentives for "engagement", as revealed by site visits. Creative non-salary incentives to promote innovation and entrepreneurship amongst staff comprise e.g. the provision of sabbatical years to follow innovative ideas, services and facilities for a lower price or a different computation of working hours, in case time is used for the work on spin-offs. Other incentives comprise rewards for the inventors of patents or plant ownership owned by the university. By law, at least 50% of revenues from university-owned patents have to be allocated to the inventor to be used for research or other academic activities. Other examples comprise premiums being handed over to the department for autonomous use. This might be used not only to incentivise patenting activities of HEIs as such, but especially to increase the share of universities in the ownership of a patent. The fact that the result of the Leader Survey does not reflect this trend, however, may mean that there are significant differences among Italian HEIs and that a national "model" for engagement has not emerged yet. Specifically, only 5 out of 18 HEIs that completed the survey declared that they reward staff members for their involvement in engagement activities alongside their standard job responsibilities. They all do so through salary increases, while there is no impact on promotions or on the reduction of teaching responsibilities.

Entrepreneurial teaching and learning

Entrepreneurial teaching and learning are about exploring innovative teaching methods and finding ways to stimulate entrepreneurial mindsets. This involves learning about entrepreneurship (e.g. how to start a new company), by receiving training on support mechanisms, tax rules, financial schemes and other private or public policy support. However, it also and most importantly means of acquiring the skills and competencies for developing entrepreneurial mindsets, which are often associated with the ability to tackle problems using a variety of methodologies and interdisciplinary approaches, problem-solving skills and more in general soft skills such as communication, management, organisational skills, etc. This can be achieved, for instance through, problem-based learning, interdisciplinary courses, internships, teamwork assignments, etc.

An innovative and entrepreneurial HEI provides a range of learning opportunities to facilitate innovative teaching and learning across all faculties. Such an HEI should be encouraging innovation and diversity in its approach to teaching and learning across all faculties and departments as well as developing entrepreneurial mindsets and skills across all programmes.

A range of practices can promote the development of an entrepreneurial mindset across students and staff. Examples to promote these skills across students include supporting change in curricula to stimulate and develop entrepreneurial mindsets and skills through, for instance, new teaching methods, student-centred, cross-disciplinary and project-based learning (e.g. internships, business competitions, living labs, case studies, hackathons, games and simulation). Academic staff can take part in these activities as organisers or participants. Staff can receive training on how to create a business but also support interdisciplinary teaching and research.

Extracurricular learning opportunities are an important complementary part of entrepreneurship teaching and learning provision. An innovative HEI should offer a range of informal learning opportunities to inspire students to act entrepreneurially, such as networking events between students and entrepreneurs/businesses or business idea/plan competitions. These initiatives are more effective when they are formally recognised.

Skills mismatch and adults' competencies remain key challenges in Italy (OECD, 2017b). Some reforms aiming at the university system have been introduced to address, at least in part, these issues. Based on these reforms, for example, universities are now requested to consult external stakeholders in the development and update of the new study programmes, on a regular basis. In addition, reforms introduced incentives to support students that do internships during their study programmes. In the same vein, reforms have introduced inter-sectoral training activities in doctoral programmes.

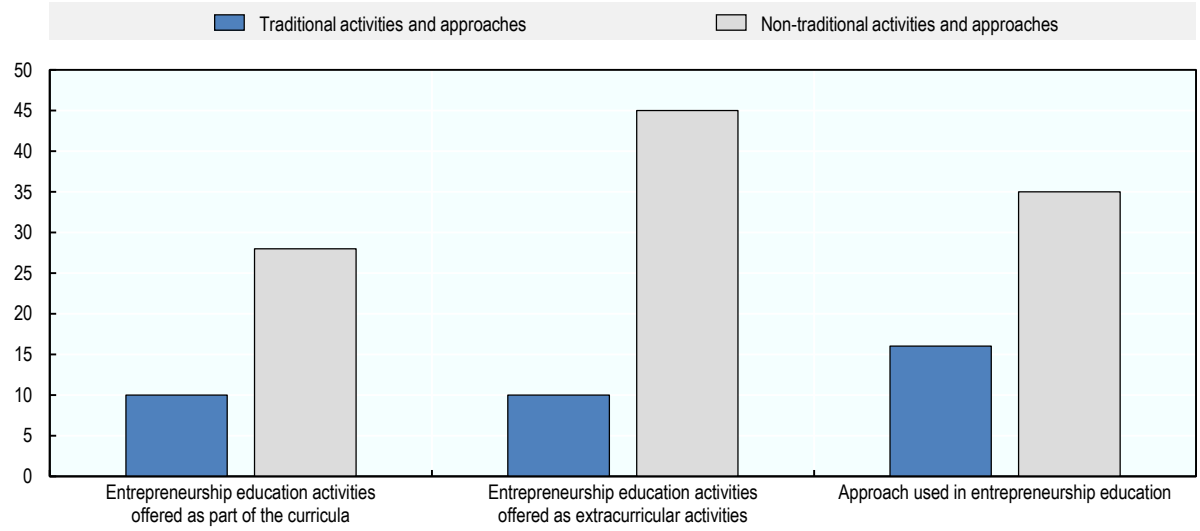
The Ministry of Education, University and Research (MIUR) encourages the development of strategies and action plans to strengthen transversal competencies and at least 20 universities in Italy adopted plans and actions to promote the development of these skills in higher education programmes. Some universities have created advanced schools or colleges where students undertake additional learning activities to improve transversal skills. These include the University of Torino, Bologna, Padova, Ca' Foscari in Venice, Udine, Macerata, Catania, Genova, La Sapienza in Rome, Camerino. Other universities have devoted efforts to promote the usage of team-based learning and problem-based learning approaches as at the University of Modena and Reggio-Emilia. Twelve institutions out of the 18 HEIs that responded to the Leader Survey also declare that they have dedicated staff to teach entrepreneurship.

A recent innovation in the higher education system was the introduction of a professional bachelor's programme or *Lauree Professionalizzanti* in Italian (OECD, 2017b). These programmes aim to develop professional technical skills at the tertiary education level in different disciplines, based on the needs of local labour markets and ecosystems. Italy needs professional skills (OECD, 2007) and it is important that *Lauree Professionalizzanti* are integrated into other institutes providing 2-year short-term tertiary professional/vocational education, the ITS. An attempt to improve integration between the two tracks consists of a co-ordination committee composed by the Conference of Italian University Rectors (CRUI), MIUR and other relevant bodies to co-ordinate the different activities.

The Leader Survey asked which activities and approaches are used by universities when dealing with entrepreneurship education (Figure 2.4). Respondents confirm that also in

Italy traditional teaching activities (lectures and frontal teaching) are becoming obsolete, while problem-based learning (PBL), simulations and direct applications, business idea generation activities and competitions, design-thinking methods, case studies and start-up competitions are gaining relevance. Education programmes often encompass internships and work-based learning, PBL, visit companies and blended learning, as opposed to traditional classroom teaching.

Figure 2.4. Activities and approaches used in entrepreneurship education in Italy



Note: HEIs responded the following questions: i) "Which of the following entrepreneurship education activities are offered as part of the curricula?"; ii) "Which of the following entrepreneurship education activities are offered as extracurricular activities?"; iii) "Which one of these approaches are used by your HEI?".
Source: OECD HEI Leader Survey Italy, 2019.

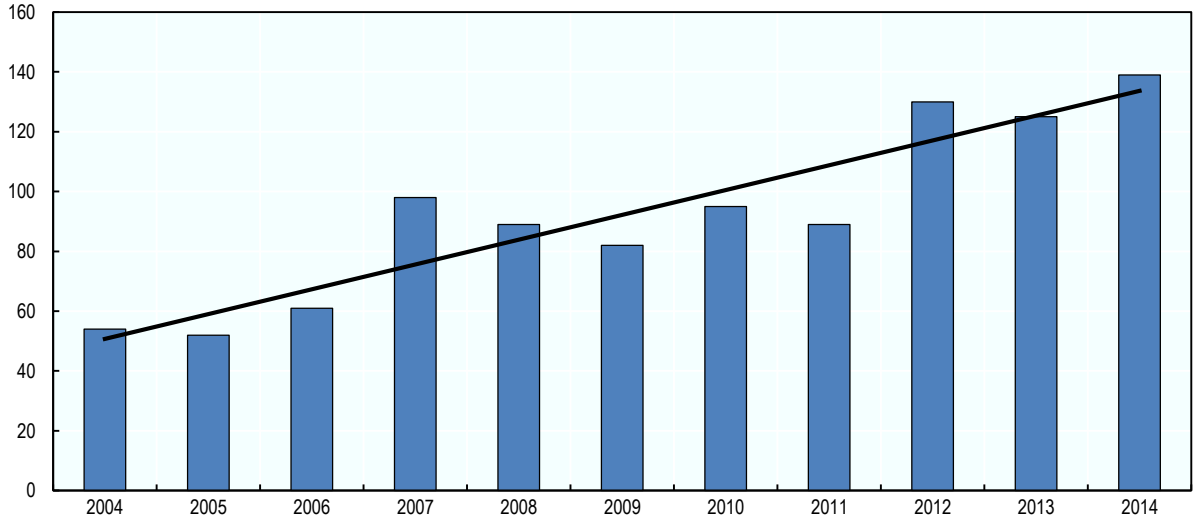
Preparing and supporting entrepreneurs

HEIs can help students, graduates and staff considering starting a business as a career option. HEIs can have an important role to help individuals reflect on the commercial, social, environmental or lifestyle objectives related to their entrepreneurial aspirations and intentions. This does not necessarily mean starting a business but rather developing an entrepreneurial mindset and the related skills necessary to work creatively also as an employee. For those who decide to proceed to start a business or any other type of venture, HEIs can offer targeted assistance to generate, evaluate and act upon new ideas, building the skills necessary for successful entrepreneurship, and importantly find relevant team members and get access to relevant networks.

Also, context matters in academic entrepreneurship (OECD, 2011). National regulations, affecting the ease of doing business in a country, is, of course, an important factor promoting business-HEI co-operation and have an obvious impact on academic entrepreneurship. However, the location of HEIs seems to play an even more important role, concerning academic entrepreneurship. National support measures are more effective when the entrepreneurship and innovation ecosystem surrounding the HEI is well developed, when, for instance, HEIs are part of a wider business and innovation support ecosystem.

Italian universities have equipped themselves to support entrepreneurship (Netval, 2018).[4] According to ANVUR (2016), 60 Italian universities have provided help to more than 1 000 spin-off enterprises, generating a total revenue of about EUR 165 million in 2014.[5] The number of academic spin-offs has been increasing over the past years (Figure 2.5). Between 2014 and 2017, 254 additional spin-offs have been established. The bulk of spin-offs are located in Italy's richest regions: 47.3% in the north and 29% in the central part of the country. There are, however, policy actions in place to promote academic entrepreneurship in all regions. For instance, the national network of incubators (PNICube) promotes either regional (StartCups) and national (Premio Nazionale dell'Innovazione) business plan competitions requiring collaboration among one or more universities, investors, private companies, national and regional authorities and foreign institutions. Finally, field visits, along with the national champions operating in cities such as Milan (PoliHub), Turin (i3p), Bologna (Almacube) and Palermo (ARCA), illustrated good practices in HEIs based in all regions, for example, the BaLab at the University of Bari, in Apulia, and Campania Newsteel, the incubator of the University of Naples Federico II. These incubators are home to highly engaged teams work to scout talent in their own ecosystem.

Figure 2.5. New spin-offs accredited in Italy, 2004-14



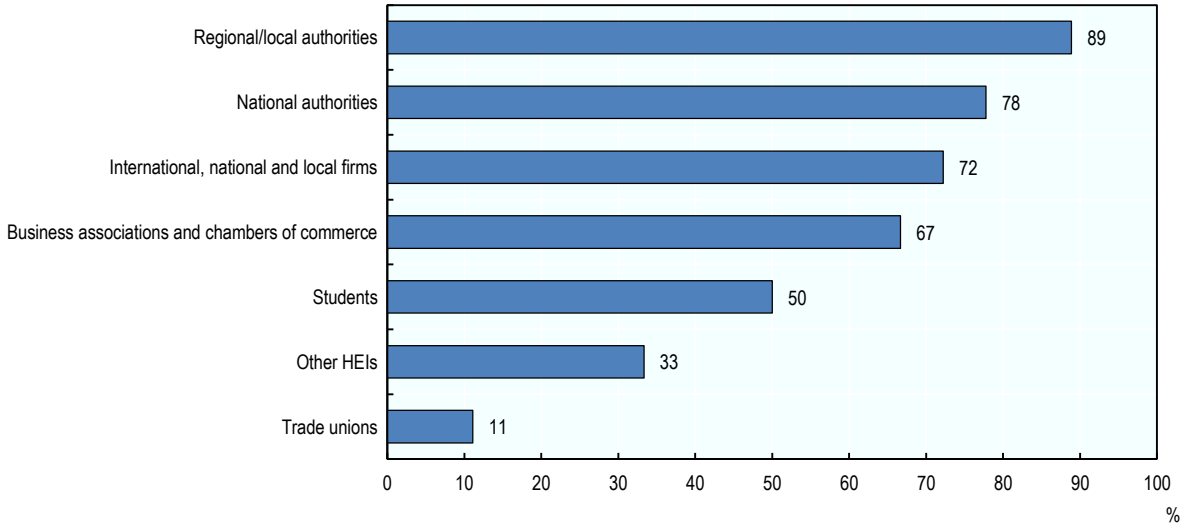
Source: ANVUR (2018), *Rapporto biennale sullo stato del sistema universitario e della ricerca*, http://www.anvur.it/wp-content/uploads/2018/08/ANVUR-Rapporto-2018.pdf.

Responses to the Leader Survey confirm the popularity of spin-offs over other approaches to preparing and supporting entrepreneurs with Italian HEIs. Only five respondents said they have an incubator, while only two have an accelerator. Illustrating the variety of cases, however, those HEIs that have an incubator are acquainted with the instrument and offer a wide range of services, such as temporary rentals, use of the HEI's IT services, coaching and training, access to laboratories and research facilities, and support for prototype development. In particular, respondents identify access to infrastructures (67%) and assistance with business plans or start-up competitions (50%) as the main measures in place, followed by providing access to start-up networks (44%) and assistance with applications for public funds (39%). Much less relevant are measures such as mentoring (28%), help in finding co-funders (17%), provision of financial resources (11%), and

support with prototype development (6%). None of the respondents prioritised the provision of post-start-up support measures.

Public authorities, and in particular regional and local governments, are Italian HEIs' main partners concerning entrepreneurship support (Figure 2.6). In line with the importance given to the local development agenda (see Figure 2.1), most respondent universities (89%) consider local and regional authorities as their main partners. A relevant role is attributed also to firms (72%) and business associations and chambers of commerce (67%). A much more marginal role, instead, is played by students (50%) and unions (11%).

Figure 2.6. Main collaboration partners of Italian HEIs in supporting entrepreneurship



Note: HEI leaders responded to the following question: "With which of the following organisations/institutions does your HEI collaborate in supporting entrepreneurship?".
Source: OECD HEI Leader Survey Italy, 2019.

Digital transformation and capability

The HEI's digital capability refers to the ability to acquire, integrate, use, optimise and transform digital technologies to support innovation and entrepreneurship in higher education. In this sense, digital capabilities are closely connected to the concept of digital transformation. The digital transformation is affecting and changing significant aspects of education, research, engagement and management activities of HEIs. The education system as a whole has to adapt and evolve to take advantage of new technologies and tools and become a driver of digital innovation.

The digital transformation process then becomes an element actively supporting innovation in all HEIs' missions, including the third mission in all of its dimensions. This implies a dual perspective: one internal to HEIs, which implies the digital transformation of institutions (infrastructure, teaching, research activities, organisational structures); one external to HEIs, concerning the enabling role universities must play to foster digital innovation in their own ecosystems.

All HEIs visited during study visits are very active in terms of projects and initiatives regarding digital technologies. Italian HEIs focus mainly on two areas: the production and use of online courses; and the introduction of digital services for students. The CRUI analysed the state of the art in the so-called massive open online course (MOOC) market

in Italy in 2015, showing an exponential growth from 2 courses in 2012 to 120 in 2015 (Paleari et al., 2015). One of the most advanced systems is the online platform "Federica" of the University of Napoli Federico II. Concerning the introduction of digital services for students, a pioneering experience is that of the University of Bologna, which has put in place several services for its students ranging from a mobile app to assess teaching quality, to an app (co-designed with students) offering career guidance and orientation services.

Other initiatives related to digital capabilities in Italian HEIs concern open science/open access and Industry 4.0. Some Italian HEIs have adopted open science and open access policies. This group of 27 HEIs (out of 98) had an open access policy as of December 2017. A good example is the University of Bologna Open Data portal, which has made available datasets on its activities and organisation and aims to provide access to research data in the near future. The CRUI has created a working group on open access, which has defined guidelines and recommendations for universities.[6] Another important driver of digitalisation in HEIs has been the National Plan Industry 4.0 (I4.0) launched in 2015 by the Ministry for Economic Development (MiSE). The plan promotes the diffusion of digital technologies and digital innovation, supporting the creation of innovation ecosystems connecting HEIs and companies.

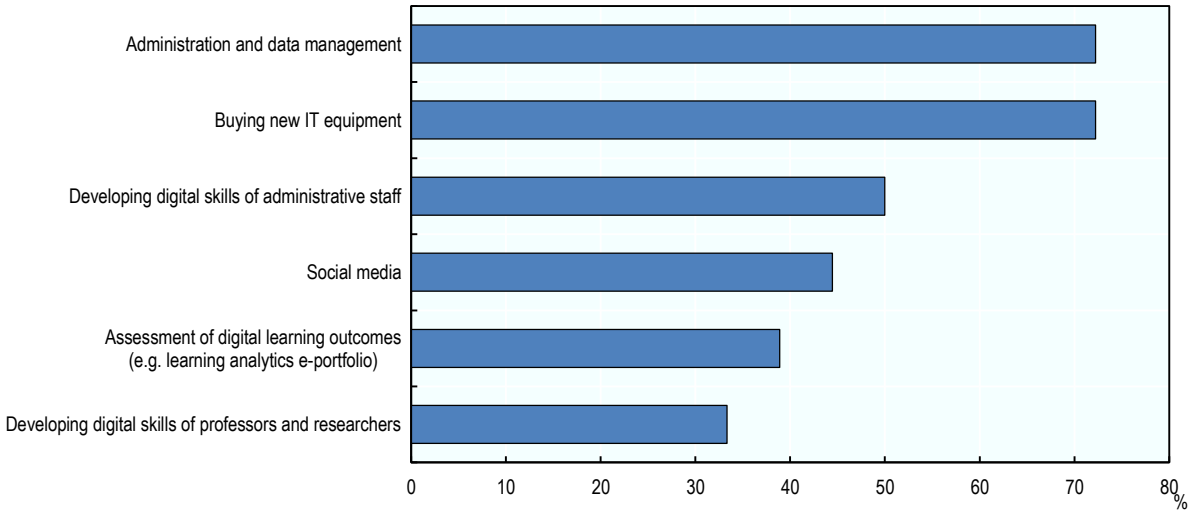
Concerning digital capabilities, the Leader Survey provides insights on the priorities that HEIs have in terms of digital transformation and in particular on the latest investments in digital technologies made by the institutions (Figure 2.7). Traditional information technology (IT) investments, including administration, data management and equipment top HEIs' spending in digital technologies. Conversely, investments in the digital skills related to teaching and learning, and research are still at a lower level of priority.

As for the use of digital teaching methods, the Leader Survey provides data on the relative popularity of different tools. The majority of the respondent HEIs makes use of platforms and course management systems such as Moodle (56%), while less diffused are tools such as blended learning (50%), MOOCs (44%), self-produced online courses and lectures (44%) and self-learning activities using digital resources (39%). Few organisations (17%) use none of these tools for learning, while only one HEI makes also use of virtual reality applications in teaching.

Knowledge exchange and collaboration

Innovative and entrepreneurial HEIs do not operate in isolation but are strongly connected to other stakeholders within their ecosystems. Knowledge exchange is an important catalyst for organisational innovation, the advancement of teaching and research, and local development. It is a continuous process, which includes the so-called "third mission" of an HEI, defined as the stimulation, direct application and exploitation of knowledge for the benefit of the social, cultural and economic development of society.

Figure 2.7. Allocation of most recent investments in digital technologies and systems performed by Italian HEIs, 2017-19)



Note: HEI leaders responded to the following question: "Indicate the main areas in which your HEI has implemented investment in digital technology/systems over the past biennium".
Source: OECD HEI Leader Survey Italy, 2019.

An entrepreneurial and innovative HEI engages with the external environment through a variety of activities ranging from informal activities, such as clubs and networking events, to formal initiatives such as internships, collaborative research, industrial PhDs and entrepreneurship projects.

HEIs in Italy have developed a broad understanding of knowledge exchange that goes well beyond the traditional emphasis on technology and research linkages with the business sector, start-ups and spin-offs only. These channels are a very important element of knowledge exchange between HEIs and the surrounding ecosystem, but knowledge exchange is not limited to that. Examples of this broader knowledge exchange initiatives include, for example, a strong emphasis on: the SDGs; the inclusion of migrants; and, finally yet importantly, cultural amenities, including museums, theatres, opera houses, archaeological sites, etc. (as noted in field visits in Palermo, Pisa or Siena). In some cases, these collaborations even led to the creation of university spin-offs in cultural-related industries. According to recent data from ANVUR, also for what concern cultural amenities, knowledge exchange activities change according to the geographical location of HEIs. Universities in northeast and central Italy exhibit higher levels of activities in the field of archaeology, while universities in the south have developed extensive collaborations with museums.

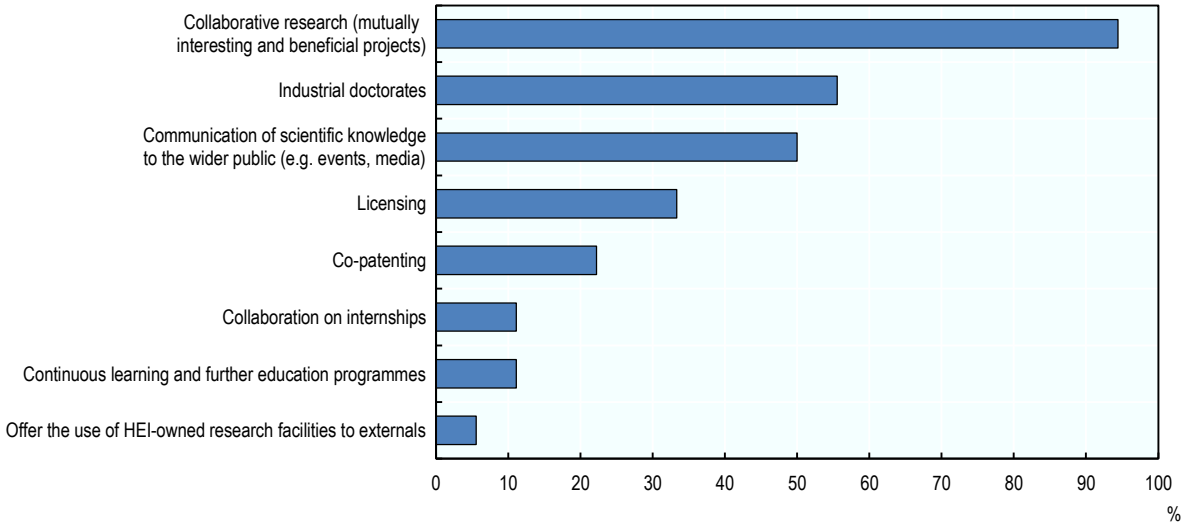
Examples from the study visits are numerous. The University of Tor Vergata created an office for sustainable development. The University of Bologna has put SDGs in its overarching strategy and works with the municipality and the region to support the integration of refugees. In addition, the university has developed humanitarian projects in Africa in collaboration with a number of non-governmental organisations (NGOs) and gives European Credit Transfer Scale (ECTS) credits to students involved these activities. The university collaborates closely with local companies, also to define study programmes. Together with other universities in the region, companies in the automotive sector (particularly numerous in the Emilia-Romagna region: Ducati, Ferrari, Lamborghini and

Piaggio are just some of the most well-known brands) have developed a master's programme entirely in English where students are offered interships. This master's course is very successful and has already gained attention from international students and also HEIs abroad.

The University of Palermo is closely connected to local museums and cultural heritage institutions in the region. They even chose every year a landmark cultural building in the city in which to host the inauguration of the academic year to bring the university closer to the city and people. The University of Bari has developed a very interesting approach to support the inclusion of refugees in the city. The university's Centre for Lifelong Learning has a specific focus on migrants. They provide vocational education to migrants and refugees by combining expertise in psychology, sociology, pedagogy and other social sciences. They combine an approach based on research in these areas, with education and training and engagement with individuals and actors outside academia. Research, teaching and engagement are combined, interlinked and reinforce each other. The centre has been accredited as best practice by the European University Association.

Based on the Leader Survey, the most common practice is that of collaborative research (Figure 2.8). No HEI mentioned practices such as selling products, selling of prototypes, systematic or ad hoc involvement of external stakeholders in teaching, consultancy contacts or collaboration on secondment. Sixteen respondents, out of 18, identified the third mission as a source of revenues for their HEI. These revenues originate from co-operation with businesses. Fundraising activities and participation in start-ups are also important, while co-operation and consulting with public authorities are less lucrative.

Figure 2.8. Practices of knowledge exchange and collaboration of Italian HEIs



Note: Leaders responded to the following question: "Knowledge exchange and collaboration can take various forms. The focus can be on teaching, research or any form of strategic collaboration with external stakeholders. Which of the following are currently practised at your HEI? Please pick the three most prominent for you".
Source: OECD HEI Leader Survey Italy, 2019.

The internationalised institution

HEIs increasingly compete and operate at the international level. For this reason, they often integrate an international or global dimension into the design and delivery of education, research and knowledge exchange. Internationalisation of HEIs is not an end in itself, but a vehicle for change and improvement by learning from peers from other countries. International connections contribute to introduce alternative ways of thinking, questions traditional teaching and research methods, opens up governance and management to external international stakeholder, offer opportunities to exchange knowledge and collaborate with relevant partners (business, academia, public agencies, etc.) abroad. Therefore, it is linked very strongly to innovation and entrepreneurship.

International mobility brings in new education and research ideas, develops intercultural connections and long-lasting partnerships (Appelt et al., 2015). In addition to attracting international staff and students, an innovative and entrepreneurial HEI actively encourages and supports the international mobility of its staff and students. It can promote, encourage and reward international mobility through exchange programmes, scholarships, fellowships and internships, for instance through European programmes.

The Italian university system is not yet as international as the one of comparable large European countries and G7 economies: according to 2016-17 data, only 5.1% of students and only 3.7% of academic staff comes from abroad. Moreover, while the share of incoming Erasmus students has remained almost stable (from 1.46% in 2012 to 1.57% 2016), the share of outgoing Erasmus students has increased from 2.08% in 2012 to 2.80% in 2016.

For this reason, Italian authorities have developed the *Strategy for the Promotion Abroad of Italian Higher Education 2017-20,* the first strategy for the internationalisation of higher education, jointly approved by the Ministry of Foreign Affairs and MIUR. However, the total funding allocated for internationalisation remains limited (EUR 18 million allocated by the Presidency of the Council of Ministers and EUR 150 million by the parliament; see MIUR, 2018). MIUR is currently also working to reinforce the web portal *Universitaly* to provide information about tertiary education in Italy. This aims to become the main entry point for procedures for incoming students and researchers.

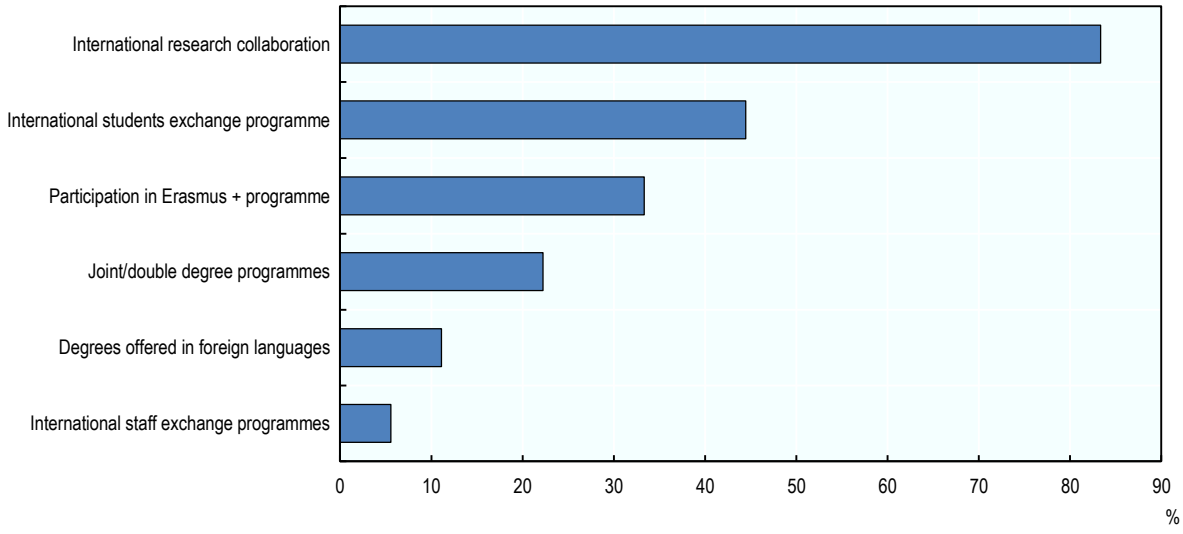
Despite these efforts, Italy does not have an integrated promotion mechanism or a dedicated agency supporting the internationalisation of the higher education system like the ones existing in countries such as France (Campus France), Germany (DAAD) or the United Kingdom (the British Council), which generally work across different key ministries and agencies involved in the internationalisation of tertiary education, science and research.

Finally, the study visits highlighted how only very few HEIs in Italy have developed and implemented an integrated strategy regarding internationalisation which goes beyond education. Most HEIs are particularly active in increasing the number of foreign students (especially Erasmus but also degree-seeking students) and less strategic in the way they internationalise their research activities or their engagement with relevant non-academic actors, including companies abroad. An interesting example was the one offered by the University of Bologna, where the internationalisation strategy clearly emphasises the role of the university as a channel to open the door to new foreign markets to local SMEs.

Based on the Leader Survey, Italian HEIs consider as internationalisation priorities research collaborations and exchange programmes such as Erasmus (Figure 2.9). These are fairly traditional approaches to internationalisation. None among the Italian HEIs that responded

to the survey mentioned as their priority international internships or the possibility of having an office attached to an HEI abroad. In addition, the Leader Survey provides information on the attraction of international staff. In particular, 10 respondents out of 18 declared to have in place recruitment policies and practices to attract international staff.

Figure 2.9. Strategic priorities in the internationalisation of Italian HEIs



Note: HEI leaders responded to the following question: "Which two of the following activities undertaken by your HEI, are the most relevant within your internationalisation strategy?".
Source: OECD HEI Leader Survey Italy, 2019.

Measuring impact

Impact measurement is a transversal dimension within the HEInnovate framework. Innovative HEIs need to understand the impact of the changes they introduce in their institution and in the wider ecosystem they operate in. Innovative and entrepreneurial HEIs combine institutional self-assessments, external evaluations and evidence-based approaches. However, impact assessment of innovation and entrepreneurship activities in HEIs remains underdeveloped. This is partly due to the fact that the currently available metrics typically focus on graduate entrepreneurship, the number of spin-offs, the volume and quality of intellectual property and of the commercialisation of research results. Such metrics do not take into account important factors such as teaching and learning outcomes, the contribution to local economic development and the impact of the broader entrepreneurial and innovation agenda such as social and cultural dimensions.[7]

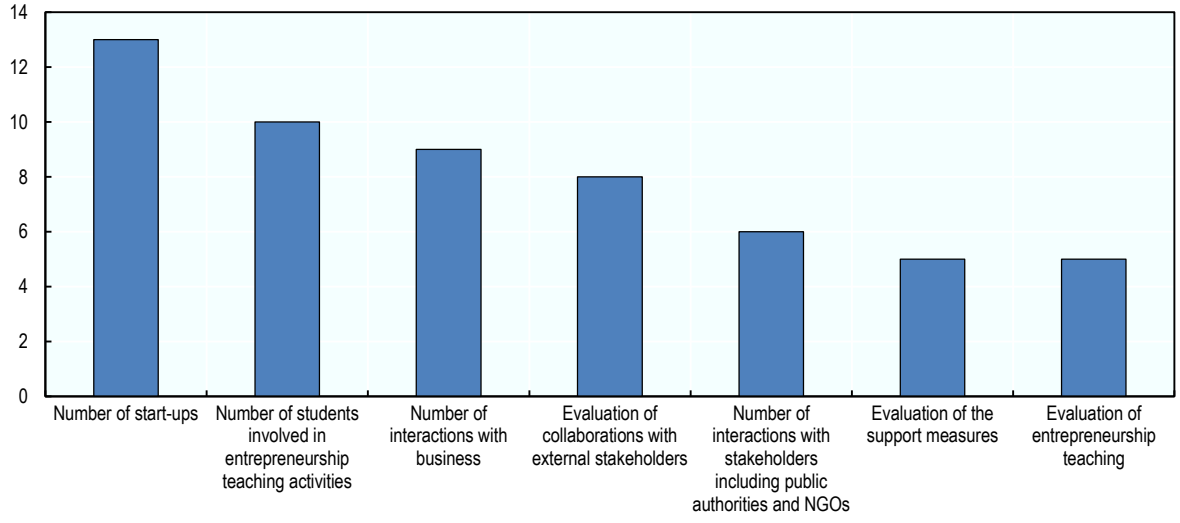
Italy has made significant efforts to improve the monitoring and evaluation of its higher education system in the recent past. Both MIUR and ANVUR were instrumental in the improvements introduced in the system. New comprehensive data collections were also launched in several areas such as student and graduate careers, scientific output of academic personnel, administrative personnel, study programmes, research quality, internationalisation, teaching, HEI budgets and their sustainability and also knowledge exchange and engagement activities.

These databases have been updated with information on the labour market from the national statistical office. The indicators developed through the data collection are used for periodical evaluations and accreditation mechanisms and are also used for the allocation of

performance-based funding. Each university can monitor and track these indicators to know its positioning in the Italian context. During the study visits, the university expressed a positive appreciation of these monitoring and evaluation efforts for steering the system towards improved quality and also to allow universities to compare the activities and outcomes with peers in the system.

ANVUR is also discussing possible mechanisms to evaluate knowledge exchange and engagement. As everywhere in OECD countries, the debate on the best way to monitor and evaluate knowledge exchange and engagement is still open. The level of the discussion in Italy is well advanced and is taking into account different dimensions avoiding a simplistic approach that only takes into account some types of engagement. Knowledge exchange and engagement activities are divided by ANVUR into two categories: those involving economic valorisation of research and those producing public and social goods. Indicators regarding intellectual property (IP) generation, spin-offs, licensing agreements, support infrastructure such as technology transfer offices (TTOs), incubators, science parks are collected and compared. At the same time, indicators including the management of cultural assets (archaeological sites, museums, music production, libraries, etc.), public health (clinical trials, etc.), lifelong learning initiatives, open teaching initiatives (such as MOOCs) and advanced training programmes are also collected. This places the reflection undergoing in Italy at a very advanced stage compared to other countries participating in the HEInnovate programme.

Figure 2.10. Indicators for the evaluation of third mission activities used by Italian HEIs



Note: HEI leaders responded to the following question: "What are the indicators that are measured or the dimensions that are assessed?".
Source: OECD HEI Leader Survey Italy, 2019.

Fifteen out of the 18 HEIs that responded to the survey assess, evaluate or measure their activities related to the third mission. Most of them use basic indicators, such as the number of start-ups and the number of students involved in third mission activities (Figure 2.10). However, several HEIs have started implementing more complex forms of assessment, based on qualitative methodologies done by external evaluators, to assess start-up support measures, and entrepreneurship education activities.

Notes

[1] The Leader Survey was not administrated to online universities.

[2] Most respondents (17 out of 18) perceive that activities related to "engagement" are not taken into account by the national evaluation system. In addition, most of them (13 out of 18) underline that the evaluation framework does not reward engagement activities.

[3] For a discussion on the Italian evaluation system, the Diagnostic Report of the National Skills Strategy of Italy (OECD, 2017).

[4] Netval (2018) reports 56 active Technology Transfer Offices (TTOs) for the year 2016.

[5] Following the definition provided by ANVUR (2016), a spin-off: i) operates on the basis of the research results produced by the university and/or entertains systematic collaborative relationships with the university; b) does not require either the university to be a shareholder of the enterprise, or the presence of university researchers in the management bodies; iii) is formally accredited by the university.

[6] Open science improves the effectiveness, quality and productivity of a research system, encourages the adoption of new research methodologies and scales up innovation in HEIs (OECD, 2015b; Dai, Shin and Smith, 2018). Through open science, the HEI promotes collaborative efforts, faster knowledge exchange, and new ways of sharing results (including publications, research data and methodologies) among students, staff and society.

[7] The lack of an effective measurement of the impact of engagement activities is that – even in advanced innovation-intensive countries – there is no consensus on the metrics to use to assess many of these initiatives. In addition, due to the wide range of activities, there is no consensus about the timescale to use for measuring such impacts.

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Chapter 3. Knowledge exchange and collaboration in Italy

Knowledge exchange between higher education institutions (HEIs) and other stakeholders is an important catalyst for innovation, the advancement of teaching and research, and local development. It is a continuous and bidirectional process, which includes the stimulation and direct application and exploitation of knowledge for the benefit of the social, cultural and economic development of society. This chapter begins with an introduction discussing theoretical aspects of knowledge exchange – including university-industry collaborations – followed by a section describing the Italian case and discussing challenges and opportunities. Importantly, the chapter benefits from information gathered in a stakeholder workshop held at the University of Milan "Bicocca" in May 2019. Policy recommendations conclude the chapter.

Knowledge exchange: An introduction

Many OECD countries and emerging economies have been developing policy initiatives to promote knowledge exchange between HEIs and key actors of national and local innovation systems. These initiatives may take the form of policy instruments specifically promoting knowledge exchange, or governance mechanisms to connect HEIs with government and wider societal actors and the business sector (OECD, 2017). Many mechanisms to promote these activities at the national and subnational policy levels, as well within the university, exist. These mechanisms include, for instance, a well-designed framework for intellectual property rights (IPRs), national funding stream designated to promote knowledge exchange activities, innovation vouchers to encourage businesses to work with HEIs, and the reward and promotion criteria for academics to engage with different knowledge users. The scope and activities of knowledge exchange are thus very broad.

There is no one-size-fits-all model for knowledge exchange policy and initiatives

Knowledge exchange covers a very wide range of activities and is not only associated with technology transfer and the commercialisation of research outcomes in science and technology fields. However, both policy and academic discussions around knowledge exchange have tended to overemphasise the creation of academic spin-offs and start-ups and/or the licensing of intellectual property (IP), based on the science- and technology-related research outputs of the university. Beyond commercialisation activities and other forms of academic engagement, HEIs foster innovation capacity by strengthening creativity and cultural development and providing the basis for the expansion of the knowledge economy (European Commission, 2017).

University-industry collaboration is an important channel of knowledge exchange

University-industry collaboration is important to foster innovation and the diffusion of innovation in productive systems. A large body of literature discusses practices and methods (OECD, 2013; Jones-Evans et al., 1999; Galán-Muros and Plewa, 2016; Vedovello, 1997; EU 2018). The report of the Danish think-tank DEA (2016) gives an overview of the literature on practices, highlighting that while a lot of emphasis has been put on technology transfer, many other practices of collaboration exist beyond technology transfer (Table 3.1). Studies on the consequences of university-industry collaboration discuss the impact both on companies' performance (Davey, Plewa and Muros, 2014) and on academics' careers (Perkmann et al., 2013). Finally, collaboration provides researchers with funding but also with first-hand information and data about industry, especially if one considers that many companies in the market own more data than universities (The Guardian, 2017).

The collaboration between universities and firms, however, is not straightforward and several challenges may emerge. These entities have different functions and missions and also their "languages" can be different. These characteristics can affect their ability and their propensity to collaboration (Boschma, 2005). Firms, and especially small firms, may lack the institutional capacity to generate functional linkages with universities.

Concerning HEIs, lack of co-ordination between institutional and individual engagement strategies hinders collaboration. In other cases, institutional support and rules may cause cumbersome bureaucracy, while many researchers would rather develop spontaneous

relations and collaboration with business (Etzkowitz et al., 2019; Centobelli, Cerchione and Esposito, 2018).

Table 3.1. Different mechanisms of university-industry collaboration

From the most popularised (top lines) to the less popularised (bottom lines)

Most popularised	1. Technology transfer (sale & licencing of IPR, spinouts)
	2. Collaborative research and development (R&D)
	3. Contract research
	4. Consulting
	5. Collaboration on teaching and training
	6. Sponsored research, gifts and endowments
	7. Informal meetings, advice and exchanges
	8. Mobility of staff
Less popularised	9. Other dissemination activities

Source: Adapted from DEA (2016), "What lies beneath the surface? A review of academic and policy studies on collaboration between public research and private firms", http://www.dea.nu/sites/dea.nu/files/baggrundsrapport_endelig.pdf.

Competing incentives within HEIs represent another challenge to collaboration. The imperative to publish versus the goal to have a practical impact and maintain collaboration alive is one of them. In many OECD countries, career evaluation and progress are often based on publications and research excellence. This system of incentives may become an obstacle to engagement outside academia, which is time-consuming and implies the development of new types of skills (Etzkowitz et al., 2000).

There are important systemic framework conditions that can facilitate collaboration, including at the national and regional levels. For example, national laws and regulations have an obvious impact on academic entrepreneurship and engagement. National frameworks affect the ease of doing business in a given country. In the same vein, regulation affects the way in which HEIs co-operate with companies, including start-ups. The capacity of HEIs to engage with the economy and society depends also on regional and local characteristics. A university is more prone to engage with industry and society in well-developed entrepreneurship and innovation ecosystems where the absorptive capacity of firms is high.

In general, due to the importance of academic engagement, policymakers in OECD countries look for practices to facilitate and support university-industry collaboration. Vinnova, the national innovation agency in Sweden, represents a well-known example of a governmental agency promoting this type of collaboration (Box 3.1).

Box 3.1. Vinnova – Financing research with a collaborative mission

Vinnova is a Swedish agency under the Ministry of Enterprise and Innovation. With its offices in Stockholm and Brussels, Vinnova is also the Swedish contact for the European Union (EU) Framework Programme for Research and Innovation. The agency has around 200 employees and generates long-term visions and strategies for the Swedish research and innovation system. Vinnova encourages the collaboration between universities, industry, public organisations, civil society and others, with a view to international diversification.

In fulfilling its mandate to support innovation, Vinnova finances early-stage innovation ideas. These ideas often entail great risk and require government aid. Due to the support of the agency, businesses and other organisations are able to test new ideas before they become profitable. This promotes the general propensity towards innovation in the system.

Vinnova has an annual budget of approximately EUR 280 million, most of which is distributed to a selection of the many funding proposals submitted. Funded projects are continuously monitored.

Innovation has a better chance when knowledge and skills in different fields can interact and create interdisciplinary new fields. This is why Vinnova focuses on stimulating cross-collaborations among universities, research institutions, industry and public services. In addition, Vinnova supports research to identify solutions to emerging social challenges, such as those of an ageing population or energy transition and the sustainability agenda.

Source: Vinnova (n.d.), *Homepage*, www.vinnova.se/en/ (accessed on 15 February 2019).

Knowledge exchange in the Italian context

Italian HEIs have developed a broad understanding of knowledge exchange, which goes well beyond the traditional emphasis on technology and research linkages with the business sector, start-ups and spin-offs. The country abounds with examples in which knowledge exchange acquires a broad meaning and scope. These include: the strong emphasis that several case-study HEIs have put on Sustainable Development Goals (SDGs); initiatives to facilitate the social inclusion of refugees in Italy by providing them with training; and, capitalising on the outstanding cultural heritage of Italy, many collaborations and partnerships with museums, theatres, opera houses, archaeological sites and other cultural institutions.

Since Italy is one of the world's leading economies, a manufacturing powerhouse and home to a vast amount of cultural and natural amenities, there is scope to increase the general level of academic engagement. On average, Italian universities display a low production of patents and spin-offs compared to other European universities (OECD, 2017a). Although the majority of universities have a Technology Transfer Office, only about one-third of them have an incubator and a few have developed partnerships with scientific parks.

The Italian case is featured by some systemic challenges – such as the dominant role of small- and medium-sized enterprises (SMEs) in the national economy – and others that depend on the ecosystems in which HEIs operates – for example, the large regional disparities in terms of household income and productivity (OECD, 2018). Therefore, besides national indicators and averages, it is also important to look at academic engagement from an eco-systemic point of view.

Differences among regional ecosystems affect the capacity of universities to develop linkages with industry and society. Universities active in regions where there is a high

density of firms, economic activities and an urban hub tend to be more responsive to the stimuli of their ecosystems. Conversely, in regions where there are fewer resources, fewer firms and local companies are less R&D-intensive, it is much more difficult for HEIs to establish long-term strategic collaborations in education, research and innovation.

Key national and regional policies supporting knowledge exchange and collaboration

Mirroring the increasing demand for innovation and skills in the country, national authorities have put in place several policies to support academic engagement over the last decade. Among others, there are the industrial PhD programmes, implemented with the support of the Italian employer association, Confindustria, that aim to promote collaboration between universities and firms at the doctoral level. The national plan Industry 4.0 (or Enterprise 4.0) represents another important example of promoting stronger university-industry technological partnerships (OECD, 2017a). Industry 4.0 connects with initiatives such as the National Technological Clusters and competency centres, which Italian stakeholders consider positively in terms of their capacity to promote entrepreneurial education and start-ups. The following sections illustrate some of the practices to promote knowledge exchange and collaboration in the Italian higher education system.

FIRST and National Technological Clusters (CTN)

The Fund for Investment in Scientific and Technological Research (FIRST) and the National Technological Clusters (CTN) are among the main policy initiatives the Ministry of Education, Universities and Research (MIUR) has put in place to promote market-oriented research.

MIUR – and in particular the Directorate-General for Research Co-ordination and Development – created FIRST in 2007 by merging different funds that were all supporting the linkage between university research and industry.[1] In particular FIRST:

- Provides financial support to basic research.
- Supports applied research (industrial research), including pilot projects in some specific industries.
- Generates legal frameworks to facilitate procurement in connection with R&D focusing on societal challenges.
- Promotes research to generate social innovation.
- Finances advanced training, technology transfer centres and spin-offs for the development of technological clusters in public-private co-operation.
- Connects to national initiatives supporting basic and industrial research, in connection with EU-funded programmes.
- Facilitates the use of research results in an industrial context.

Since 2017, FIRST allocates funds to the National Technological Cluster (CTN) initiative, which represents a policy favouring public-public and public-private collaboration. Consistently with Horizon 2020 priorities, the objective of CTNs to gather together critical skills from the productive sector, the research system and the public sector – both at the national and regional levels – to define shared goals for the respective research agendas and co-ordinate their implementation (roadmaps).

The Rectors' Conference of Italy (CRUI), the National Research Council (CNR) and the Italian industrialist association (Confindustria) have been implementing a consortium with

the aim to generate more economic and social value from academic research and technology transfer. MIUR has supported this initiative with an initial instalment of EUR 4 million. The consortium should protect and strengthen intellectual properties and patents, and facilitate the transfer of knowledge and research spurring from universities and research entities.

Industrial PhD and PhD ITalents

The Italian higher education system has been promoting the use of high-level skills in the productive sector. Policies have been supporting innovative PhDs and project PhD ITalents. The former are PhD programmes implemented in collaboration with a firm that generates a research opportunity and employment experience for the PhD candidate. The latter is a policy that promotes the employment of PhD graduates in firms looking to improve their R&D capacity.

Innovative doctoral programmes, introduced by the National Research Programme 2015-20, are based on three main features: international, inter-sectoral and interdisciplinary. In particular, inter-sectoral industrial programmes (which include "industrial doctorates") have to fill at least one of the following requirements:

- Programmes are based on co-operation with research institutes, enterprises or other entities carrying out R&D activities.
- Programmes are selected within international or European programmes related to university-business co-operation.
- Programmes are linked with Industria 4.0.
- Programmes are based on agreements with other entities on activities related to research and transfer of innovation, with joint supervision of candidates.

PhD ITalents is a project that promotes linkages between PhD programmes and R&D activities in firms, similar to the ones developed in other OECD countries (Box 3.2). The project is financed by MIUR and is managed by the CRUI Foundation, in partnership with the Italian industrialist association, Confindustria. PhD ITalents connects with different European strategies, such as the Innovation Union (European Commission, 2010) and the national strategies for the innovation of doctoral education. The project aims to generate a virtuous cycle of "guidance-information-placement" in which PhD students can go to carry out their research activities in the R&D departments of partner companies. The programme provides co-funding to firms hiring PhD students on a three-year contract. In particular, the public sector co-finances 80% of the cost in the first year. Then 60% in the second year and 50% in the last year of the contract period.

PhD ITalents has been a successful initiative, as illustrated by the fact that the number of firms involved in the project was much larger than expected. When the CRUI Foundation launched the project in 2016, it received 682 applications from Italian firms including many SMEs. A total of 450 firms passed the first selection and gained the possibility to submit their job openings to PhD candidates. Only 258, in 2017, could identify a candidate of their interest. Interestingly, the share of SMEs in the pool of firms has remained quite stable throughout the different levels of the selection process. Finally, about a third of the hiring firms offered PhD students an open-end contract, instead of a fixed-term three-year contract.

Based on information collected in a stakeholder workshop held in Italy in May 2019, Italian stakeholders have mixed views on the collaboration between universities and firms at the doctoral level.[2] For examples, while recognising the importance and the potential of the policy, some firms highlight the need for improved collaboration with universities in the

design and implementation of the doctoral programmes. One area for improvement is the twofold relation PhD candidates have with the firm hosting them and with the university from which they are graduating. These graduate students face the challenge of responding to the research needs of the company hosting them, while preserving the research standard of their doctoral education. In the current system, PhD candidates have to handle a twofold relation: one with the firm hosting them and the other with the university from which they are graduating. According to business stakeholders, this limits their capacity to respond to the research needs of the company in which they operate. Furthermore, while industrial PhDs are a good instrument to underpin collaboration between universities and large firms, it proves difficult to use them with small firms, which are those that would benefit the most from innovation and R&D activities. The same applies to PhD graduates, who tend to be overqualified for the skills needs emerging from the Italian productive sector (OECD, 2017).

Box 3.2. Industrial doctoral programmes in France – CIFRE

In France, CIFRE (*Conventions industrielles de formation par la recherche*, or industrial research training agreements) are industrial doctoral programmes that were launched in the early 1980s to bridge the gap between academia and the private sector. CIFRE have been working for several decades now and implemented in all disciplines (including social sciences and humanities). They have had quite successful results: in 2016, the employment rate after graduation was of more than 85% and CIFRE doctorate holders tended to have higher salaries than the rest of the population of doctorate holders.

The principle is as follows: the doctoral student, enrolled at a research laboratory, is hired by a company to conduct research on a project that is considered as strategic for the socioeconomic development of the company. The agreement sets terms on working conditions (salary, 100% of working time dedicated to research, academic and professional training, etc.), intellectual property, etc. Companies get subsidies and tax exemptions to hire the doctoral student through CIFRE.

Source: ANRT, cifre@anrt.asso.fr.

Collaboration in the agro-food supply chain

Agro-food is an important industrial sector in Italy and generates many opportunities for collaboration between HEIs and firms. For example, Italian HEIs such as the University of Siena in Tuscany and the University of Parma in Emilia-Romagna have developed specific activities and institutions to collaborate with firms in agro-business and improve the competitiveness of their ecosystem (Box 3.3).

Support to the agro-business is also systemic. Inspired by the positive experience of industrial PhDs and ITalents, the Ministry of Education has developed a programme to connect PhD programmes and the agro-food sector. The project aims to modernise the agriculture supply chain and improve the competitiveness of firms operating in this sector. The ministry has developed FAI Lab in co-operation with the largest farmer association in Italy (*Coldiretti*). The project promotes the placement of students enrolled in PhD programmes in food and sustainable development in firms and institutions operating in the agricultural and agro-food sector. The selection process and the call for companies are currently underway.

Box 3.3. Italian HEIs collaborating with the agro-food industry in their ecosystem

The University of Siena

The University of Siena is located in Tuscany, which is highly specialised in agribusiness. The region tops the national rankings in terms of certified geographical indications and traditional specialities, known as protected designation of origin (PDO), protected geographical indication (PGI) and traditional specialities guaranteed (TSG). Within this context, the University of Siena has been developing a series of projects to collaborate with agri-food firms and help them improve productivity and international visibility. Among others, the University of Siena Santa Chiara Lab (SCL) hosts the Italian Secretariat of PRIMA, a major Euro-Mediterranean research and innovation programme on food systems and water resources. This makes SCL a national and local hub in knowledge exchange in the agri-food sector.

Within this context, the university launched the first Italian professional bachelor's programme (*Laurea professionalizzante*) in agribusiness, in 2018. The professional bachelor's will generate skilled workers and managers for agribusiness. Study programmes will be interdisciplinary and encompass mathematics, statistics, biology, chemistry, as well as economic and legal disciplines in the agricultural and agribusiness sector.

The University of Parma

The University of Parma is located in the core of the so-called Italian food valley. In Emilia-Romagna, there are 44 PDO- and PGI-certified products – the highest number in Europe. The region is home to renowned products/brands including Parmigiano Reggiano (Parmesan cheese), Prosciutto di Parma (Parma ham) and Aceto balsamico di Modena (balsamic vinegar from Modena). The city is also home of the European Food Safety Authority (EFSA).

This regional hyper-specialisation in the agro-food supply chain has affected the three university missions and spurred their integration. Within this context, the University of Parma has pioneered a university degree in agri-food economics and has created a research centre – Parma Technopole – that has developed new technologies and methods to promote organic vegetal and animal productions. The co-operation with firms, including those active in the agro-food industry, happens through several channels. For instance, the University of Parma has created a co-ordination table TACRI (*Tavolo di Coordinamento Della Ricerca Indistriale di Ateneo*) involving industrialist associations, public research institutes and the university's technology transfer offices (TTO). TACRI centralises and brokers all the requests for collaboration coming from the productive sector, including from the agro-food industry.

Note: The University of Siena was one of the 11 case studies selected by the OECD and Italian authorities in the framework of the present review. Representatives from the University of Parma participated in the stakeholder workshop held in Milan (Bicocca University) on May 2019.
Source: gonews.it (2019), "Delegazione toscana di Coldiretti al Tuttofood: "Agribusiness filiera chiave", https://www.gonews.it/2019/05/07/delegazione-toscana-di-coldiretti-al-tuttofood-agribusiness-filiera-chiave/ (accessed on 2 June 2019).

Innovation Flow

To promote the interaction between public research and pharmaceutical companies, the Italian Society of Pharmacology (SIF) and the Italian Association of pharmaceutical

companies (Farmindustria) have created Innovation Flow. Researchers active in the life science sector have the opportunity to publish their works on the Innovation Flow web portal and make them visible to companies that can assess opportunities for co-operation and R&D investment.

To promote this project, the University-Business Observatory of the CRUI Foundation has created a specific working group that promotes the visibility of the web portal. The working group co-operates with Italian universities to promote the use of the Innovation Flow platform by researchers and technology transfer offices.

National Plan Enterprise 4.0

The National Plan Industria 4.0, now known as Enterprise (*Impresa*) 4.0, is a large-scale policy initiative promoting innovation, skills and digital technologies in Italy (OECD, 2017a; 2017b). Enterprise 4.0 provides firms with assistance for investments, digitalisation of production processes, training and the development of new products and processes. Enterprise 4.0 aims also to reduce the systemic uncertainty that negatively affects the investment propensity in innovation of the Italian private sector.

To achieve these results, the policy initiative has put in place a series of tools and instruments. These include incentives for technological acquisitions, R&D tax credits, super- and hyper-depreciation allowance to facilitate the acquisition of digital machinery tools, tax incentives for training activities in the digital technologies, credit schemes for SMEs, the creation of digital innovation hubs and competency centres (OECD, 2017).

Competency centres are very important for HEI "engagement". They are public-private partnerships providing technology transfer services, guidance and training on technologies enabling the Enterprise 4.0 paradigm.

These centres specialise in different technology supply chains and involve networks of universities, acting as providers of R&D capabilities, training and digital awareness. Within competency centres, universities work together with the private sector offering technology consulting to firms, including SMEs, launching and accelerating projects and technological development, co-ordinating with European competency centres.

The Italian government has allocated an envelope of about EUR 73 million to this policy initiative promoting the creation of 8 competency centres across the country. These centres are in the process of being established, involving a total of more than 70 universities and research centres and almost 500 companies. All competency centres, with the exception of one, which is associated with the National Centre for Research, will be located in one university that will act as the hub of the network of HEIs connected with that specific centre/technological area. The Italian HEI community has great expectation about the impact of competency centres on productive ecosystems and on their entrepreneurial and innovation agenda. In general, Italian HEIs consider with great favour the Enterprise 4.0 policy initiative.

In particular, the competency centres that are about to open or have just started functioning are the following:

- Manufacturing 4.0 @ Polytechnic of Turin.
- Made in Italy 4.0 @ Polytechnic of Milan (Box X).
- Big Data Innovation & Research EXcellence (BI-REX) @ University of Bologna.

- Advanced Robotics and enabling digital Technologies & Systems 4.0 (ARTES 4.0) @ Scuola Superiore Sant'Anna of Pisa.
- Social network, Mobile platforms & Apps, Advanced Analytics and Big Data, Cloud, Internet of Things (SMACT) @ University of Padua.
- Industry 4.0 @ University of Naples "Federico II".
- Security and optimisation of strategic infrastructures 4.0 (START 4.0) @ CNR.
- Cyber Security (Cyber 4.0) @ University of Rome "La Sapienza").

Box 3.4. "Made in Italy 4.0" competence centre – Politecnico di Milano

"Made in Italy 4.0" aims to provide businesses, especially SMEs, with the necessary tools (orientation, training, technology transfer, co-design) to face the digitalisation of production processes. It currently involves 39 companies (technology providers, system integrators, consultants, training experts and manufacturing industries) and 4 universities, namely Politecnico Milano, the University of Bergamo, the University of Brescia and the University of Pavia.

The project foresees a contribution from the partners, in terms of investments in infrastructure, transfer of equipment and the provision of qualified personnel, of over EUR 20 million in total over the first 3 years, with the aim to be financially self-sustaining after 5 years. The chosen location, the Bovisa district, is already characterised by the presence of the Joint Platform just inaugurated with the Tsinghua University of Beijing and PoliHub, the accelerator of the Milan Polytechnic, which currently hosts more than 100 start-up companies.

The competency centre is not a university research lab, but a hub of innovation in which companies share experiences and technologies on Industry 4.0 for advanced manufacturing by carrying out training activities and implementing joint research and innovation projects. A central target is to contribute to the recovery of key sectors of the Italian economy. At the same time, the universities involved should benefit from the interaction of companies by gaining input for research needs and entrepreneurial know-how from the business sector.

Note: The Polytechnic of Milan was one of the 11 case studies selected by the OECD and Italian authorities in the framework of the present review.
Source: Industria Italiana (2018), "Prendono forma i Competence Center, e Milano è in prima linea", https://www.industriaitaliana.it/prendono-forma-i-competence-center-e-milano-e-in-prima-linea/ (accessed on 28 February 2018).

Regional initiatives supporting knowledge exchange and collaboration

Regional governments are actively supporting the entrepreneurial and innovation agenda of HEIs. Some regions have put in place a broad range of programmes and initiatives to strengthen knowledge exchange between the university and local stakeholders. In some cases, the co-operation between regional authorities and universities has been focusing on promoting regional development. Universities represent a reservoir of capabilities and technical support, especially in southern regions.

Another area in which regional government have played an important role is that of ISCED level 5 tertiary education. Since 2010, Italy has been developing two-year professional/vocational tertiary education – *Istituti Tecnici Superiori* (ITS), a sort of community college. Regional governments are responsible for vocational educational and

training. In some regions, such as Piedmont, the Polytechnic of Turin, regional authorities and industrialist associations have been co-operating to promote the creation of integrated higher education pathways between ITS and professional bachelor's programmes in the Polytechnic of Turin. The aim is to provide regional manufacturing companies with skills that help them make the most of digital technologies. This collaboration provides university students with the possibility to use ITS laboratories, which are equipped with modern machinery and tools, due to the collaboration between the latter and local manufacturing companies (Box 3.5).

Box 3.5. Integrating professional bachelor's programmes with ISCED level 5 institutions (ITS): The experience of the Polytechnic of Turin

The co-operation between the Polytechnic of Turin and the regional government of Piedmont

The Polytechnic of Turin is experimenting the possibility to generate pathways between ISCED level 5 HEIs, called Technical Higher Institutions (*Instituti Tecnici Superiori*), and the professional bachelor's programme (*Laurea professionalizzante*), a new university degree (ISCED level 6) introduced in the 2018/19 academic year.

The Polytechnic of Turin is an important regional actor. It co-operates with other institutional actors such as the regional government of Piedmont and the City of Turin. Taking advantage of its institutional capital, the polytechnic has been co-ordinating a regional round table to discuss the harmonisation of ITS curricula with its new professional bachelor's degree. The round table involves all the regional ITS specialised in manufacturing vocational education and training (VET), regional and local authorities and other stakeholders, such as the regional branch of the national industrialist association, Confindustria.

Regional ITS involved in this policy dialogue should update their curricula to make them modular with the professional bachelor's degree offered by the Polytechnic of Turin. This will allow ITS graduates who want to get a professional bachelor's to attend only one final year at the Polytechnic of Turin.

In addition, the Polytechnic of Turin will co-operate with ITS to give its students access to ITS' technical laboratories. Most ITS are equipped with modern laboratories that are provided by firms co-operating with them, to train individuals able to plug immediately into their production processes. To achieve this result, firms have provided ITS with modern machinery tools that the institutions can use to train students. Thus, by co-operating with ITS, the polytechnic gains access to their facilities.

The Italian experience illustrates the possibility of integrating professional education at ISCED levels 5 and 6. The aim is twofold: i) streamline educational pathways and provide individuals with the possibility to move from one education ladder to another; and ii) generate new professional figures that will help local firms be more innovative and productive.

Italy offers many examples of collaboration between regional governments and universities. Based on evidence collected on study visits, regional policies in regions such as Emilia-Romagna, Sardinia and Tuscany have been successfully supporting HEIs engaging with their ecosystems. For instance, the University of Bologna, in federation with all the other universities in Emilia-Romagna, has established a partnership with the local

automotive industry (the so-called "motor valley" that is home to car producers such as Ferrari, Lamborghini, Maserati, Pagani, etc.) to organise education programmes and internships. In the same vein, but focusing on cultural amenities, the Tuscany region has been promoting the engagement of the University of Siena with rural communities such as Poggibonsi, where the university has created an archaeo-drome (an open-air museum) to support tourism businesses.

Monitoring and evaluation of knowledge exchange

Italy has developed knowledge and good practices concerning the evaluation of the performance of higher education institutions and is currently experimenting with innovative approaches to assess university engagement. The importance of evaluation practices in the country depends on the large share of the public budget allocated to universities based on their research performance, a much larger share than that allocated by evaluation systems in other OECD countries (OECD, 2017). Since 2009, over a total of about EUR 7 billion, approximately EUR 1 billion per year, have been allocated based on research results.

At the centre of the evaluation system is ANVUR, the National Agency for the Evaluation of the Universities and Research Institutes. ANVUR has also started discussion groups to look at monitoring and evaluating university activities related to third mission or "engagement". In particular, ANVUR has divided third mission activities into two main areas, respectively involving the generation of economic value from research and the production of public and social goods. Concerning the first area – generating value from research – ANVUR has designed quantitative and qualitative indicators measuring intellectual property management (patents and plant variety registrations), academic entrepreneurship (spin-offs), third-party activities and intermediation activities. Regarding the second area – the production of public and social goods – ANVUR uses quali-quantitative indicators measuring the management of cultural activities and the cultural heritage (museums, archaeological excavations and cultural heritage), clinical trials, continuous education and public engagement. Evaluation also involves peer-reviewing activities. Additional information about technology transfer activities and academic spin-offs, patenting and licencing are available via the survey managed by NETVAL.

Despite these advancements, some challenges in defining standard metrics for the evaluation of "engagement" remain. The regulator considers "engagement" as an institutional responsibility to which universities answer according to their own development priorities and research fields. Therefore, "engagement" can be very important in certain university contexts and very marginal in some other contexts. This generates structural diversity in the system, which hampers the comparability of HEIs. This is a common challenge across OECD countries, as illustrated by Box 3.6.

Box 3.6. Indicators to attempt measuring knowledge exchange: Examples from OECD countries

There have been attempts across OECD countries to develop indicators to measure the impact of knowledge exchange (sometimes called "third mission", or "valorisation") activities. Some of these activities are quantifiable and others are not. It is generally acknowledged that there is no ready-made one-size-fits-all sets of indicators that match the broad definition of knowledge exchange. It is also noted that the broader societal and economic use of the knowledge generated in the university needs to be accounted for as part of the complex ecosystems at the national and regional levels. As some of the examples show below, the form of measurement tools and choice of indicators depend on the specific purpose of the measurement and the context of the knowledge exchange activities.

In the Netherlands, the term "valorisation" is used to refer to knowledge exchange activities. In 2010, a comprehensive four-dimensional framework was proposed to measure "valorisation performance", combining quantitative and qualitative indicators. The framework and the indicators can be applicable in a wide variety of settings, including research universities and the University of Applied Sciences (UAS), on several levels and for a variety of evaluation goals. The new approach emphasises a process-oriented measurement moving away from focusing only on quantitative outcome-based indicators (OECD/EU, 2018). In 2012, when all Dutch HEIs were preparing individual performance agreements with the Ministry of Education, Culture and Science for the first time, the review committee invited the HEIs to make use of indicators to illustrate their ambitions with respect to valorisation. Some HEIs responded to this request and agreed to include a number of indicators in their performance agreement as well as in the (mandatory) annual reports they publish each year to report on their overall activity. However, so far, a commonly defined set of indicators used by every HEI is not in place, which makes it difficult to compare results and monitor progress nationally (OECD/EU, 2018).

In the United Kingdom, systematic data on knowledge exchange activities at the university level has been collected since 1999/2000 under the Higher Education Business and Community Interaction (HE-BCI) survey, which all HEIs are requested to return data annually. In England, since the late 1990s, there has been a series of national funding dedicated to the strategic development of knowledge exchange activities. Since 2001, the Higher Education Innovation Fund (HEIF) has been awarded to HEIs in England based on their knowledge exchange performances. The funding allocation is based on a variety of knowledge exchange outcomes including the data captured in the HE-BCI survey. The HE-BCI survey includes data on income generated through a broad range of knowledge exchange activities including research collaboration, intellectual property, spin-offs and graduate start-ups, continuing professional development (CPD), facilities and equipment-related knowledge exchange activities, and social, community and cultural engagement activities. Submission of the institutional knowledge exchange strategies is also a requirement of HEIF allocation. It is reported that over the last decade, all knowledge exchange indicators have grown substantially across the HEIs in the sector (Coates-Ulrichsen, 2014). At the same time, the limitation of the use of the common metrics to a diverse range of HEIs including large research universities and small specialised colleges is recognised (Rosli and Rossi, 2015). In 2017, the government asked the Higher Education Funding Council for England (HEFCE, now Research England) to lead on developing the

Knowledge Exchange Framework (KEF) as part of its broader knowledge exchange policy and funding framework. Currently, KEF metrics and good practices are being developed.

In Australia, as part of the government's National Innovation and Science Agenda, the Engagement and Impact Assessment (EI) was piloted in 2017 (Australian Research Council, 2017). It aimed to measure HEIs' research interactions with industry, government, non-governmental organisations, communities and community organisations as well as research contributions to the economy, society and environment. A key principle guiding the development of the EI methodology was that: i) any assessment must be rigorous; and at the same time ii) such assessment should minimise the administrative burden on the university sector. The EI is expected to help drive collaboration between universities and end users and to help universities focus on research with more direct social, economic and environmental benefits, in addition to conducting fundamental research. The EI has been rolled out in 2018 across all research disciplines, by using a small set of key indicators alongside narrative statements, with all ratings made by panels of experts.

Source: Australian Research Council (2017), Engagement and Impact Assessment Pilot 2017, Australian Government, Commonwealth of Australia, ISBN 978-0-9943687-6-8 (online); Coates-Ulrichsen, Tomas. (2014). *Knowledge Exchange Performance and the Impact of HEIF in the English Higher Education Sector*. 10.13140/RG.2.1.1748.4409; OECD (2018), *OECD Regions and Cities at a Glance 2018*, https://doi.org/10.1787/reg_cit_glance-2018-en; OECD/EU (forthcoming), *Supporting Entrepreneurship and Innovation in Higher Education in Croatia*, OECD Skills Studies, OECD Publishing, Paris/EU, OECD, Paris/EU, Brussels OECD/EU (2018), *Supporting Entrepreneurship and Innovation in Higher Education in the Netherlands*, OECD Skills Studies, OECD Publishing, Paris/EU, OECD, Paris/EU, Brussels, https://doi.org/10.1787/9789264292048-en; Rossi, F.; Rosli, A. (2014). "Indicators of university–industry knowledge transfer performance and their implications for universities: Evidence from the United Kingdom". *Studies in Higher Education*. Vol 40. pp 1-22. https://doi.org/10.1080/03075079.2014.914914

Strengths in the Italian university system

Italian HEIs have a good awareness of knowledge exchange and collaboration and its implications

Italian universities are aware of the importance of their engagement with society. All case-study universities have engaged in knowledge exchange and collaboration activities in many different ways. University leaders and institutional strategies often promote knowledge exchange and collaboration activities. However, engagement activities have been observed also in institutions whose strategies do not formally mention third mission activities.

As in other OECD countries, the type of knowledge exchange activities developed by HEIs varies considerably depending on the type of university and the surrounding ecosystem. Italy has some specific features that affect collaboration between universities and their ecosystems. First, the country is home to a large and globally connected manufacturing sector (the largest in Europe only after Germany's). Second, the vast majority of firms are small- and medium-sized, typically family-managed. In some cases, especially in the centre-north of the country, small firms have traditionally clustered creating dense productive communities called "industrial districts" (Becattini, 1987).[3] Third, Italy has a complex geography based on a vast number of intermediate cities, requiring advanced social services and expertise. Fourth, there are large regional disparities: some southern regions are lagging behind compared with European averages and receive support from the European Cohesion Fund. Last, the country is home to an immense cultural legacy, which generates opportunities for collaboration with HEIs beyond science and technology.

The next sections will focus on the different form of knowledge exchange and collaboration universities undertake with business and society, including with cultural institutions and assets. The discussion will take into account actions to support academic entrepreneurship of faculty and students (within HEIs) and knowledge exchange activities with external stakeholders.

Support for entrepreneurship and innovation within HEIs

Concerning academic entrepreneurship, most Italian universities have technology transfer offices (TTOs) and about one-third participate in incubators supporting faculty and students trying to commercialise the results of their research. TTOs and incubators assist academic entrepreneurs with the "proof of concept" – with the aim of reducing the mortality of start-ups in the first year of their activity, the so-called "death valley" – and help them attract venture capital and investors. Importantly, there is a good understanding that knowledge exchange and collaboration are not for faculty only or for students only, but for both. MIUR promoted some important innovation to improve the quality of teaching and learning. For instance, universities must involve external stakeholders in the design and monitoring of study programmes and employability rates have been gaining importance when evaluating study programmes. All these efforts aim to embed creativity, entrepreneurship and other 21st century skills in student's curricula. Universities have increasingly focussed on entrepreneurship education. Study programmes, and expected learning outcomes, have been developed in collaboration with external stakeholders, in order to take into account their actual needs.

Universities have benefitted from new arrangements such as internship programmes and industrial PhD programmes to give students the possibility to engage with businesses. It is now a common occurrence that Italian universities help students take advantage some form of training, including in R&D activities. There are several good examples of student engagement, e.g. in Siena, where a local bank offers internship opportunities to students from the local university.[4] The contamination labs of Cagliari and Turin operate between their respective HEIs and the local business communities to provide students with an entrepreneurial mindset (Box 3.7).

Box 3.7. Contamination labs in Turin and Cagliari

Contamination Lab in the Polytechnic of Turin

C.lab Torino is a Contamination Lab, in other words, an informal meeting place for students and faculty from different disciplines, organisations and companies to generate new ideas, projects and companies. C.lab Torino was founded by Politecnico di Torino and the University of Torino and is partially funded by the Ministry of Education, University and Research (MIUR). C.lab provides facilities but also events such as hackathons and tailor-made programmes for students and graduates who want to answer challenges submitted by companies and/or faculty.

CREA at the University of Cagliari

This entrepreneurship centre at the University of Cagliari supports an entrepreneurial culture, enhances inter-disciplinary activities and creates innovative business projects through the contamination among diverse areas of studies. CREA is a crucial linkage among entrepreneurs, stakeholders, ideas and opportunities emerging inside the University of Cagliari. The centre builds bridges between students, researchers and entrepreneurs who act locally and globally.

Active engagement in knowledge exchange and collaboration of HEIs with business

Italian universities engage with entrepreneurship and innovation outside academia, with business stakeholders in different forms. Polytechnics are very active in knowledge exchange activities with businesses. For example, the Polytechnic of Turin, in co-operation with a Turin-based bank foundation (*Compagnia di San Paolo*), has developed the LINKS Foundation, an entity that promotes digital innovation for the economy and society. The Polytechnic of Milan co-ordinates a competency centre, in partnership with a large number of firms in its ecosystem. Likewise, the engineering school of the University of Naples Federico II has developed extensive co-operation programmes with businesses in its "academies" (four high-level professional schools that the university has developed in co-operation with Apple, Cisco, Deloitte and Ferrovie dello Stato – Italy's railway company – respectively) and through the Advanced Centre for Metrological Services CeSMA.[5]

Co-operation with businesses has also become a priority for HEIs undertaking excellent basic research such as the Scuola Superiore Sant'Anna, the Scuola Normale Superiore, the Scuola IMT Alti Studi Lucca and the IUSS Pavia. These small HEIs have joined forces to develop a joint TTO (JoTTO) and organise the JoTTO Fair, in which firms can discover the research activities carried out by students.

Because of the number and importance of SMEs in Italy, many universities have been seeking to engage with smaller firms, including in the south of the country, which is characterised by firms in more traditional sectors.[6] In 2016, SMEs represent 99.9% of the Italian industry in terms of the number of enterprises, 66.6% in terms of persons employed and 56.8% in terms of added value (European Commission, 2017). Many HEIs have developed a strong relationship with Confindustria to reach out to SMEs and involve them in different types of activities. The involvement of external stakeholders in curriculum design foreseen by the legislation is being implemented by the Universities of Bologna, Cagliari and Palermo through the participation of representatives from local branches of Confindustria. Universities use clusters and research labs as platforms to exchange with SMEs and offer them services or trigger collaboration opportunities. Relevant examples are the NEST Lab in Pisa (National Enterprise for Nano-Science and Nano-technology) and the Fondazione Cluster Marche, founded by the Marche Region's Technological Clusters.

Finally, HEIs can become an anchoring factor for the development of an industrial cluster in a given ecosystem. A dynamic university, producing excellent research connected with academic entrepreneurship (spin-off companies) and supported by local public authorities and government agencies may attract firms and research activities carried out by the business community. This is the case in Pisa due to the presence of excellence research in bio-robotics at the Sant' Anna School. Other examples of these dynamics include the Tuscany Life Sciences Cluster and the Digital Innovation Hub 4.0 Sardinia (Box 3.8).

Box 3.8. Clusters as channels of knowledge exchange: Examples from Tuscany and Sardinia

The Tuscany Life Sciences Cluster

Tuscany has a long tradition of research and development (R&D) in the life sciences. In 2004, regional stakeholders founded the Toscana Life Sciences Foundation to pursue and reinforce this part of the national economy and identity, and to enhance opportunities of commercialisation of life sciences research results. Later, the Tuscany Life Sciences Cluster and the Regional Technological District of the Life Sciences were created in 2011 by the Tuscany region to gather R&D activities in life sciences for regional growth. The cluster groups approximately 190 small, medium-sized and large businesses, the local universities of Florence, Pisa and Siena, the Sant'Anna, Pisa and other public and private research organisations.

The Digital Innovation Hub in 4.0 Sardinia

The Digital Innovation Hub (DIH) 4.0 Sardinia comprises universities in the region, Sardinia Confindustria, National Confindustria, the Union of the Chamber of Commerce and the Autonomous Region of Sardinia. DIH 4.0 Sardinia is part of a national network comprising 19 DIHs, sponsored by the Ministry of Economic Development (MiSE). The government mandate of DIH 4.0 Sardinia is to support the conversion to digital technology in the industry, including the technological transfer, innovation and organisation of businesses to promote the productivity of system processes.

DIH 4.0 Sardinia is responsible for evaluating actors in the digital and technological innovation fields at the national and international levels. It also arranges workshops, conferences, undergraduate courses, prizes and scholarships for students. The hub has these aims:

- To support businesses by identifying needs, opportunities and technological options.
- To plan activities and disseminate information to businesses on the opportunities available in the Industria 4.0 national plan.
- To mentor managers and operators. Through targeted collaboration agreements, to promote a network of public and private actors with skills useful for carrying out the digital transformation of businesses and the transfer of technology.
- To aid access of businesses to regional, national and European funding, both public and private.

Knowledge exchange and collaboration based on social and cultural engagement

Collaboration and knowledge exchange activities are not limited to businesses and many universities have found alternative ways to fulfil their engagement mission. Many HEIs have adopted the Sustainable Development Goals agenda to inform and guide their engagement strategies.[7] In Rome Tor Vergata, Sustainable Development Goals are actually at the centre of their engagement agenda. In the same vein, the University of Bologna has developed a strategy – Alma2021 – that defines actions under each of the 17 SDGs. At the University of Siena, the Santa Chiara Lab (Box 3.9) organises its various activities in accordance with these goals. Nonetheless, several stakeholders at the workshop in Milan have asked for further integration between science and the humanities, taking advantage of the new enabling technologies.

Many universities also collaborate with subnational authorities, in particular regions and municipalities from which they get funding to create local economic and societal impact, but not only. However, some universities show a will to expand this, by involving the civil society for instance, through cultural events, conferences and lifelong learning. In some southern regions, HEIs have been using EU structural funds to conduct knowledge exchange and collaboration activities with stakeholders. For instance, the new campus of the University of Naples "Federico II" was built using cohesion funds, considering the localisation of university facilities in an impoverished neighbourhood as an action to promote urban regeneration and economic development.

Box 3.9. Engaging through SDGs – The case of the Santa Chiara Lab in Siena

The Santa Chiara Lab of the University of Siena is a multidisciplinary teaching and learning centre where faculty and students can find support to develop collaborative projects. It hosts the Santa Chiara Fab Lab, where everyone – including the general public – can attend courses or use facilities such as 3D printing or laser cutting. The Santa Chiara Fab Lab is a self-sustained organisation within the university, managed by two fixed positions. The lab can be a meeting place for citizens and researchers to develop products, for instance in the development of Quietude, a collection of jewellery through which deaf women can experience sound. The lab exemplifies both the economic and societal aspects of knowledge exchange and collaboration, as well as the synergies between the three missions of a university – teaching, research and valorisation of research. Indeed, the lab has a commercial orientation, since it gets funding from customers; in addition, it is open to all, from inside or outside the university.

To promote collaboration and engagement, some universities have established foundations, often in partnership with local authorities. Foundations are more agile and quick to start up projects and therefore in some cases a more appropriate partner for non-academic stakeholders. For instance, the *Fondazione Politecnico di Milano* (Box 3.10), created in partnership with the public sector (region and municipalities), industry and other organisations, works as a matchmaker between regional needs and research capacity of the Politecnico and as a support in research funding applications.

Box 3.10. The *Fondazione Politecnico di Milano*

The Politecnico di Milano created a foundation in 2003, the *Fondazione Politecnico di Milano*, in collaboration with businesses (such as ENI, Pirelli or Siemens) but also the public sector (municipalities and region), to support both research activities within Polimi and the economic and social development of the region. Polihub, Polimi's incubator, is managed by the foundation.

The foundation also provides lifelong learning. Beneficiaries of the foundation are not only its founders but also its 200 partners. The main advantages of this status of foundation is to be less constrained by university bureaucracy and thus to be able to act faster, with greater flexibility. The foundation manages approximately 200 projects per year, matching regional needs and university research, and providing support for instance in terms of funding application or network creation.

Because of the importance of cultural amenities in Italy, several universities have developed activities to engage in social sciences and humanities. For instance, the archaeology department of the University of Siena actively works to improve the visibility of historical assets in the region and help communities recognise the value of their historical assets. The department has developed several projects, including another archaeological site, the *Archeodromo di Poggibonsi*, which helped to attract visitors in the small municipality lying out of regional tourist circuits. Other examples concern activities to help local communities forge their historical identity and use it to market agri-food products, including wine. In the same vein, the University of Naples "Federico II" has developed a project – the *Illuminated Dante Project* – that helps a local library capitalise on antique books and other artistic assets.

HEIs are evaluating their knowledge exchange and collaboration activities to increase funding

Another strength of Italian universities is the fact that some case-study HEIs have developed methods to evaluate knowledge exchange and collaboration activities, with the aim of allocating them more funds. These attempts are mostly bottom-up initiatives that are not co-ordinated with the national process put in place by ANVUR, as discussed above. For example, the University of Bologna, where knowledge exchange is a strategic priority, has created a third mission observatory. The observatory has developed an evaluation system of faculty that takes into account their knowledge exchange and collaboration activities, besides their research excellence (see chapter on organisational capacity).

Weaknesses in the Italian HEI system

The Italian higher education system and many individual universities lack a strategic approach to knowledge exchange and collaboration

The lack of strategies to co-ordinate knowledge exchange and collaboration, both at the national and individual HEI levels, represents the main weakness of the Italian system. There is a large number of bottom-up initiatives but the governance fragmentation and lack of horizontal co-ordination reduce the overall impact. Therefore, despite the presence of some national champions – capable of collaborating and being visible in key international networks – the Italian system struggles to take advantage of its status of second manufacturing economy in Europe.

There is a low level of "institutionalisation" of engagement activities, including knowledge exchange and collaboration. The importance of knowledge exchange and collaboration with external stakeholders is well understood by some faculty members, especially in those disciplines where collaborations are essential to develop research and teaching, but it is rarely set as a formal priority in universities' strategies. This generates some challenges and is certainly not linked to the sustainability of a given approach. The level of engagement of a given university depends on the agenda of the rector and its team, and may change when his/her mandate is over.

These limits in the institutionalisation of engagement activities are also mirrored by a lack of institutionalised relationships between external stakeholders – public entities or private firms – and universities. External stakeholders are represented in the Administrative Board of Universities and there is a compulsory consultation in design and revision of study programme, but these structured relations often do not focus enough on engagement activities or are not sufficiently close-knit to do so. As far as knowledge exchange and

collaboration is concerned, these relationships are usually linked to personal networks, resulting in sporadic contacts and a continuous change of references within the organisations.

Furthermore, in a situation where there are strong budget constraints, choosing knowledge exchange as a strategic priority is not enough. The university needs to have the capacity to provide support to its faculty, staff and students to engage in knowledge exchange and collaboration and in particular to develop long-lasting relationships with external stakeholders. All of these activities require long-term investment and specialised positions within a faculty. Most Italian universities, including those that have developed ambitious institutional strategies for engagement, face structural problems due to the lack of funding.

For knowledge exchange and collaboration to be effective, commitment needs to be bidirectional: external stakeholders should also be open and pro-active towards HEIs. To achieve this result, it is important that all stakeholders in the system harmonise their visions, narratives and strategies. University actions in particular need to be in line with national and regional policies, which are relevant for knowledge exchange. Public authorities should design industrial and innovation policies capitalising on the potential role of HEIs in productive systems, for example.

The policy portfolio should co-ordinate across different ministries and national agencies, in order to optimise funding allocation and avoid inconsistency and fragmentation. There is evidence that Italy does not perform well in its governance systems supporting innovation and skills (OECD, 2017a). There are some international examples that Italy could take into account to improve the overall co-ordination capacity, including in specific industries, such as the automotive sector (Box 3.11).

Box 3.11. Automotive Dynamics & Control Group, Tsinghua University in China

This case describes how academic entrepreneurs commercialised two technologies through their interaction with industry. The Anti-Lock Braking System (ABS) and the Automated Mechanical Transmission (AMT) were the focus of a successful industry-university (I-U) knowledge transfer with the Automotive Dynamics & Control Group at Tsinghua University in China; the transfer exemplifies the academic entrepreneurship (AE) ecosystem at work. The integrative framework we established defines sources of I-U knowledge transfer, the contents of the transfer and the phases of AE, as well as their interacting linkages.

Three sources supply the university with industrial knowledge: previous experiences involved academics, commercialisation partners and leading customers. The content of the knowledge being transferred primarily includes entrepreneurial norms, which emerge from academic experiences in industry; market information, from commercialisation partners; and information on application contexts, from leading customers. The framework also describes the chronology of the I-U knowledge transfer between the source and its corresponding content with the university: during the early stage of invention, academic entrepreneurs lean heavily on their own industrial experience; during the consolidation to practice phase, commercialisation partners supply the learning; and in the last phase, the malfunction exposure and renovation stage, learning flows from leading customers.

The next sections discuss in detail the three major challenges facing knowledge exchange and collaboration in Italy: i) generating incentives and narratives to promote strategic vision and co-ordination; ii) strengthening the role of intermediary institutions to bridge HEIs with their ecosystems; and iii) generating synergies among the three university missions to strengthen knowledge exchange and collaboration.

Generating incentives and narratives to promote co-ordination

HEI strategy for knowledge exchange and collaboration needs to be supported by the right incentives for internal and external stakeholders. In Italy, too often researchers face the dilemma between producing (and publishing) excellent research and engaging with external stakeholders. This situation depends on the national system of evaluation of research, which is still mainly based on research excellence (i.e. the number and quality of publications). Also, the allocation of the state budget depends disproportionally on the evaluation of research results (OECD, 2017). This catalyses the challenge of developing "institutional" engagement activities.

Several stakeholders participating in the Milan workshop stressed the need for: i) clear incentives for the staff involved in technology transfer; ii) dedicated structures, capitalising on ad hoc professional competencies and resources (such as the example of the "broker" discussed above); and iii) a line of funding also for those enterprises that actively support the engagement activity of the university.

As discussed in Chapter 6 of this report, collaborating and exchanging knowledge with society and the economy requires overcoming relevant organisational obstacles and red-tape bureaucracy. First, engagement – by definition – can be sustained if the staff is supported and motivated. Second, entertaining fruitful relationships with businesses requires being able to answer quickly to the operational needs (e.g. in the case of public calls, tenders, etc. for which universities have the same constraints as any other entity within the public administration) and to make information available and easily reachable for external actors (e.g. on ongoing research projects, available competencies, etc.). Without these elements, those firms which are considering collaborations with universities would either be discouraged from new investments or would do it autonomously, either by setting up internal research labs or resorting to other non-university providers.

Within the system, there is also a need for new narratives concerning collaboration, which can affect the behaviour of university researchers. Stakeholders interviewed during field-visits revealed that too many faculty and students carrying on basic research do not consider entrepreneurship and innovation as attractive opportunities. However, the very same students and researchers, asked if they liked to be creative, adopted a far more positive approach. Based on this anecdotal evidence, there may be a need to make it explicit that entrepreneurship encompasses creativity and the adoption of an entrepreneurial mindset and it is not only associated to business creation. This same approach is shared by the Marconi Institute for Creativity, a joint initiative by the University of Bologna and the Marconi Foundation. This institute provides training to develop and democratise creativity, both within universities in Bologna and in the private sector. At the international level, there are many examples of initiatives to promote creativity through teaching. One of these is the Technion-Israel Institute of Technology (Box 3.12).

Box 3.12. Project-based innovation learning from traditional industry at the Technion-Israel Institute for Technology

At the Technion-Israel Institute of Technology, programmes have been developed where industrial engineering and management students promote innovation in traditional industries, as part of their final year projects of their higher education studies.

Mission

The Knowledge Center for Innovation at the Technion – Israel Institute of Technology together with the Israel Innovation Authority and the Council for Higher Education (under Israel Ministry of Education) have joined forces to promote technological and business innovation in the traditional industry sector of Israel, and introduce engineering students to the industry through their final year capstone projects.

Rationale

As part of the research done by interviewing 162 chief executive officers (CEOs) of SME companies in the northern part of Israel, it was observed that 50% of company CEOs spend less than 5% of their time on innovation and only 5% of the CEOs spend 20% of their time or more on innovation.

The programme

As part of the programme, students at their fourth and final year of their industrial engineering and management studies participate in a project aimed at uncovering challenges and weak spots, analysing the causes and coming up with innovative ways to address them. Students bring a clean and fresh mindset, go beyond existing paradigms and, therefore, can bring new ideas on possible ways of solving problems.

It is also an opportunity for companies to recruit young and capable students who tend to prefer the well-known high-tech employers as default.

Several academic institutions take part in this unique programme across all of Israel, including the country's most prestigious universities as well as newly established colleges at its periphery.

Accomplishments

During the past 7 years, over 170 students and over 50 companies from various sectors – metal, plastics, agriculture, printing, chemicals and many more – have participated in the programme.

Source: based on https://www.technion.ac.il/en/technion-israel-institute-of-technology/ visited on March 2019.

Investing in the relations and strengthening the role of intermediary structures to bridge HEIs with their ecosystems

Italian HEIs also need to improve the systemic capacity of higher education to co-operate with business and society as a whole via intermediary structures such as incubators, accelerators, science parks and TTOs, following an open innovation paradigm. These are structures common in many universities in OECD countries, although the level of success depends on the way they are designed and connected to external stakeholders. They can

depend directly on a given HEI or being co-managed by HEIs in co-operation with regional and local stakeholders. Regardless of the governance arrangement, it is important that these structures facilitate a multi-directional flow of resources. To achieve this objective, it is crucial that TTOs, incubators and other academic facilities promoting collaboration house external stakeholders and behave like a gateway between the universities and the external community.

When thinking of incubators, HEIs and private sector representatives could have the joint use of the facilities and services of incubators. External stakeholders should also be involved in the management of the incubator, including its financial aspects. In some international good practices, incubators are placed outside university campuses to facilitate access from external stakeholders and become community landmarks. There is a need for all these conditions to generate osmosis between HEI incubators and productive ecosystems.

Some HEIs in Italy have attempted to go in this direction and embedded their institutions in their ecosystems. A good example is the incubator "New Steal" at the University of Naples "Federico II". The incubator is based on the strong collaboration between the university and the regional branch of the industrialist association, Confindustria. The incubator hosts academic entrepreneurs but also start-uppers coming from outside the university, identified by mentors and other professionals working in the facility. Within the incubator environment, there are co-working spaces and activities supporting digitalisation and internationalisation. It should be said, however, that many case-study universities reported difficulties in engaging or co-ordinating with science parks, often located far away from university facilities and campuses.

One of the conclusions the stakeholder workshop underlined is that industrial PhDs should also be used in a more strategic way in this respect. First, this type of doctorate requires an intermediation between firms and doctoral schools, to facilitate the interactions among them. Doctoral programmes should communicate with a language firms can easily understand, and promote existing initiatives. For example, firms often criticise the fact that many PhD programmes mainly focus on academic outputs – such as publications – or that they cannot take part in the selection procedures of the PhD candidates. Second, while firms promote research for high technology readiness levels (TRLs) – say, 7, 8, 9 –, universities typically promote research for the lowest TRLs (1 and 2); industrial doctorates should act as bridges and focus on projects with intermediate TRLs to close the gap.

Some new educational programmes could facilitate osmosis between universities and productive ecosystems. The implementation of *Lauree professionalizzanti* – professional tertiary education programmes that will be put in place in some Italian HEI for the first time in 2018/19 – may represent another gateway for external stakeholders to participate in the design of curricula and in the professional education of students. The Italian higher education system, however, could also capitalise on the presence of *Istituti Tecnici Superiori* – ISCED 5 education institutions. Since 2015, ITS graduates have been enjoying remarkably high employability rates illustrating the need for this kind of professional profile on the market. In this framework, it would be important to enhance co-operation between *Lauree professionalizzanti* and ITS, as in the case of the Polytechnic of Turin (Box 3.13).

Box 3.13. Integrating professional bachelor's programmes with ISCED level 5 institutions (ITS): The experience of the Polytechnic of Turin

The co-operation between the Polytechnic of Turin and the regional government of Piedmont

The Polytechnic of Turin is experimenting the possibility to generate pathways between ISCED level 5 HEIs, called Technical Higher Institutions (*Instituti Tecnici Superiori*), and the professional bachelor's programme (*Laurea professionalizzante*), a new university degree (ISCED level 6) introduced in the 2018/19 academic year.

The Polytechnic of Turin is an important regional actor. It co-operates with other institutional actors such as the regional government of Piedmont and the City of Turin. Taking advantage of its institutional capital, the polytechnic has been co-ordinating a regional round table to discuss the harmonisation of ITS curricula with its new professional bachelor's degree. The round table involves all the regional ITS specialised in manufacturing vocational education and training (VET), regional and local authorities and other stakeholders, such as the regional branch of the national industrialist association, Confindustria.

Regional ITS involved in this policy dialogue should update their curricula to make them modular with the professional bachelor's degree offered by the Polytechnic of Turin. This will allow ITS graduates who want to get a professional bachelor's to attend only one final year at the Polytechnic of Turin.

In addition, the Polytechnic of Turin will co-operate with ITS to give its students access to ITS' technical laboratories. Most ITS are equipped with modern laboratories that are provided by firms co-operating with them, to train individuals able to plug immediately into their production processes. To achieve this result, firms have provided ITS with modern machinery tools that the institutions can use to train students. Thus, by co-operating with ITS, the polytechnic gains access to their facilities.

The Italian experience illustrates the possibility of integrating professional education at ISCED levels 5 and 6. The aim is twofold: i) streamline educational pathways and provide individuals with the possibility to move from one education ladder to another; and ii) generate new professional figures that will help local firms be more innovative and productive.

Promoting synergies among the three university missions to strengthen knowledge exchange and collaboration

Embedding entrepreneurship, creativity and innovative activities in the teaching and learning process is an opportunity to be further developed in the Italian higher education system to support knowledge exchange. There is pressure on universities to become more entrepreneurial, innovative and deliver values for society. The key challenge to achieve this result is to mainstream entrepreneurship and entrepreneurial mindsets across the university organisation and activities, including teaching and research. Entrepreneurial universities need to mobilise all of their faculty members and students to support knowledge exchange and collaboration.

Teaching and learning activities can be improved by supporting academics in innovating their methodologies, by involving more significantly external stakeholders in programme design and by empowering students in their learning process. There are many different

ways to achieve this result such as providing open spaces and facilities for collaboration with external actors. HEIs can also involve representatives from business and society in lectures (Box 3.14), joint workshops, and networking events and opportunities (e.g. the "entrepreneurship breakfast series"). An important part of the external collaboration is mobility of staff and students through internships, sabbaticals and dedicated study programmes (e.g. industrial doctorates, sandwich programmes).

The entrepreneurial mindset of students is also developed by their direct involvement in knowledge exchange activities, even if institutional strategies too often overlook them. In many OECD countries, while students are to a large extent involved in university start-ups, entrepreneurship support activities and business contacts in general, their participation in such activities could be more strategical and more forward-looking (Klofsten and Lundmark, 2016). Nurturing students' mindsets with entrepreneurship is also important to respond to the needs of external stakeholders, whose rationale to get involved in science parks and incubators is to access and recruit talents and young pre-professionals, among university undergraduates (Cadorin, Johansson and Klofsten, 2017; Bellavista and Sanz, 2009). In addition, long-term strategies promoting students' entrepreneurial mindsets, implemented in co-ordination with stakeholders and public authorities, can be a way to promote regional economies.

Box 3.14. The involvement of professionals in teaching: Temporary teaching assistant contracts in France

In France, universities and other types of higher education institutions have the possibility of temporarily hiring professionals, whether CEOs or employees at a public or private organisation, to teach in courses related to their professional activity. This type of position is called "*chargé d'enseignement vacataire*", i.e. temporary teaching assistant. It is mostly used in vocational programmes, such as engineering schools or business schools. This could be for instance an accountant teaching accountancy, a lawyer teaching business law or a company manager teaching business strategy, etc. In addition to bringing insights and tips from the field to the students, having a professional as a teacher can potentially result in internship or recruitment opportunities for students.

Note: For more information, see this SciencePo Toulouse webpage (in French): http://www.sciencespo-toulouse.fr/recrutement-de-vacataires-d-enseignement-505428.kjsp.

HEIs, however, can find it challenging to design knowledge exchange and collaboration activities for the whole of the student community, in all university faculties and departments. This depends on the student numbers compared with existing opportunities and organisational costs, and on the heterogeneity of students' expectations in terms of collaboration with external stakeholders. For example, students attending teacher colleges may aim to collaborate with the public sector (schools and other education institutions). Conversely, students at technical faculties may look for a collaboration with businesses and, in particular, knowledge-intensive firms. Integrating research, teaching and knowledge exchange and collaboration activities can stimulate the creation of new knowledge and provide students with innovative learning opportunities.

Achieving these results, however, is not easy. HEIs have to create mechanisms to integrate and absorb information and experience from the wider ecosystem into their teaching and research activities. In addition to creating spaces for dialogue with external stakeholders,

they have to monitor research activities undertaken outside academia to identify new and relevant knowledge.

The capacity to generate synergies among academic missions characterises some of the Italian case-study universities. For instance, the incubator of the University of Cagliari represents a good practice for its capacity to co-ordinate incubation activities with teaching and research projects and to capitalise on collective intelligence and diversified knowledge (Loi et al., 2017). Students, as a part of their education, can work in smaller firms to learn to practise and implement what they have learnt. Representatives from local firms are also invited as guest lecturers. At the University of Bologna and at the Sant'Anna Institute, students are encouraged to gain work experience in non-governmental organisations (NGOs), often abroad, during the study programmes to learn how to work in different environments.

Box 3.15. The Danish cluster initiative Biopeople

Biopeople was founded in 2005 and is a Danish life science cluster base at the University of Copenhagen. The initiative is a part of the country's efforts to support innovation and is co-funded by the Ministry of Higher Education and Science.

Biopeople enhances the collaboration between firms and public research and aims to pursue changes within the healthcare sector and increased attention given to future biomarkers, diagnostics, personalised medicine and stakeholder involvement as well as patient and investor communities, for example. Through different programmes and networking activities, the mission is for firms and entrepreneurs to become a part of the worldwide business value chain and also to establish public-private and cross-disciplinary partnerships.

Contact: pesp@biopeople.ku.dk.

Source: https://www.clustercollaboration.eu/cluster-organisations/biopeople-denmarks-life-science-cluster, visited on June 2019.

Conclusions and recommendations

The potential of Italian HEI system in terms of knowledge exchange and collaboration is strong but largely underutilised. The Italian system is characterised by many good practices at the HEI level, yet the lack of strategies, long-term commitment and co-ordination platforms negatively affects the systemic impact of entrepreneurial universities.

Italian universities have the capacity to win the engagement challenge and to do so should capitalise on the distinctive traits of the national system. First, the continuous and non-episodic engagement with firms and also with public authorities should not transform universities into "service providers"; Italian HEIs possess the DNA of research-oriented institutions and should take advantage of this nature in the interaction with stakeholders. Second, the Italian way is not that of pushing towards a centralised unitary model; it rather tends towards creating an integrated system, a distributed network of territorial nodes and poles. These two characteristics also imply that the university system should abandon the "fractal" model in which all institutions – as with other public administrations – replicate similar activities and organisational structures; they should instead embrace a model of

specialisation, in which each HEI can benefit from its own context, experience, dimension and competencies.

Doing so requires not only overcoming the regulatory limits imposed on the institutions but also ensuring the appropriate funding. The Italian higher education system is underfunded, compared to peer OECD countries, and the situation got worse due to the austerity measures following the global economic recession (OECD, 2017a). The scarcity of funding, exacerbated by the fragmentation of initiatives, particularly affects the capacity to develop third mission activities, which are often considered as residual compared with teaching and research. Increased investment in all missions, including engagement, could generate synergies and more efficient and effective use of resources.

There is a need for new narratives to explain the benefits that HEIs can provide through engagement. The higher education system struggles to be actively involved into policies aiming at innovation, economic development and social inclusion. Industry 4.0 policy demonstrated the potential of higher education in terms of innovation and capacity to interact with business and society. In the same vein, some universities in the south of the country have been able to maximise the availability of EU cohesion funds and use of additional funding to improve their capacity to engage with local communities. Based on these experiences, public authorities should consider HEIs as important partners to design and deliver policies.

Nevertheless, there are remarkable good practices, which would deserve more visibility and national support. For instance, ANVUR, the national agency for the evaluation of higher education institutions has been developing a comprehensive methodology to assess third mission activities, including collaboration and knowledge exchange. Public authorities could support this initiative and pilot some innovative assessments.

At the HEI level, there are many well-functioning and encouraging initiatives in the Italian system aimed to create collaborations (including international collaborations) between academia and society. These initiatives reflect the respective regional contexts, challenges and needs of the local stakeholders. Universities have found different ways of dealing with external stakeholder collaboration and it seems to be that there is no best way of organising third mission activities. However, overall, there is a need for institutional support, because initiatives are mainly bottom-up and very dependent on entrepreneurial individuals, who can encounter bureaucratic stickiness. In this respect, during the stakeholder workshop, it was suggested to create a co-ordinating committee (*cabina di regia*) composed by representatives of different ministries to create and support structured and transversal actions for engagement.

Italian HEIs could play the role of intermediate institutions in their respective ecosystems driving regional development (OECD, 2007; Arrighetti and Seravalli, 1999). The competitiveness of many SME clusters in Italy – which represent the legacy of "industrial districts" – may also depend on the capacity of public policies to generate new institutions. In particular, HEIs could support the competitiveness of SME clusters generating positive externalities including knowledge spillovers, access to international networks and skills.

Recommendations

Based on the analysis above, this chapter identifies several recommendations to the higher education system and individual institutions. These recommendations are listed and discussed below:

1. Incentivising universities to include knowledge exchange and collaboration in their long-term vision, for teaching and for research activities. These incentives may require the integration among policies implemented by different relevant ministries, such as MIUR, MISE, MAE, etc. Non-academic stakeholders, including business, regional and local governments, research entities, NGOs, etc. should contribute to the definition of this long-term vision concerning the role of higher education (institutions) for entrepreneurship in Italy. External contributions can strengthen the vision and make it more resilient vis-à-vis changes in national politics. The interaction with external stakeholders is also important to clarify what HEIs can deliver to their ecosystems and communities and what, conversely, is out of their scope or mandate.[8] In addition, more effective involvement of internal stakeholders would help, in this respect, to improve institutional cohesion and increase the ownership of the vision in the university as a whole.
2. Institutionalising "engagement" in the governance of HEIs. There is a gap between the decision-making process at the institutional level and the one in departments or in decentralised services. In many cases, the universities are led by very enthusiastic and committed rectors who promote the orientation towards the entrepreneurial university. As already seen, there is also a number of bottom-up initiatives, either led by certain more reactive disciplines or by dedicated structures within the administration. In between, there is often a lack of alignment, that can make it difficult to implement an efficient organisation for the third mission throughout the whole university and to integrate an entrepreneurial mindset in the university culture.
3. Promoting the already well-developed efforts around the monitor and evaluation of knowledge exchange, led by ANVUR. Engage in peer learning and discussion by involving international experts to promote pilot evaluations and experiments featuring the leading best practices at the international level.
4. Supporting the use of cluster initiatives to organise knowledge exchange and collaboration activities between HEIs and ecosystem businesses. So far, university engagement is linked to the initiatives of individuals – including rectors, and entrepreneurship professors. Promoting institutional engagement – rather than "individual" engagement – is likely to make third mission activities more impactful and visible. A strategic approach to knowledge exchange and collaboration with their ecosystems may help universities handle the extreme fragmentation of the productive sector and supply chains, which are mostly based on SMEs.
5. Creating narratives around knowledge exchange and collaboration activities as something enriching for faculty members and students within the university. This could be done by expanding collaborations to involve a broader group of stakeholders, thus enhancing opportunities to find the most relevant stakeholders for each academic activity.
6. Strengthening the student-centred system. Involving students, at all levels, in collaboration with external stakeholders. The Italian economy is thirsty for skills (OECD 2017a, 2017b). Universities need to mobilise all their potential to give students at all levels, including ITS, *Lauree professionalizzanti*, bachelor's, master's programmes and PhDs, disciplinary and transversal skills that can help them be active citizens, perform on the labour market and promote the competitiveness of the Italian economy as a whole.

Notes

[1] The funds that were merged were the *Fondo per le Agevolazioni alla Ricerca* (FAR); the *Fondo per gli Investimenti della Ricerca di Base* (FIRB); and *Progetti di Ricerca di Interesse Nazionale* (PRIN).

[2] Representatives from the productive sector, along with representatives from Italian HEIs, participated in a stakeholder workshop held in the University of Milan "Bicocca" in May 2019.

[3] Industrial districts consist in a system of companies, mainly SMEs, characterised by horizontal and vertical integration and productive specialisation, generally concentrated in a specific territory and linked by a common historical, social, cultural and economic experience (OECD, 2017).

[4] In Siena for instance, the Monte dei Paschi bank alone hired in 2018 16 apprentices and 52 interns; and the only recruitments that were made since 2015 are apprentices at the end of their studies.

[5] Other interesting examples in the Lombardy ecosystem include: the collaboration between all the universities of Milan and Assolombarda, the local branch of Confindustria; the CORIMAV Consortium for research on materials, created in 2001 by the University of Milan "Bicocca" and Pirelli, funding PhD positions in materials science; the collaboration between Politecnico di Milano and ROLD (innovative firm focused on the introduction of digital technologies in manufacturing processes), where the firm finances inter-departmental research projects and takes advantage of the role of a "broker", a researcher employed by the company to act as a liaison between the firm and external research centres, including universities.

[6] One of the contributions of the stakeholder workshop underlined that universities should engage more actively with small and micro firms, which constitute the economic fabric of the country, especially in areas that cannot benefit from dynamic urban agglomerations. So far, this has been one of the limits of competency centres, which privilege the interactions with large firms.

[7] In this respect, the stakeholder workshop represented an opportunity to identify positive experiences such as that of InVentoLab (http://www.inventolab.com/), a B-Corp that promoted entrepreneurial education activities in the social and environmental sectors.

[8] As discussed at the stakeholder workshop, Italian research universities should not become central of services for the productive sector. However, it would be important that universities are part of an integrated higher education system that capitalises on the presence of new entities (ITS and professional bachelor's programmes) to connect research with business and society.

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Chapter 4. Internationalisation of higher education in Italy

This chapter expands on the findings of Chapter 2 related to the internationalisation of the Italian higher education system. It provides a more in-depth discussion of the challenges faced with regard to the need to embed internationalisation into systemic and institutional strategies and providing a conceptual framework to analyse this phenomenon under a multidimensional perspective. It explores which rationales drive internationalisation in Italy and in which areas, and what actors are critical in these respects. The chapter also presents various national models and good practice examples.

Introduction

The international dimension of higher education (HE) has become increasingly important for governments and higher education institutions (HEIs) in Europe and worldwide. The European Association for International Education (EAIE) Barometer (EAIE, 2018) and the International Association of Universities (IAU) Global Survey (Egron-Polak and Hudson, 2014)[1] highlight the growing importance of internationalisation for HEIs. In these reports, it has been pointed out that the majority of the institutions already have (or are developing) policies to promote internationalisation and have been developing a supportive infrastructure to monitor and foster progress in this area. However, there is not a single and universally applicable model, but rather different approaches to internationalisation across countries, regions and institutions (De Wit, Hunter and Howard, 2015).

Italy has been developing efforts to internationalise its HE system, which have been significantly encouraged by both external (European) and internal (systemic and institutional) drivers for change. External drivers such as the European Higher Education and Research programmes and, in particular, by the adoption of the so-called Bologna Process, have not only fostered initiatives for internationalisation and successfully paved the way for new and more diverse forms of internationalisation, but have also been the driving force behind recent legislation to reform Italian higher education. European initiatives have then been combined with a set of internal initiatives and efforts, at a systemic but also at an institutional level, which have been boosting internationalisation. However, such efforts and initiatives for internationalisation often face a context of economic and political instability and strong internal resistance (from the academic community), which have been hindering and slowing a more successful development and implementation (De Wit, Hunter and Howard, 2015).

Although internationalisation has traditionally developed in the areas of education and research, there has been a growing debate about how it can be embedded in a more transversal way in universities. This would include taking advantage of internationalisation in another range of activities, namely in what can be broadly considered the university's engagement with society. Through this, the university could magnify its societal relevance by becoming a platform connecting the local and the global in a way that is enhanced by its capacity to create and disseminate knowledge to the various areas of economic and social life.

In this chapter, we discuss internationalisation policies and practices in Italian HE, reflecting on their main features, opportunities, strengths, challenges and weaknesses, both at a systemic and at an institutional level. We will explore the multiple dimensions, the complexity and the diversity we expect to face when dealing with this matter. Despite the possible limitations of this approach, we will follow the analysis with a set of recommendations and suggestions for further reflection aimed at Italian decision-makers at the national and institutional HE levels.

Defining internationalisation

HE, by its very nature, has always been international. Nevertheless, the international "nature" or dimension of HE has profoundly changed over the centuries. Internationalisation of HE, as it is understood today, is a recent phenomenon that has emerged over the last 30 years driven by academic, economic, political, and socio-cultural rationales (De Wit and Hunter, 2018).

The concept of internationalisation is neither simple nor static. It is a complex concept that has been reflecting the changes in the approaches to the international dimension of HE. Nowadays, internationalisation means not only "the process of integrating an international, intercultural or global dimension into the purpose, functions or delivery of post-secondary education" (Knight, 2008, p. 21), but has also become an instrument (rather than an end in itself) to enhance the quality of teaching, research and the service role of HE to society (Hunter and De Wit, 2016; De Wit et al., 2015).

Broadly considered, the notion of internationalisation incorporates two components: internationalisation abroad, translating all forms of education across borders: mobility of people, projects, programmes and providers; and internationalisation at home, which is more curriculum-oriented and focuses on activities that develop international or global understanding and intercultural skills (Hudzik, 2011).

Nonetheless, the recognition of these two components of internationalisation does not necessarily reflect a fragmented understanding of the concept. On the contrary, the need for a holistic and comprehensive approach to internationalisation by HEIs has been increasingly emphasised in the literature. Indeed, the concept of comprehensive internationalisation defines "a commitment, confirmed through action, to infuse international and comparative perspectives throughout the teaching, research and service missions of HE. It shapes institutional ethos and values and touches the entire HE enterprise. It is essential that it be embraced by institutional leadership, governance, faculty, students and all academic service and support units. It is an institutional imperative, not just a desirable possibility" (Hudzik, 2011, p. 6).

Rationales for internationalisation

The rationales for internationalisation in HE are diverse, though they are interconnected and may overlap in terms of characterising particular goals (De Wit and Hunter, 2015; Helms et al., 2015; Seeber et al., 2016).

The first rationale to be considered is the academic one. This involves issues such as the expansion of HE's capacity, the improvement of HE's quality, the expansion of knowledge creation's capacity of HEIs, the enhancement of prestige (especially as reflected by rankings and league tables) and the opportunity to benchmark institutional performance.

The second rationale is the economic one. This integrates aspects ranging from short-term economic gains to long-term effects in national economic development, and the development and qualification of the workforce. In the short term, international students bring additional revenue through general living expenses. In the long term, international students can add to the domestic pool of highly-skilled workers and thereby help to strengthen the domestic knowledge economy. This is especially important for countries, such as Italy, that experience demographic change, negative population developments and growing skills shortages.

The third rationale is the political one, which is based on issues of public diplomacy, national security and international development.

Finally, there are social and cultural rationales, that include topics such as international awareness of and deeper engagement with global problems (such as those outlined in the United Nations' Sustainable Development Goals), global citizenship and mutual understanding. In addition, one may argue that there are also national and organisational-institutional levels rationales influencing how academic, political, economic and social-

cultural rationales come into play in shaping internationalisation strategies and how these strategies are actually developed and implemented (Seeber, 2016).

The role of national policies

Given the growing visibility of internationalisation in HE policy, several governments have introduced policies to promote the internationalisation of their HE sectors (Davies and Hunter, 2018; Rumbley and Helms, 2018). In addition to having different rationales, these interventions vary in scope and complexity: the role of governments can range from an active, dynamic and greatly influential role to a very distant and almost absent one.

National governments can greatly facilitate or hinder internationalisation strategies and their actions need to be carefully assessed and contextualised within the broader HE framework. However, the experience of some national policies can be also useful in suggesting possible ways of effectively promoting the internationalisation in the Italian context.

Like many European governments, the Finnish government is committed to enhancing internationalisation policies and practices in HE. The Ministry of Education and Culture (2017) has prepared a set of "policies to promote internationalisation in Finnish higher education and research 2017-25", based on seven main packages of actions: international attraction through renewal of science and leading-edge research; strengthening the quality and pioneer spirit in HE as well as reinforcing internationally attractive clusters of competency; momentum for the export of Finnish competency; simplification of the processes of seeking education and employment in Finland to facilitate entry into Finland; making Finnish messages heard in international discussion; establishment of a Team Finland Knowledge network to represent Finnish higher education and research in selected countries; calling on expat experts and alumni. The aim is that, by 2025, Finland has a genuinely international community for and an international appeal based on scientific quality.

One of the key issues when it comes to internationalisation policies is that of co-ordination between the different actors, as the proliferation of actors and initiatives may hinder their effectiveness and lead to an incoherent policy framework. Internationalisation has become a very relevant topic in HE in Germany. Being a federal country poses particular issues in terms of co-ordination. In the case of Germany, the promotion of HE's internationalisation is co-ordinated by five entities: the German Federal Ministry of Education and Research (BMBF), the German Council of Science and Humanities (DFG), the German Rectors Conference (HRK), the German Academic Exchange Service (DAAD), and the Alexander von Humboldt German Academic Exchange Service (AvH). The agenda-setting by these federal-level players defines overarching goals, which are then carried out at state and local levels by agencies, research institutes, foundations and academic institutions (De Wit, Hunter and Howard, 2015). In addition, Germany has moved from fragmented national internationalisation policies towards a more coherent and common agenda on internationalisation, especially since 2008 when the German Federal Ministry of Education and Research has carved out its first comprehensive internationalisation strategy, updated in 2017 with the Strategy for the Internationalisation of Education, Science and Research (Federal Ministry of Education and Research, 2017). The Federal and Länder Ministers of Science (2013) have also launched the Strategy for the Internationalisation of the Higher Education Institution. This strategy outlined nine fields of action to be implemented by the federal and individual *Länder* governments and covered themes related to student mobility,

internationalisation at home, staff, research, services, strategic frameworks and transnational education (De Wit, Hunter and Howard, 2015; Helms et al., 2015).

The effectiveness of national policies needs to take into consideration the fact that HEIs are key actors in the successful development and implementation of internationalisation strategies. Thus, one area of intervention of national policies has been the certification and assessment of internationalisation. The Dutch-Flemish Accreditation Organisation (NVAO) has developed a "distinctive (quality) feature" for internationalisation and, in addition, an "internationalisation certificate", which was adopted by the European Consortium for Accreditation (ECA) (Dutch Ministry of Education, Culture and Science, 2011). This has handed the institutions substantial tools for profiling themselves nationally and internationally on the issue of internationalisation. The aim of the Certificate for Quality in Internationalisation (CeQuInt) is to assess, enhance and reward internationalisation. This certificate confirms that a programme or an institution has successfully incorporated an international and intercultural dimension into the purpose, function and delivery of its education (ECA, 2018).

International examples illustrate the multidimensionality and complexity of internationalisation and the potential of government intervention in supporting the HE system in this respect. They also highlight the need to develop consistent approaches in collaboration with HEIs and in a way that addresses the needs and specificities of the HE system and its various actors. In the following sections, we will analyse more systematically the various tools and forms of internationalisation.

Multidimensionality of internationalisation – An analytical framework

Given the complexity described so far, in order to analyse and understand internationalisation, either at the national/systemic or institutional level, one should consider different dimensions of analysis, namely:

1. **Motivations, drivers and rationales**: which motivations, drivers (European, national and/or institutional) and rationales (academic, economic, political and social) for internationalisation are there when developing institutionalisation strategies?
2. **Goals**: which are the main goals internationalisation strategies aim to achieve?
3. **Actors**: which are the leading actors promoting and implementing internationalisation strategies (at the national level or in the institutions)? In the definition and implementation of internationalisation strategies, which role does the leadership play? Which other external stakeholders impact the operationalisation and outcomes of the internationalisation strategies?
4. **Areas and instruments**: how can internationalisation strategies integrate the different HEIs' missions and activities? And which instruments in each "mission" are being developed, considering internationalisation abroad and internationalisation at home (Table 4.1)?
5. **Strategy and management**: how HEIs (or the national government) generally approach internationalisation and define internationalisation strategies? Do they embrace a comprehensive and systematic approach to internationalisation – based on a clear strategic plan, integrated into the broader management and governance context of the institution – or a more fragmented approach – based on looser internationalisation activities and initiatives?

Table 4.1. Instruments of "internationalisation abroad"

Teaching and learning	Research	Engagement	Other services/activities
Recruitment of international students	Research co-operations and partnerships	Partnerships with business	Establishment of branch centres abroad
Staff and student exchange programmes	Participation in EU research projects	Development of international companies	Establishment of branch campuses abroad
Joint programmes	Publications with international partners	Overseas consultancy and development	Establishment of new institutions in collaboration with local providers
Joint faculty appointments		Strategic alliances and partnerships with overseas institutions	Development of regional offices (for market intelligence and permanent presence of the university abroad)
Development of alumni networks			
Opportunities for international volunteering, work or study placements			
Exchange of curriculum resources and learning materials			
Distance and e-learning programmes			

Source: Adapted from Middlehurst, R. (2008), "Developing institutional internationalization policies and strategies: An overview of key issues", in M. Gaebel et al. (eds.), *Internationalization of European Higher Education: An EUA/ACA Handbook*, RAABE, Berlin, pp.1-24.

These various dimensions try also to encompass the diversity of possible paths when approaching this topic. This is particularly relevant when we are analysing a diverse landscape of HEIs, whose internal and contextual diversity is likely to be reflected in the way each HEI approaches internationalisation and the general and specific challenges faced by each and all of them.

In the subsequent sections, we will use as much as possible this set of dimensions to analyse the internationalisation of the Italian HE system. This will be based on the documentary evidence collected in the review and the views and perceptions expressed in the meetings during the two site visits.

Table 4.2. Instruments of "internationalisation at home"

Teaching and learning	Research	Engagement	Other services/activities
Internationalisation of the curriculum (integration of international perspectives, international relevance)	International recruitment of researchers	Support for the engagement of international students in the community/society	Encouraging the acquisition of language skills
Study abroad opportunities and study visits	Organisation of international research events/conferences	Collaboration in international partnerships/networks	Provision of specialist or tailored support for international students
Development of courses attractive to international students	Collaboration of international researchers in the research activities/projects developed in the institution		Improvement of current provision of international student facilities

Teaching and learning	Research	Engagement	Other services/activities
English-language teaching			Encouragement of international students to participate fully in the social and cultural life of the university
International foundation programmes			Compliance with national and European legislation
Exchange of curriculum resources and learning materials			Commitment to equality and diversity
Distance and e-learning programmes			Implementation of the Lisbon convention for the recognition of foreign qualifications
International recruitment of staff (teaching and research) and of students			Study skills for international students
Embracing different pedagogical cultures to ensure that teaching is sensitive to students' educational contexts			
Staff development on intercultural understanding			

Source: Adapted from Middlehurst, R. (2008), "Developing institutional internationalization policies and strategies: An overview of key issues", in M. Gaebel et al. (eds.), *Internationalization of European Higher Education: An EUA/ACA Handbook*, RAABE, Berlin, pp.1-24.

The Italian case

Like several other OECD countries, Italy has been developing efforts to internationalise its HE system, which have been driven by external and internal factors. According to the most recent data (for the academic year 2016/17), the number of foreign students is 92 655 (corresponding to 5.1% of total enrolments in HE) and the number of foreign academic staff in HE is 3 240 (corresponding to 3.7% of total academic staff). The figures for student mobility in the first 3 years of the Erasmus+ Programme (2014/15-2016/17) indicate that the number of students enrolled in that mobility programme has stayed above 30 000 each year with a tendency to grow every year and in all types of mobility considered in that programme. Among the main destination countries of those students involved in mobility are the following: France, Germany, Portugal, Spain and the United Kingdom. The figures for incoming mobility students also present a tendency to grow since 2012, though less than that observed with outgoing students. Moreover, the number of incoming students is clearly below that of outgoing students (56% in 2016), which suggests issues linked to the attractiveness of Italian universities in European Union (EU) mobility flows. Hence, whereas the total number of outgoing students corresponded to 2.8% of total enrolments (in 2016), incoming students were less than 1.6% of total enrolments (in 2016).

Other figures regarding the internationalisation of Italian HE indicate that there is clearly room for expansion. In the academic year 2018/19, there are 466 first- and second-cycle programmes that are considered international. The definition of international study programmes includes joint and double degrees and programmes taught in English with at least 10% of students coming from abroad. A key instrument for internationalisation, the teaching offer in English, is growing, though it is particularly concentrated in the areas of engineering, informatics, technologies, economics and business and in second-cycle degrees and doctorates. Currently, almost one-third of the doctorates are in English and

more than half of them accredited as Innovative Doctorate for internationalisation. The supply of summer or winter schools and first/second level of master's programmes in English is also growing.

These figures, however, do not compare well with leading EU countries with much more consolidated strategies in the internationalisation of HE. For instance, in the case of Sweden, whose government has been developing great efforts to improve internationalisation of Swedish HE through the recent Strategic Agenda for Internationalisation, the figures on internationalisation of education and research indicate that 14% of graduates in Swedish HE studied abroad for more than 3 months (2016/17 academic year). Moreover, the number of incoming students was about 50% higher than that of outgoing students (35 900 and 24 100 in 2016/17). On the other hand, one-third of the teaching and research staff was internationally mobile for at least 1 week in 2015 and the proportion of internationally recruited teaching and research staff was slightly below 20% in 2014. There was also intense collaboration in research with 65% of the publications written by 2 or more authors and based on international co-operation (Swedish Government Official Reports, 2018).

Another interesting example is that of Germany, which is one of the most popular host countries worldwide in HE. Over the past 30 years, there has been a strong increase in the number of German students engaged in degree-related mobility, from 34 000 in 1991 to 133 800 by 2011 and there is the goal to increase the number of foreign students in Germany to 350 000 and the number of German students going abroad to 50% until 2020 (De Wit et al., 2015). Moreover, according to data of the German Rectors Conference, 6.9% of the programmes were registered as "international" in terms of the content of the curriculum, the language of instruction or the fact of offering a double degree. English was the language of instruction in around 20% of all international programmes and 40% of all international programmes led to a double degree. In total, more than half of Germany's HEIs offered international programmes (De Wit and Hunter, 2015; DAAD, 2018).

In the following sections, we will analyse in a more systematic way the current situation regarding internationalisation in Italian HE by looking at the main issues at the system and institutional levels.

System policies and initiatives

As stated above, national governments can have a greatly influential role, fostering or hindering internationalisation strategies. National policies for the strategic development of universities steer institutions towards including internationalisation as one of the five main strategic targets for institutional development plans, together with teaching, research, students' services and recruitment. As the implementation of institutional plans is co-funded by the ministry on the basis of an evaluation process, for the period 2016-18, 33 plans have been positively evaluated and co-funded for a total of EUR 23.5 million. Actions eligible for funding were aimed at the increase of:

- the number of internationalised study programmes, including the third cycle
- the proportion of international students
- the number of European Credit Transfer Scale (ECTS) credits earned abroad after a mobility period.

Mid-term results of institutions are quite positive. Hence, in the academic year of 2018/19, 466 first- and second-cycle programmes are considered international.

There are two kinds of additional incentives provided for the increase in international programmes. On the one hand, professors from partner universities in foreign countries contribute to the calculation of the minimum requirements for initial accreditation. On the other hand, financial incentives are provided by the fund for the strategic planning of the university system.

Recruitment procedures have been also progressively adapted to facilitate international recruitment and a new legislative provision has been introduced as from 2018 in order to allow the double-appointment of professors and researchers.

The Italian government is also financially supporting international credit mobility by investing EUR 60 million per year to foster it.

The government has been developing special policies encouraging the internationalisation of HE. In order to support and implement actions to strengthen the internationalisation of HE, the Italian parliament established a fund of EUR 150 million for the period 2017-20 with Law No. 232/2016 for the cultural promotion of Italy abroad, including Italian HE.

The law promulgated, the Presidency of the Council specifically dedicated EUR 18 million for the internationalisation of HE, funds aimed at supporting the new Strategy for the Promotion Abroad of Italian HE 2017-20. The document approved jointly by the Minister of Foreign Affairs and Ministry of Education, University and Research (MIUR) is the first policy document giving an overview of the future of Italian HE in the international scenario. The choice of having such a strategic document was also driven by the candidature of Italy as Secretariat of the European Higher Education Area, approved in May 2018. The aforementioned strategy, following an analysis of the current academic incoming and outgoing mobility flows, proposed a new set of rules to simplify the visa procedure for incoming students. These regulations have also been enforced with new Legislative Decree No. 71 of 11 May 2018, implementing in Italy EU Directive 2016/804 on the conditions of entry and residence of third-country nationals for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational projects and au pairing.

The Ministry of Education, University and Research (MIUR) is presently working, in line with the provisions of both the aforementioned national strategy and Legislative Decree 71/2018, in the development of a web portal, new platform “Universitaly”, which will manage all procedures for incoming students and academics. Thus, by the end of 2019, it will become the unique entry point for such types of international mobility.

The Italian NARIC Centre (CIMEA) launched the *Diplome* initiative in order to develop a portfolio into which individuals can upload their qualifications. This aims to create a decentralised, transparent, certified and stable system, with the goal of simplifying the procedure for students, graduates and professionals to enrol in university or to apply for a job in another country. The *Diplome* initiative and Blockchain technology are also being used in a targeted action to assess refugees’ qualifications, following the Council of Europe’s Guidelines for the European Qualifications Passport for Refugees.

At the bilateral level, MIUR is presently enforcing a new approach to academic recognition agreements, elaborated on the basis of a simple format in co-operation with CIMEA. The investment made for internships at the national level is matching the one made within Erasmus+ and by the ministry. The Erasmus+ EU programme is providing funding for

traineeship mobility of students and graduates. MIUR is further supporting European traineeships mobility.

The national government is addressing the need for an institutional subject that co-ordinates and supports promotional actions, such as DAAD or the British Council. The organisation Uni-Italia, promoted by the Ministry of Foreign Affairs in co-operation with MIUR, has been the first step in this direction.

Box 4.1. National organisations supporting internationalisation (governmental, quasi-governmental and independent organisations)

In several countries, one finds organisations responsible for co-ordinating and supporting the internationalisation of HE (or internationalisation beyond the HE field). These organisations range from governmental agencies overseen by a certain ministry (or the articulation of several ministries), to quasi-governmental or even independent organisations.

In Finland, the Centre for International Mobility (CIMO) provides expertise and services on international mobility and co-operation as an independent agency under the Finnish Ministry of Education and Culture, promoting the internationalisation of Finnish society in education, training, working life and culture. CIMO has a particular focus on the internationalisation of education and promotes Finland abroad through supporting the teaching of the Finnish language and literature in universities outside Finland, as well as through promoting Finland as a study destination for students and international affairs professionals in HEIs (CIMO, 2014).

Under the oversight of the French Ministries of Foreign and European Affairs and Higher Education and Research, Campus France is a public institution in charge of promoting French HE abroad and welcoming foreign students and researchers to France. It encourages international mobility and manages scholarship programmes and the alumni network. Campus France provides foreign students and researchers with the tools to learn more about the French institutes of HE and also assists French institutes of HE and research bodies in their international development strategy (Campus France, 2018).

Sources: CIMO (2014), *Centre for International Mobility, Finland: Finnish National Agency for Education,* http://www.cimo.fi/instancedata/prime_product_julkaisu/cimo/; Campus France (2018), *Campus France's Mission, France: Ministry of Foreign and European Affairs and Ministry of Higher Education and Research*, https://www.campusfrance.org/en/Campus%20France-missions.

Finally, the government acknowledges that a significant factor to attract international students is the presence, in the country of destination, of robust communities coming from foreign countries. Thus, one possible instrument to increase the number of international students could be the promotion and support (at a national level) of associations of graduates who have studied in Italy (such as alumni associations) in foreign countries.

Governmental internationalisation policies and initiatives explored above seem to translate a global commitment to internationalisation, essentially (though not exclusively) focused on student mobility, mostly driven by the will to expand HE capacity and to reinforce international reputation. Indeed, at a systemic level, academic rationales, combined with economic rationales for internationalisation seem to prevail, as internationalisation in Italy seems to be getting a more revenue-generating character (EAIE, 2018). Attracting more

international students and improving international institutional reputation and prestige are amongst the main reasons to internationalise. Simultaneously, the national strategy for internationalisation seems to be indisputably focused on teaching and learning and (though to a significantly lesser extent) on research, whereas instruments of internationalisation at home and internationalisation abroad interact.

Incoming and outgoing student mobility seems to top the list of most common instruments included in the national internationalisation strategy in Italy. Moreover, joint and double degrees are being expanded, as a consequence of governmental funding for joint programmes. Italian institutions are actively trying to recruit more international students both in the form of degree-seeking students and ones pursuing part of their studies in Italy through such joint programmes. Naturally, intensified efforts to recruit international students and develop joint programmes led to an increased international population on campus with distinct service needs. Consequently, for internationalisation to reach its true potential, adequate funding and coherent policies are needed, accompanied by qualified staff equipped to deal with the ever-changing field of internationalisation.

Despite increasing national policies promoting internationalisation in HE and despite the commitment to reforms that open up Italian HE, there is still a lack of an integrative and holistic strategy dedicated specifically to international HE. Namely, this should include the different HEIs' missions and activities: teaching and learning, research, engagement and other support services. Moreover, it should take into consideration different dimensions and instruments (e.g. covering internationalisation of the curriculum, student and staff mobility, research collaboration, development goals, partnerships with regional and local businesses, development of regional offices). Furthermore, the absence of a dedicated body promoting the internationalisation of HE and the low level of co-ordination between the different ministers can significantly hinder the necessary policy synergies for the development and implementation of a comprehensive internationalisation strategy. It is, for example, worth stressing that the Ministry of Economic Development (which is promoting Industry 4.0) does not play any role in the internationalisation strategy of the HE system.

Work still remains to be done in order to raise the profile and quality of Italian HE, yet these challenges are familiar to many other European countries as well and there are signs of progress and potential for improvement.

Institutional strategies and activities

Internationalisation is generating change within the system and Italian universities are taking active steps to internationalise, albeit to different degrees. Overall, "internationalisation" is part of the strategic goals, mission, vision and management of universities, though the depth and consistency of the institutional approaches vary across the system.

Motivations and rationales

We have seen that the motivations and rationales for internationalisation (and the ways they are combined) differ substantially not only across countries but within the countries, their regions and their HEIs. Italy is not an exception and one can find significant differences between regions and between institutions. There are however some major trends in the rationales for the development and implementation of internationalisation strategies:

1. Academic rationales are the most frequently highlighted, namely aspects such as the expansion of international students' numbers, improving HE's quality, enhance

institutional prestige and position in rankings (particularly visible in the most prestigious HEIs) and, to a lesser extent, knowledge creation and advancement.

2. Economic rationales are less visible, though recognised by HEIs (especially regarding regional development), namely issues such as the contribution of students and potential economic and growth and development, at a national and regional/local level.
3. Political rationales are not often mentioned and are mainly related to public diplomacy, soft power and international development.
4. Social and cultural rationales are present in several HEIs through initiatives of internationalisation at home and abroad with some references to the United Nations Sustainable Development Goals 2030. This last "type" of rationale is, for example, widely translated into the initiatives developed by a large majority of Italian universities and aimed at refugee's students, which have been integrated successfully through different support programmes in Italian universities.

Italian universities have tended to emphasise the academic rationales in their quest for internationalisation. However, in a context of declining financial governmental contributions, international students (particularly from outside the European Union) have become an additional funding opportunity. Moreover, internationalisation can improve universities' reputation and its attractiveness in an increasingly competitive international market for students and academics. In addition, attracting international students has become very important for many Italian universities, due to adverse demographical trends (decline of youth population) and social-economic factors (namely in some regions struggling with very difficult economic and social conditions). Demographic and social-economic factors, as well as the lack of embeddedness of HEIs in regional development strategies, have depressed student enrolment in many regions and that has become a very important issue for many Italian universities. Though international students' recruitment itself cannot solve the problem of declining national enrolments, it is well known that international attractiveness is a way to promote not only the HEIs located in a region but also the region as a whole, ultimately attracting more national students.

Areas of internationalisation

The most prominent area of internationalisation is education and training, followed by research and finally by engagement. Despite some variety across the system, the most consolidated internationalisation strategies developed by Italian HEIs are mainly related to teaching and learning activities, with student mobility arguably the most prominent and frequent focus. In general, universities invest both in activating collaborative international study courses (double, multiple and joint degrees) and in making existing degree programmes more international through intensive programmes and summer schools. At the same time, Italian universities invest in internationalisation at home, creating study programmes where the international dimension is represented by a more internationally oriented content of programmes and by the language of instruction (often English).

The institutional figures regarding the internationalisation of the student body confirm a picture of significant diversity, though the general situation is that of low shares of foreign students. Some universities visited indicated figures of foreign students close or even above 10% (the two HEIs in Pisa and the Universities of Bologna, Siena and Rome Tor Vergata, and the Polytechnics of Torino and Milano). However, several others indicated much lower shares of 1%-2% of total enrolments, which seems to be the general rule of those

universities located in the southern part of the country. The situation seems to be particularly weak in first-cycle enrolments. None of the universities discriminated figures of students involved in mobility periods or those enrolled in a degree programme, though the impressions collected during the site visit indicated that the former corresponded to the largest share, despite a few exceptions.

Initiatives on the internationalisation of research are also present in Italian universities. Academic mobility and research collaboration are increasingly present, though much less significant than initiatives developed on education. The figures provided by the universities visited during the review indicate a significant diversity in the degree of internationalisation of academic staff and research. The weakest point is the proportion of foreign staff, which in general is very low (below 5%), with several institutions presenting figures around 1% of the total academic staff. More significant international activity is taking place in the collaboration of their academic staff with other researchers, as shown by the figures about publications with foreign co-authors. The best examples presented percentages of 30%, 40% or even 50% of total scientific publications with foreign co-authors, namely the Universities of Bologna, Rome Tor Vergata, Bari, Cagliari and the two HEIs in Pisa. However, a few universities visited presented values below 10% (such as Palermo) or did not offer relevant data. The diversity among disciplines may also be very significant within each university, as often happens, with some fields much more engaged in international research than others.

Still, one can observe some pockets of greater internationalisation and good examples of participation in European and international research networks, of international mobility of doctoral students and of institutional structures supporting internationalisation policies. Moreover, the international mobility of doctoral students is often a cornerstone of universities' strategy to strengthen the efficiency and quality of doctoral courses, namely by increasing scholarships dedicated to foreign doctoral students and by promoting promotion new agreements with universities and foreign research centres. Thus, some universities visited indicated significant shares of foreign students enrolled in their master's and doctoral programmes (e.g. Polytechnic of Milan or the two HEIs in Pisa), though these did not correspond to the general landscape.

Offices supporting participation in competitive research funding are also increasingly present in the majority of Italian universities. Therefore, to efficiently engage with European funding programmes, universities have created structures (offices, working groups) supporting the design and development of applications to European and international funding, frequently in co-operation with other international HEI and research centres (as is the case, for example, in the University of Cagliari, Rome Tor Vergata, the University of Siena or the University of Bologna).

Internationalisation activities related to engagement are less visible. When presenting their internationalisation strategy, universities tend to highlight their aim for excellence both in education and in research, and rarely link their internationalisation strategies to their engagement activities. Still, there are interesting practices promoted by some universities (for example, the University of Cagliari or the Polytechnic of Milan, which promote the collaboration between international students and local companies, or foster partnerships with international corporate partners). Although there is significant potential for attractiveness, brand-recognition and opportunities to transfer knowledge internationally, this area is largely overlooked by most Italian universities.

Approaches to internationalisation

Considering the two approaches to internationalisation – abroad and at home – the most disseminated in Italian HE seems to be that of "internationalisation abroad". Regarding the instruments adopted in this approach, the most widely used are the following: recruitment of international students; staff and student exchange programmes; joint programmes; distance, e-learning programmes and massive open online courses (MOOCs); opportunities for international volunteering, work or study placements; research co-operations and partnerships; participation in European research projects; publications with international partners; establishment of branch centres abroad; and establishment of branch campuses abroad.

As regards the approach of internationalisation at home, this is more visible in the most consolidated cases of internationalisation. In this approach, the following instruments stand out: internationalisation of the curriculum (integration of international perspectives and international relevance in the curriculum); study abroad opportunities; English-language teaching; international recruitment of staff (teaching and research) and of students; collaboration of international researchers in the research projects developed in the institution; encouraged acquisition of language skills; improvement of current provision of international student facilities; encouragement of international students to participate fully in the social and cultural life of the university; integration of refugees.

Overall, "internationalisation" is part of universities' strategic goals, mission and vision. This strategic "vision" of internationalisation is frequently highlighted not only by the institutional actors during the visits but also in several institutional documents. The leadership of HEIs, particularly rectors and their teams, seem to be the main actors promoting the development and the implementation of internationalisation strategies, which indicates a "commitment" with internationalisation. Nonetheless, there are also several bottom-up activities, facilitated and supported by the institutional top level, without an apparent consolidated strategy. These bottom-up activities seem to be particularly prominent within the context of the development of partnerships for international research projects, which are often stimulated through personal contacts and collaborations.

Despite the overall "commitment" to internationalisation, most universities have an insufficiently developed structure in this area. On the one hand, most HEIs struggle with the lack of financial resources and of qualified and trained human resources which hinders the implementation of internationalisation strategies. On the other hand, the existence of different institutional actors and bodies responsible for internationalisation, though, in some cases, facilitates the dissemination of internationalisation activities, in most cases results in fragmentation and insufficient co-ordination of responsibilities, hampering the development and implementation of an integrated and effective internationalisation strategy. To a large extent, one could say that these two aspects (insufficient resources and loosely connected institutional structure) are two sides of the same coin and reinforce each other.

Institutional good practices

Overall, all the institutions have "internationalisation" as part of their strategic goals, their mission, vision and their management and are strongly willing to engage at the European and global levels. The system has seen the emergence of some good examples that have developed significant internationalisation efforts and activities.

Unlike the general perception that there is mostly a bottom-up trend in internationalisation initiatives in Italy, which are facilitated by the institutional top level, the most "successful" internationalisation strategies in southern universities in Italy are top-down, particularly promoted by their rectors. The cases of the University of Cagliari (UniCa) and the University of Bari (UniBa) are interesting examples of a change of strategy due to a change of rector and his/her team. It is also interesting to notice that one of the most important challenges faced by these universities in the near future is giving continuity to this proactive and dynamic "culture" built by the current rectors and embedding it into their institutional "culture" and "mission", not only with regard to the internationalisation strategy but to a much broader entrepreneur and innovative institutional strategy.

UniCa is a university with committed governance supported by a very well-articulated team operating on internationalisation, third mission and innovation. Though operating in an adverse economic and social context, UniCa has been developing a sustainable internationalisation strategy, supported by a well-structured "team" and by the regional ecosystem.

As most of the universities in Italy (and indeed in most countries), the internationalisation policies in UniCa focus mostly on education, namely on: attracting international doctoral students (a three-year scholarship for each doctoral programme for a foreign candidate holding a degree awarded abroad), double master's degrees, mobility of teaching staff and researchers (visiting professor and visiting scientist programmes), promotion of international co-operation among institutions of HE in southern Mediterranean countries and Sardinia; but also on research, where it is interesting to observe, amongst other initiatives, the constitution of a working group for promoting the participation of UniCa in European research programmes; and on engagement, particularly by promoting professional experiences in regional companies by international students.

In UniBa, the current governance and its team have developed a strategy that can be characterised as comprehensive. It is based on the internationalisation of teaching and learning, promoting the international mobility of doctoral students (through programmes such as: Global Thesis Grants, SEMINARE and Global Doc Grants), attracting international students (despite the limitations in broadening the courses taught in English), attracting international researchers and professors (visiting professors), developing international degree courses; research and engagement, with the active participation of all departments in international research partnerships and networks, also involving local enterprises.

Notwithstanding, the social rationale behind UniBa's internationalisation strategy and, particularly, the awareness of and deeper engagement with the refugees' situation is particularly noteworthy. The Centre for Lifelong Learning (CAP) is determinant in supporting European and non-European citizen's and refugees, namely by certificating the competencies (soft skills) in formal, informal and non-formal contexts and by supporting the integration of the refugees in the community.

Another encouraging example is the Polytechnic of Milan (often called PoliMi), which has been developing a consistent and careful strategy for internationalisation. In the case of this institution, the focus has been on privileging the postgraduate level of education and English as the dominant language of instruction at that level. This was pursued through a gradual strategy increasing the enrolment of international students and the proportion of international staff teaching at that level as well as targeting its master's programmes increasingly at the international market, both regarding enrolments and curriculum orientation.

The experience of PoliMi, though certainly benefitting from the specific characteristics and context of this institution, is very relevant because it proves the feasibility of the development of a mature strategy of internationalisation, despite limited national support. Capitalising on the advantages offered by its ecosystem, the experience of PoliMi highlights the relevance of focus and prioritisation, since it was the result of an institutional path pursued persistently and consistently over two decades. Moreover, the institutional strategy has been selective in its choices, being able to discriminate not only what it wanted to achieve, but also clarifying what was not feasible or a priority for PoliMi. PoliMi reflects well the industrial specialisation of its territory and this creates a virtuous cycle that other local universities cannot fully exploit.

A very good experience is also that of the University of Bologna (UniBo). Being one of the oldest and more reputable universities in Europe has not prevented this institution from engaging in a proactive way with other universities and different stakeholders in its region when it came to internationalisation. This collaborative approach has led to several relevant initiatives. This includes the development of joint master's programmes with other universities of Emilia-Romagna that focus on some of the region's most important economic clusters, namely the automobile sector and the agrarian sector. These programmes are taught in English and have a strong international vocation, namely to attract students from abroad.

On the other hand, by developing these programmes in partnership with major economic partners in the region, UniBo generates the possibility of exploring new linkages between different institutional missions – education, research, services to society – through internationalisation. This takes advantage of the local economic strengths to promote certain areas of expertise abroad and enhance the attractiveness of those programmes by having them interact with worldwide recognisable Italian brands and sectors. This also creates opportunities for further collaboration in which universities enhance their regional relevance as a platform for the internationalisation of important sectors of economic activity.

Overall, these different examples of Italian universities located in very different parts of the country illustrate the potential of the system regarding internationalisation. They also point out the multidimensional nature of international projects and the need for each university to assess carefully its strengths and limitations in order to devise feasible and potentially successful strategies of internationalisation. The results also show that, despite significant constraints, several Italian universities are able to make important inroads into the highly competitive international HE market.

Challenges

The internationalisation of Italian HE has made important progress in recent years, both due to national and institutional efforts. However, this has been more limited than its potential due to some challenges and constraints to which we now turn our attention. We will start by looking at those challenges at the system level and then will analyse those more relevant at the institutional one.

The system level

One of the most important systemic challenges to the internationalisation of the Italian HE system refers to its large number of universities. The Italian system, like many other European HE systems, has expanded visibly in the last decades, not only in its size

measured by the enrolments, but also in the number of institutions, departments and programmes. Moreover, several universities have become complex units of multiple branches and campuses, which has created a dense network of institutions, dispersed around the country that make it quite complex to manage the system as a whole.

To this large network of institutions should be added the large diversity in the system. This diversity has many dimensions, some of which are internal to the institutions and others contextual to them. Thus, the system includes very different HEIs in their disciplinary coverage, size, age, prestige, research intensity and degree of interaction with their communities. The system comprises several of the oldest universities in Europe but also many recently established institutions. It also comprises several comprehensive universities and a few specialised ones. The relevance of postgraduate education and research is also uneven across the system.

On the other hand, they also face very different contexts, especially economically, with several located in some of the wealthiest regions in Europe and others in some of the poorest ones. Some universities are located in areas with significant industrial activities and others in largely de-industrialised areas. Some are located in areas dominated by a few large and highly internationalised companies, where others are embedded in a territory of small- and medium-sized enterprises (SMEs) and, even in that case, the reality regarding their competitiveness and internationalisation can be rather contrasting.

Another characteristic of the Italian HE system that poses a relevant challenge is the limited degree of co-operation. Like many other HE systems, the Italian system has seen the development of intense competition, visible in aspects such as student attraction (due to demographic declines) or funding (due to the retrenchment of public sources, which were the cornerstone in the funding of the system). This exacerbated the competitive nature of many aspects of the academic sector and has also been reflected in a tendency of Italian universities to develop individual strategies regarding internationalisation. However, many activities related to internationalisation require a scale and co-ordination that imply co-operation between universities. There are some examples, but these do not seem to be either systematic or the rule for institutional behaviour. Thus, one aspect requiring attention at the policy level would be how to encourage Italian universities to co-operate more in this respect.

There is a lack of a detailed international HE strategy covering the major aspects to be considered. These should include aspects related to HEI missions – teaching and learning, research and engagement – and, in particular, aspects such as student mobility, research collaboration, business partnerships, regional engagement and development goals. In the documents available, the policy vision regarding the internationalisation of the Italian HE system was not fully clear. There are some statements about its importance, though they tend to be rather limited and generic, and many aspects are still to be addressed.

The potential role at the system level is somewhat constrained by the fact that HEIs enjoy significant autonomy and this leads to the perception that internationalisation is only a responsibility for the institutional level. However, and despite the respect for that autonomy and for the specificities of each university, one must not neglect the central role to be played by national and regional authorities in the promotion and implementation of a comprehensive internationalisation strategy. This can provide incentives and stimuli for HEIs to develop more elaborate and consistent strategies in this dimension.

In fact, during the institutional visits, the government was hardly mentioned as playing a key role in this area and this omission was rather striking, especially when compared to

other European countries where the government is usually regarded as a key actor in this respect. Moreover, the few references to the government tended to be associated with the Ministry of Foreign Affairs, which is usually regarded as being very helpful and willing to contribute to institutional initiatives in this area. By contrast, the Ministry of Education, Universities and Research and the Ministry of Economic Development were hardly mentioned, which was rather striking and warrant some reflection. Given that HEIs can play a very important role as intermediaries between the local and global networks, the Ministry of Economic Development could play a role by encouraging universities to include that international dimension in their engagement with the regions in which they are located. This can enhance the attractiveness of both the university and the region and be potentially translated in the attraction of qualified workforce, international projects or new partners for training and research and development (R&D).

The strategic weaknesses are also reflected in the lack of a dedicated body for the promotion of the internationalisation of Italian HE. This should have major responsibilities in areas including overseas representative offices or participation in conferences, trade fairs and marketing events. One of the effects of the lack of a dedicated body is that several initiatives do not have continuity after initial support and funding.[2] The lack of this body has also an impact on relevant indicators monitoring the consolidation of the degree of internationalisation of the Italian HE system. For instance, in the information available, it was unclear what national/systemic efforts have been made to sustain or increase the number of bilateral agreements/memoranda of understanding (MOUs) signed between Italy and foreign education ministries on the topic of collaboration in HE. This has certainly expanded but through the multiple and largely uncoordinated efforts of each individual HEI (or groups of them) and not clearly the result of a national push or co-ordinated activity. The existence of greater national co-ordination would also be supported by more systemic efforts to monitor and inform the internationalisation of its HE system, e.g. by reinforcing and spreading data on international student and faculty mobility, programme and provider mobility and research collaboration.

The limitations regarding co-ordination are also amplified by the insufficient integration between the national and regional levels. During the visits, there were several references to the limited or even non-existent co-ordination between the national and regional levels. In some cases, there were initiatives at the latter, though they seemed to operate regardless of what was being defined at the national level. Despite internationalisation being ultimately a responsibility of the institutions, the state and the regions have a crucial role in promoting internationalisation, at a central and regional/local level, and in fostering innovation ecosystems. Moreover, this regional difference in the engagement with HE and its internationalisation tend to amplify the diversity and inequality across the system that will be discussed in more detail below.

These challenges do not contribute to making the Italian system an important player in the growing international HE market. Although there is a widespread welcoming attitude regarding internationalisation, especially at the European level, the levels of mobility and attractiveness are generally low compared to peers in OECD countries. The Italian HE system needs to work harder to assess its comparative advantages and explore more effectively its untapped potential in this area.

The institutional level

At the institutional level, there is also a limited identification of a systematic approach to internationalisation. Internationalisation was regarded by HEIs as a very important

dimension of institutional development in most cases and there was a clear willingness to make it an important aspect in the institutional strategy. However, the perception formed through the interviews and the data collected indicated that there was a limited formulation of a strategic approach to this area. The predominant tone tends to be of generic statements stating the importance of internationalisation but with a lack of maturity that tends to characterise the earlier stages of internationalisation.

This limited maturation of institutional internationalisation strategies is reflected in the type of data they collect about internationalisation. Although all universities collect data about this, the data available tends to be concerned mainly with areas such as the mobility of students and staff. In several cases, there is also data about international students and staff. However, there is far more limited data available regarding more consolidated aspects of institutional internationalisation such as joint initiatives in teaching (e.g. joint programmes, dual degrees), in research (data on joint projects, co-authorship of publications), and even less about engagement activities developed in the framework of institutional international activities.

The priorities in internationalisation are still largely focused on teaching and learning, with more limited reference to research and even less so to engagement and services to society. In the interviews and documentation collected during the review, the references to the first mission were very frequent, less so to research (though still common in most universities) and very limited in the case of engagement. A few exceptions to the latter were the cases of international programmes (either because the language of instruction was not Italian or the recruitment of students aimed at the international market) developed in collaboration with the business sector. In fact, several Italian universities have a significant potential in this respect given the existence of world-class companies or business clusters with international visibility and reputation and that could be explored in the development of educational and research-related activities aimed at the international market.

Internationalisation activities and initiatives seem to be more fragmented than integrated. Though internationalisation in Italian HE ranges from looser and fragmented activities to better integrated and comprehensive initiatives, the former seems to be the rule. One would argue that a central-systematic strategy, in which a large volume of co-ordinated international activities is undertaken to support the international mission of a university, is less frequent in Italian universities. According to Davies (1992), universities can adopt four different approaches to achieve their internationalisation goals: a central-systematic strategy, a spontaneous-central strategy, a systematic-marginal strategy and a spontaneous-marginal strategy. Despite the variety across the system and the co-existence of the four approaches within the system, the spontaneous-central strategy, in which a large volume of international activities is undertaken but with no clearly defined plans and goals, seems to be predominant. Thus, we could say that there is more a "reactive mode" of internationalisation, which is based more on spontaneous activities than a "proactive mode" based on more organised strategies, which are integrated into the principles of general strategic management (Rudzki, 1995).

Regarding the development of initiatives in internationalisation, the perception of the team is mixed and the evidence collected was rather limited. The leadership of several of the universities visited seemed to be convinced of its role, though the evidence was less clear. The fact that the team could not have extensive meetings with other levels of the institution suggests that this should be considered with caution, especially since the evidence from many institutional internationalisation strategies is that it tends to be often initiated and supported, in its initial stages, by individual initiatives. The fact that most of the universities

presented a limited development of their internationalisation strategies suggests that a lot of the activities in this area tend to be developed more through a bottom-up approach, started by individual academics or groups of them and then facilitated by the institutional top level.

In the area of internationalisation, there is a certain degree of fragmentation of activities and decision-making. Internationalisation, like other activities of universities, seems to be associated with multiple bottom-up initiatives that do not coalesce around an overall institutional and systemic strategy. Furthermore, many actors and institutions still think that more is better regardless of the value it adds and the additional strain it places on the institution. Although the existence of a dynamic rank and file is a very important aspect in any successful university, the following step is the need to co-ordinate and establish greater coherence at the institutional level, screening and integrating them into a consolidated strategy. This is a step that seems yet to be taken by most Italian universities.

Universities seem to privilege quantity over depth and impact in their partnerships. They seem to be especially concerned with the number of partnerships rather than with the establishment of deeper interactions enabling major benefits of international collaboration.

The difficulties are common to many universities, though they are particularly relevant in the Italian case due to the tradition of weaker institutional autonomy and the more recent strengthening of power at the centre of the university. Internationalisation is one of the areas where it is difficult and most necessary to have a cogent strategy, since the relevance, meaning and forms of internationalisation may mean very different things to different stakeholders, disciplines or levels of decision-making. On the other hand, certain important initiatives in some of the universities the team visited seem to be too dependent on specific people (including at the top level) without being fully integrated into institutional policies/strategy and there is the risk that a change in the key individuals may seriously weaken these initiatives.

Recommendations

The system level

Self-critical attitude

There are many aspects that need to be addressed more effectively; internationalisation should receive more attention from HE leaders. Nonetheless, the perception of the national stakeholders is that the current situation is more positive than it is, especially when compared to other countries in Europe. Thus, an important change is to adopt a more self-critical attitude about the current positioning of Italian HE in the European and global scenario and this can be done through systematic benchmarking.

Vision and strategy

At the moment, the views put forward at the national level regarding internationalisation tend to express generic and favourable purposes regarding this matter. It would be important to develop more focused and articulate views about why and how is internationalisation relevant for the specific case of Italian HE. The way internationalisation fits into the wider views and priorities about the HE system and its development is also very important. In particular, it will be relevant to devise an overall strategy that can effectively accommodate the diversity of the system and integrate the multiple initiatives of the various actors.

Incentives and tools

A national vision and strategy about the internationalisation of Italian HE will have to be supported by tools that encourage the different institutional and individual stakeholders to align their strategies and behaviour with what has been defined nationally. Thus, the system needs to have incentives for institutions, academics, students, local authorities and the business sector to internalise this priority and make it part of their priorities. Many systems are dealing with similar challenges in this respect and Italian decision-makers could benefit from identifying good practices among other countries to enhance the attractiveness of Italian HE and support the participation of Italian HEIs in international networks.

Comprehensiveness

Our analysis has highlighted the variety of activities and multidimensionality of internationalisation. Although national policies have traditionally privileged internationalisation in the areas of education and research, it would be important that they aim to embed it in a more transversal way in universities' strategy. This would include taking advantage of internationalisation in another range of activities, namely in what can be broadly considered the university's engagement with society. Through this, Italian universities could explore their societal relevance, connecting the local and the global in a way that is enhanced by its capacity to create and disseminate knowledge.

The institutional level

Vision and strategy

Most Italian universities value internationalisation as an important dimension of their mission. However, universities need to develop a clearer vision that is embedded in their development and to revise their existing internationalisation strategies, elaborating more comprehensive strategies that articulate and contextualise this dimension within their other institutional priorities. Developing a more mature institutional strategy to internationalisation requires, on the one hand, exploring the broad scope of internationalisation (not only teaching or research but also engagement) and, on the other hand, adopting a more selective approach in the definition of priorities and instruments according to their feasibility and desirability to each institutional context.

Institutional dynamics and co-ordination

Although the bottom-up dynamics is very important in institutional internationalisation, Italian universities would need to develop greater effectiveness in dealing with the multiple opportunities and initiatives in this area. Thus, greater capacity to co-ordinate the various activities across the different missions, disciplines, levels of decision-making, ministries and national agencies would be important. This needs to be negotiated and communicated internally and externally, to avoid frustration and waste of energies in less relevant initiatives.

Scope and density of partnerships

Most Italian universities still seem to adopt an approach that privileges quantity rather than depth in their partnerships. Thus, along with a reflection about potential synergies in the development of international activities that cut across different missions and different parts of the university, Italian universities should also privilege deeper interactions that may

allow greater internalisation of the benefits of international collaboration and that may promote spillovers to other areas.

Concluding remarks

The Italian HE system includes some of the oldest universities in the Western world and thus presents a historical university tradition of international mobility and co-operation. This has also been stimulated by the process of European integration, of which Italy has been one of the founding countries and one of the most engaged for several decades. Nonetheless, the acceleration of internationalisation in HE in recent years has had more limited effects on Italian HE than in most European systems and there is a general perception that the system is not taking full advantage of the opportunities created with the development of the European HE and research areas, alongside the densification of global networks in HE and science.

Italian universities are becoming more international, especially as they choose to align with international practices by enhancing their international education and research profile in order to position themselves more successfully and contribute to enhance the level of attractiveness of Italy as a study destination and knowledge nation (De Wit, Hunter and Howard, 2015). However, there is a lack of maturity in the institutional thinking about internationalisation and its various dimensions, which is reflected in an insufficiently systematic and comprehensive approach to internationalisation. There is certainly diversity across the system, though the rule seems to be fragmented and multiple initiatives, rationalised *ex post*.

Notes

[1] The last available IAU Survey is the 4th Survey from 2014. According to the International Association of Universities, the results of 5th Global Survey are expected to be available in early 2019.

[2] During the site visit were mentioned several examples of national and international funding that did not have continuity, leading to the end of the initiatives that they were aimed to support.

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Chapter 5. Digital transformation and capabilities

Digital technologies are transforming people's life, business and society. Higher education systems and institutions are particularly affected by digital transformation, which can enable new services and provide new opportunities for innovation and entrepreneurship. Higher education institutions (HEIs) embracing digital technologies can become drivers of growth and development for their own ecosystems. This chapter introduces relevant concepts and definitions on how the digital transformation is affecting HEIs and presents the specificities of the Italian case, discussing good practices and challenges emerged during study visits. Recommendations for policymakers and leaders of HEIs conclude the chapter.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Introduction: Defining digital transformation and capabilities

The rapid development and spread of digital technologies are contributing to change in every aspect of people's lives, business and society. Digital transformation is the result of digitisation and digitalisation of economies and societies (OECD, 2019a).[1] Some authors consider digital transformation as a more pervasive set of changes that digital technologies cause or affecting all aspects of human life (Stolterman and Fors, 2006). The digital transformation is intrinsically connected to what has been defined as the "fourth industrial revolution" (Schwab, 2016): a process through which digital technologies are shaping the future of society and economic development in a comparable manner to the case of steam power for the first industrial revolution.

Digital transformation is a process involving several digital technologies, from 5G to artificial intelligence, big data and Blockchain. These technologies form an ecosystem through which future economic and social changes will arise (OECD, 2019a). In particular, experts identify three categories for seven "vectors of digital transformation" (OECD, 2019d) (Figure 5.1). These properties of the digital transformation differ from the ones related to the past analogic world, with also possible disruptive effects on policymaking. As a consequence, it becomes central for policymakers to take into account these features, and consider the challenges posed by a process, digital transformation, which is a complex phenomenon of different, often uncorrelated, development (OECD, 2019d) (Figure 5.1).

Academics and more generally people working in or with HEIs are becoming increasingly aware of these transformations. For instance, there is a strong positive sentiment about digitalisation from the perspective of scientists and researchers concerning the promotion of collaboration and the efficiency of scientific research (Figure 5.1). However, scientists have more reservations about the role of private sector engagement, the impact that digital technologies may have on the inclusiveness of research opportunities and the engagement with the public. Based on these, the digital transformation and capabilities dimension within the HEInnovate framework could support and enable a better understanding of how digital technologies can be used to support innovation and entrepreneurship in HEIs.

Table 5.1. Vectors of digital transformation

Vector	Description	Examples of policy implications
Scale, scope and speed		
Scale without mass	Core digital products and services, notably software and data, have marginal costs close to zero. Combined with the global reach of the Internet, this allows these products and the firms and platforms that use them to scale very quickly, often with few employees, tangible assets and/or no geographic footprint.	The scale effect of being digital may allow the rapid acquisition of market share – that may also be fleeting – suggesting that policies ensure that barriers to entry and innovation are low, and adjust size-based approaches such as de minimis thresholds and categorisation based on the number of employees.
Panoramic scope	Digitisation facilitates the creation of complex products that combine many functions and features (e.g. the smartphone) and enable extensive versioning, recombination and tailoring of services. Interoperability standards enable the realisation of economies of scope across products, firms and industries.	Policies may need to span multiple policy domains, requiring co-ordination across historically separate issue areas and a more multidisciplinary perspective. This may argue for high-level principles as opposed to narrow rules, a shift from strict harmonisation to interoperability and the convergence of policy oversight authority.

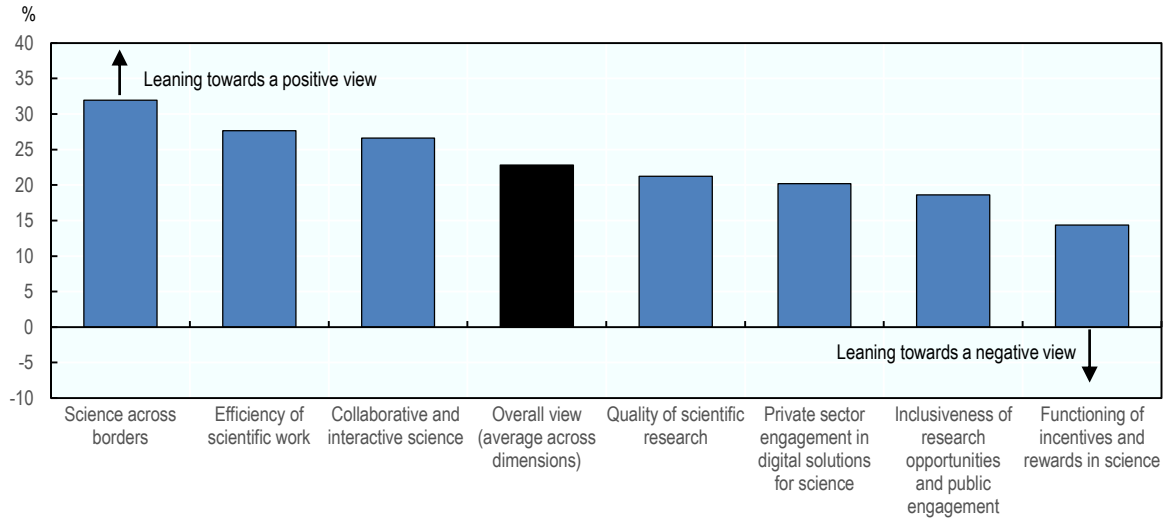
Vector	Description	Examples of policy implications
Speed: dynamics of time	Digitally accelerated activities may outpace deliberative institutional processes, set procedures and behaviours and limited human attention. Technology also allows the present to be easily recorded and the past to be probed, indexed, repurposed, resold and remembered.	Guiding policy principles may be preferred to specific rules that may be quickly rendered obsolete. New approaches such as the use of regulatory sandboxes and the exploitation of data flows and big data analytics may both accelerate and enable more iterative and agile policymaking.
Ownership, assets and economic value		
Intangible capital and the new sources of value creation	Intangible forms of capital like software and data are receiving greater investment. Sensors that generate data allow machinery and equipment (e.g. jet engines, tractors) to be incorporated into new services. Platforms enable firms and individuals to monetise or share their physical capital easily, changing the nature of ownership (e.g. from a good to a service).	Policymakers may want incentives to investment more aligned with the economics of digital innovation and production (e.g. research and development [R&D], data, intellectual property [IP]). The ability to efficiently market services derived from capital equipment (as opposed to direct investments) may have implications for incentives to invest as well as measures of investment and productivity.
Relationships, markets and ecosystems		
Transformation of space	Thanks to their intangible, machine-encoded nature, software, data and computing resources can be stored or exploited anywhere, decoupling value from borders and challenging traditional principles of territoriality, geographically-based communities and sovereignty. This separation creates opportunities for jurisdictional arbitrage.	Policies relying on geographical specifications like nexus, rules of origin or defined markets may need to be revised, to consider other points along the process of value creation and distribution (e.g. location of value creations vs. value delivery). This separation of value creation from use increases the need for policy interoperability between countries and regions.
Empowerment of the edges	The "end-to-end" principle of the Internet has moved the intelligence of the network from the centre to the periphery. Armed with computers and smartphones, users can innovate, design and construct their own networks and communities through mailing lists, hyperlinks and social networks.	Public policies will need to consider reorientation away from the centre (large institutions) and toward more granular units like individuals. This includes policies ranging from digital security and data stewardship to labour and social policies.
Platforms and ecosystems	Lower transaction costs of digital interactions reflect the development not only of direct relationships but also digitally empowered multi-sided platforms, which in turn contribute to further reducing transaction costs in many markets. Several of the largest platforms essentially serve as proprietary ecosystems with varying degrees of integration, interoperability, data sharing and openness.	Public policies need to reflect on the shift of markets toward platforms which may increase efficiencies while re-intermediating and reconcentrating activity that may have implications for maintaining sufficient competition. Governments may need to rethink the provision of public services to take advantage of platforms.

Source: OECD (2019d), "Vectors of digital transformation", https://doi.org/10.1787/5ade2bba-en.

The digital transformation and the HE sector

Digital innovation changes the ways people interact, learn and produce, pushing and driving digital transformation. It creates opportunities for new markets and business models to emerge, together with new products, and directly impacts the efficiency of the public sector (OECD, 2019a).

Figure 5.1. Scientific authors' view on the digitalisation of science and its potential impact, 2018



Source: OECD (2018), *International Survey of Scientific Authors (ISSA) 2018*, Preliminary Results, http://oe.cd/issa (accessed on 15 January 2019).

Digital transformation is affecting and changing significant aspects of education, research, engagement and management activities of HEIs. The education system as a whole is called to adapt and evolve to take advantage of new technologies and tools and to develop strategies and actions to play an active role in the digital transformation process. HEIs can become the driver of digital innovation, including in the provision of the types of skills generally needed to navigate this change of paradigm.

For HEIs, dealing with digital transformation means introducing new digital processes in their organisations, adopting new digital teaching methods and tools, helping students in achieving the skills and competencies needed to act in digitalised societies and economies or having open science policies. It also means adopting a broader view of their role as actors of digital innovation. HEIs, with adequate policies and support from the government, can have an important role in helping firms, in particular small- and medium-sized enterprises (SMEs), adopt emerging technology and acquire relevant digital skills for their workers (OECD, 2019a). Start-ups and spin-offs can benefit from partnerships with HEIs in order to acquire the initial know-how, equipment and funding to test new technologies and scale-up new products and services linked to new the research results in the digital field (OECD, 2019a).

The digital transformation process then becomes an element actively supporting innovation in all HEI missions, including the third mission in all of its dimensions. This implies a dual perspective: the one internal to the organisation with the digital transformation of HEIs themselves, with a new mindset taking into account the challenges and opportunities brought by digitalisation and new digital processes supporting students, staff and researchers; and the one external to the HEI with the enabling role that HEIs must play to foster digital innovation and support a wider ecosystem formed by firms, institutions and stakeholders, jointly pursuing the effort of innovation and growth through the means of new innovative digital technologies.

Digital skills, MOOCs and open science

Digital skills are crucial to navigating today's technology-dense society and economy. However, OECD Survey of Adult Skills (PIAAC) (2012-15) data show that 13% of 16-65 year-olds in many OECD countries lack basic cognitive skills and less than 30% have a cognitive skillset combining high levels of literacy, numeracy and problem-solving skills. Younger generations of workers have a higher level of skills for problem-solving in technology-rich environments, five times more than the older generations of workers. Continuous training and upskilling are necessary to thrive in digital transformation (OECD, 2019b). These figures show the central role of education and higher education as enablers of the digital transformation.

MOOCs stands for "massive open online courses" and represents a new opportunity for digital learning that has developed in recent years. Dedicated Internet platforms provide users with access to MOOCs. Usually, the access is free and students can pay if they want the certificates recognising their enrolment and acquisition of knowledge related to the courses. MOOCs are also used by companies for workers' skills acquisition, with specific training developed ad hoc for these purposes.

"Open science" is a term that refers to the process of making the output of publicly funded research widely accessible to the public (scientific community, business sector and society at large) through the use of digital technologies. Science has an old tradition of openness and, together with the new digital technologies, its actors have created the new paradigm of the scientific enterprise. The main elements of open science are: open access to scientific publications and open data (OECD, 2015).

The emergence of MOOC platforms, of open education and open science, of new digital teaching methods, together with the development of new technological infrastructures, are all developments already changing the practices and the processes in which HEIs accomplish their main missions.

The Italian case

Digital skills in Italy

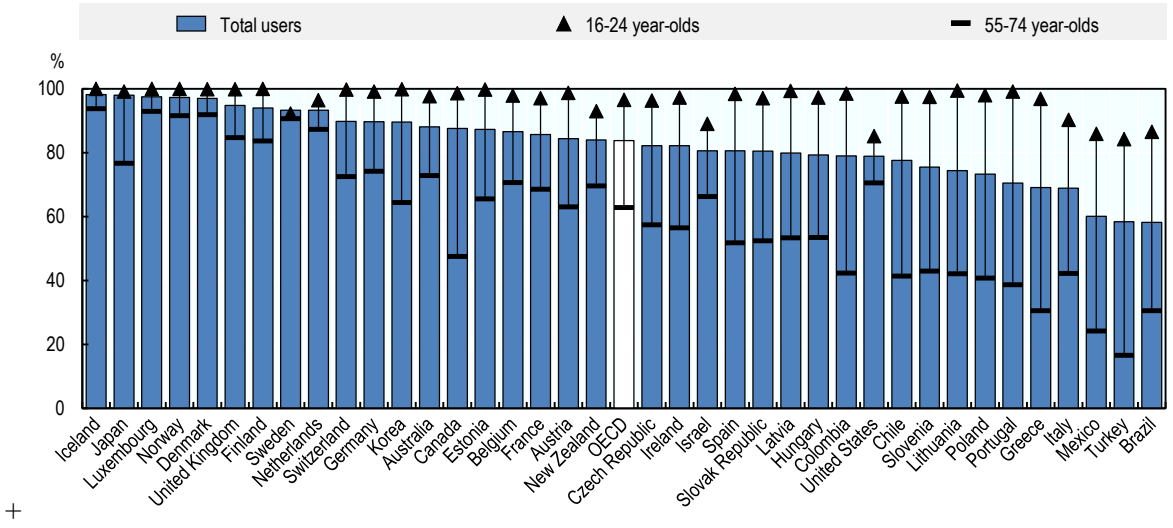
Italy needs to upgrade its skillbase, including digital skills. The OECD Skills Strategy Diagnostic Report of 2017 (OECD, 2017b) recognises how Italy is struggling to make a transition towards a dynamic skills-based society. The mismatch of skills, in particular digital skills, in Italy is an issue that affects the country's innovation capacity (OECD, 2017b). Several indicators show the lower level of digital skills in Italy than in peer countries. For example, Italy ranks very low in the OECD area regarding the use of the Internet, also with respect to the younger cohorts (Figure 5.2).

Moreover, Italy ranks last, within the group of countries for which indicators are available, concerning the percentage of individuals who carried out training, both formal or informal, to improve their digital skills (Figure 5.3).

The Digital Economy and Society Index (DESI) 2019, a composite index published every year by the European Commission measuring the progress of European Union (EU) countries towards a digital economy and society, highlighted the struggles of Italy with digital technology and digital skills. Italy ranks 24th among the 28 members states (Figure 5.4). Among the challenges facing Italy there is still the low level of digital skills. As key actors in the national education system, HEIs have clearly a role to play to help Italy catch up in several dimensions linked to the development of digital skills for students and, to a minor extent, the adult population.

Figure 5.2. Internet users by age, 2016

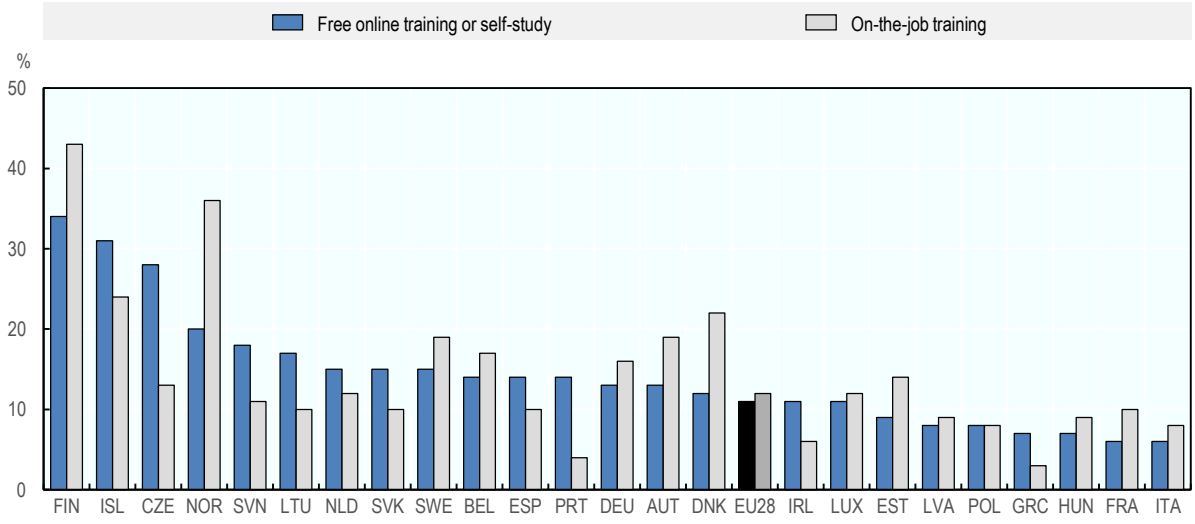
As a percentage of the population in each age group



Source: OECD (2017b), *OECD Skills Strategy Diagnostic Report: Italy 2017*, https://doi.org/10.1787/9789264298644-en.

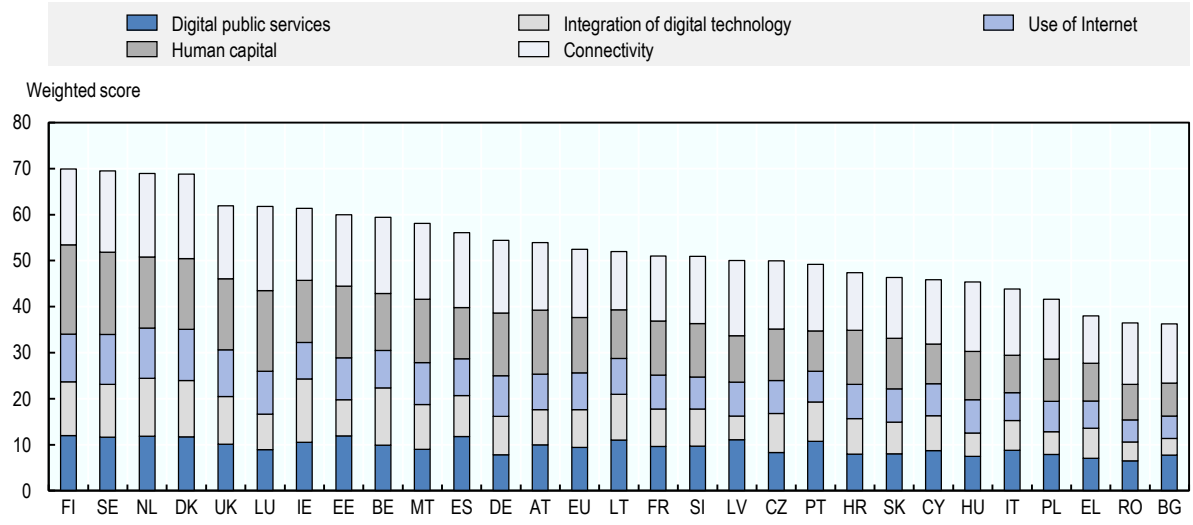
Figure 5.3. Individuals who carried out training to improve their digital skills, by type, 2018

As a percentage of Internet users



Source: OECD (2019b), *Measuring the Digital Transformation: A Roadmap for the Future*, https://doi.org/10.1787/9789264311992-en.

Figure 5.4. Digital Economy and Society Index 2019



Box 5.1. University of Cagliari professional courses for digital skills

Within the framework 2014-20 of the European Social Fund (FSE POR 2014-20), the University of Cagliari launched a course for "Web and mobile application programming and Internet of Things". The course was aimed at acquiring digital skills and promoting employability in the digital economy. The course targeted students with a high school diploma but among the participants, most had a degree in a different subject (from law to philosophy and civil engineering). The course was established in collaboration with 19 local companies lacking digital skills. In total, the course offered 600 hours, 400 hours of internship and the involvement of the university's e-learning training centre. The university also recognised 15-20 ECTS cretids for the course, recognised by the Sardinia Region as a best practice. At the end of the course, 100% of students found employment. The course enrolled a total of 50 students for 200 applicants. The University of Cagliari also works alongside the Regional Digital Innovation Hub to help workers develop new skills, including digital skills.

Main national actors for the digital transformation of Italian HEIs

Apart from HEIs themselves, the main national actors of the Italian HE system playing an active role in digital transformation, together with the Ministry of Education, Universities and Research (MIUR) and the Ministry of Economic Development (MiSE) regarding Industry 4.0 policies, are the following:

- The Agency for Digital Italy (*Agenzia per l'Italia Digitale*, AgID) was created to support the achievement of the Italian digital agenda objectives, to contribute to the diffusion of digital technologies and to support digital innovation. The agency also supports the acquisition of digital skills and overlooks the implementation of the national digitalisation strategy. AgID interacts with several other actors and works in co-ordination with various levels of government (from ministries to local governments), stakeholders, enterprises and experts. To support further the digital

transformation in the public administration, AgID launched a specific task force for artificial intelligence that published a white paper (Task Force sull'Intelligenza Artificiale dell'Agenzia per l'Italia Digitale, 2018) that identified how the public administration and citizens more generally could benefit from new innovative application of artificial intelligence.

- The Conference of Italian University Rectors (CRUI) Manifesto – National Plan for Digital Universities and open science initiatives. The manifesto provides a vision and a strategy to promote digital technology in HEIs. In addition, the CRUI is involved in the promotion of open science, the so-called "Messina open access declaration", issued in 2004, through which Italian universities signed the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities*.
- CINECA is a not-for-profit consortium formed by 68 Italian universities, 9 Italian research institutions and MIUR. As of 2018, it hosted the largest Italian computing centre and the Marconi supercomputer, which ranked 19th supercomputer in the world (top500, 2018). CINECA also deals with the development of IT applications and services, providing computing resources, infrastructures and digital services to Italian HEIs. It also supports technology transfer, connecting HEIs with industry and public administration.

Box 5.2. Artificial intelligence at the service of citizens

The Task Force for Artificial Intelligence of AgID produced a detailed white paper, with analysis and recommendations for the Italian public administration in order to obtain the best results from the implementation of artificial intelligence in their services. Among all the other possible applications, artificial intelligence can be used in all sectors of public administration, profitably in the healthcare, education and judiciary systems, public employment, security and, more broadly, in the management of relations with citizens. However, the task force discussed several challenges, from ethics to technology development and the need for more digital skills to be addressed, issues that could prevent to use effectively the artificial intelligence. It provided important elements to help all sectors of Italian public administration use artificial intelligence to empower citizens, in view of artificial intelligence becoming a tool for reducing inequalities and promoting inclusion.

Source: Task Force sull'Intelligenza Artificiale dell'Agenzia per l'Italia Digitale (2018), *Libro Bianco sull'Intelligenza Artificiale al Servizio del Cittadino*, https://ia.italia.it/assets/librobianco.pdf.

National strategies and plans

The Italian government adopted in 2015 the Strategy for Digital Growth 2014-2020 (*Strategia per la crescita digitale 2014-2020*) (Presidenza del Consiglio dei Ministri, 2015). The strategy identified three main overall goals to reach: i) the progressive switch from analogical to digital for the use of public services, using a user-centred approach; ii) supporting growth through the development of digital skills in companies and spreading the diffusion of digital culture among citizens; 3) planning co-ordination and public investments in digital innovation and information and communication technology (ICT) in order to increase the efficiency of the system.

The higher education system is not specifically mentioned in the strategy but the overall goals apply to HEIs too as they are part of the Italian public administration. The strategy implementation follows specific and dedicated actions, from the strategy for ultra wideband to the digital platform for the interaction among public administration, citizens and firms following the "digital first" approach. Moreover, the strategy is connected with other initiatives taken by ministries and the national government, such as the smart specialisation strategy, the Plan for Digital Justice, the National Plan for Digital Schools, and the National Operative Plans on Competitiveness, Governance and Smart Cities.

The National Plan for Digital Schools (*Piano Nazionale Scuola Digitale*), launched with the Buona Scuola reform in 2015, is a plan aiming to stregnthen digital competencies among teachers and students and introduce modern learning environments in schools through digital technologies. EUR 1.1 billion have been allocated for measures such as new infrastructures, technological equipment, training for new digital skills, both for teachers and students. While the National Plan for Digital Schools targets only secondary education institutions, the Rectors' Conference (CRUI) proposed the adoption of a National Plan for Digital Universities (CRUI, 2018) in a manifesto. The plan proposes to develop an overarching strategy to face the challenges and opportunities of new digital technologies. The goal is to reduce the gap between the Italian higher education system and those in other European countries in terms of the number of graduates and performance of the HE system. The proposed plan considers several actions: teaching and learning, competencies, frontier research, knowledge for society, national actions and co-ordinated governance. The CRUI and MIUR opened a bilateral dialogue in order to develop and implement the plan described in the manifesto and to dedicate funding to it.

In addition to national strategies and plans, relevant European programmes also affect the way HEIs use and develop digital technologies for education, research and engagement. In particular, under the current EU Programme for Research and Innovation, Horizon2020 actively promotes open science, open research data and supports the usage of digital technologies in science and research.

Italian good practices

Digital teaching: Massive open online courses (MOOCs)

New services are enabled by digital technologies in education and training. Digital learning can significantly lower the cost of access to training and better meet individual needs (OECD, 2019a). New actors are entering the market of education and at the same time traditional ones, such as universities, can take advantage of digital technologies to develop new teaching and learning material.

One of the most prominent trends connected to the digital transformation of HEIs is the development and growth of MOOCs, which can be seen as the first wave of innovative digital methods for teaching and learning and can attract the attention of digital native students. MOOCs extend the environment in which education takes place and thus foster lifelong learning. MOOCs are also an opportunity for firms that want to invest in human resources development and training, with a lower cost and more flexibility (OECD, 2019a). However, numbers are still low: according to the data available, the share of Internet users who followed an online course in 2016 was below 15% in 30 out of 35 countries with data available (OECD, 2017a).

Internationally, private platforms such as Coursera or HEI institutional platforms such as EdX are among the leading actors in the MOOCs landscape worldwide. Italian HEIs started experimenting the use of digital technologies in teaching and learning well before the CRUI's Manifesto for Digital Universities by offering students study programmes with distance learning and MOOCs. Although the landscape is still very fragmented, many Italian HEIs have shown interest in education through MOOCs. Several platforms have been developed by single universities and also by consortia of universities. Among the visited universities, Federica from University of Napoli Federico II and PoliMi Open Knowledge are worth mentioning as well as the multi-institution platform EduOpen (Box 5.3). A shared feature of these platforms is to be open to other users than their students: future students, postgraduate students, professionals, through post-university and preparatory courses.

Box 5.3. MOOC platforms in Italy

Naples Federico II's Federica web learning platform

The Federica web learning platform, developed by the University of Napoli Federico II, consists of a digital platform and a wide range of digital services and products. Federica Web learning proposes a new model of "content-oriented" services to support learning, combining the academic tradition and innovation of digital technologies. Federica allows for a personalised way of creating knowledge and meeting the needs of the target audience. The platform focuses on three factors: open access, flexibility and portability of contents. Federica hosts 12 courses in English, 2 courses in production and another 25 in programming, together with 48 Italian language courses in the catalogue, with 19 more courses in production and 39 in programming.

Contact: https://www.federica.eu/ - Prof. Mauro Calise mauro.calise@unina.it

Polytechnic of Milan Open Knowledge (POK)

The Polytechnic of Milan is the largest in Italy and has developed its own MOOC platform, POK. The platform is open both to students and users enrolled at the polytechnic but wanting to learn about specific scientific issues. In addition, the platform has also developed specific MOOCs for researchers, teachers and for soft skills ("from university to jobs"). Contents are available both in Italian and English.

Contact: https://www.pok.polimi.it/

EduOpen

EduOpen is an online platform for the design and delivery of MOOCs. It is a consortium formed by 17 Italian public universities. It is a national project funded by MIUR. The platform is free and open, the courses are certified and they give European Credit Transfer Scale (ECTS) credits, open badges and certification. There are 241 MOOCs on offer, organised along 30 paths, with more than 50 000 students enrolled to date. Students can participate in the EduOpen community as translators, transcribers or mentors and, in exchange, receive badges and credits to obtain official certificates for the courses they attended. Enterprises can also decide to use EduOpen to host their courses, which can be co-created with the EduOpen team. Companies can also have a dedicated portal for their courses.

Contact: www.eduopen.org

The CRUI analysed the state of the art in the MOOC market in Italy in 2015, showing exponential growth, from 2 courses in 2012 to 39 in 2014 and 120 in total in 2015 (Paleari et al., 2015). This phenomenon grew spontaneously, with a strong contribution from HEIs already experienced in online teaching and learning. However, HEIs that have not delivered any MOOCs still face organisational issues and, in order to produce and provide online courses, actions are needed to overcome these issues: from specific courses for teachers and professors to investment in technologies and infrastructures.

Moreover, increasing attention has been given by HEIs to the United Nation's sustainable development goals (SDGs) and related initiatives. MOOCs in this area represent an additional channel of engagement of the HEIs with different typologies of MOOC users. It is worth mentioning the "Sustainable Food System: a Mediterranean Perspective" online course developed by the University of Siena, which discusses the challenges and opportunities of the agricultural sector in the Mediterranean area. The course focuses on global-to-local trends related to the achievement of SDGs, outlines the history and culture of agriculture, focusing on the "Mediterranean diet", and explains agricultural data on rural development models and value creation.

To achieve good results in terms of quality of produced contents, quality of teaching, experience for students and users, the creation and distribution of MOOCs must be considered together with the professional training of professors, technicians and staff members in order to maximise the potential of the new tools. Through the Digital Science and Education for Teaching Innovative Assessment (DISCENTIA) project, the University of Cagliari is looking to go in this direction. DISCENTIA is a project funded by MIUR with EUR 1.2 million and is specifically designed to increase the number of teachers with adequate training in digital education. From 35 people at the beginning, DISCENTIA has ultimately trained 600 people, from tenured professors to doctoral students and technical staff. The model of DISCENTIA will become mandatory for new professors and researchers at UniCa.

Open badges and competencies recognition through digital technologies

Often connected to MOOCs, open badges offer digital solutions for recognising competencies and skills acquired both in classic courses and training, but also within MOOC digital platforms. Open badges are digital tools that keep a record of competencies acquired during a course. They are defined by an open standard, which contains metadata that provide information about the organisation, the person to whom they are assigned and the evidence of the positive assessment of the criteria provided by the badge. They provide for a digital credentialing tool that attests education and professional growth, which can be displayed immediately by students. The open badge standard should automatically link the student information system of the universities to the open badge platform, in order to integrate the badges with the university's formal recognition of competencies (e.g. diplomas, ECTS). Open badges can simplify the procedure of acknowledging competencies acquired and defined via external third parties (e.g. in the case of stages, internships, training courses).

Some universities in Italy are experimenting with blockchain technology for the accreditation of open badges. For example, in 2018, the University of Rome Tor Vergata and the University of Cagliari started pilot projects to register student diplomas by using blockchain technology to guarantee authenticity and certify skills (Box 5.4).

Box 5.4. Italian universities' blockchain experimentation

A degree certificate, both in paper and digital formats, is easily falsifiable or alterable. Thanks to technology, it is possible to guarantee the authenticity and integrity of digital certificates for the benefit of potential employers and institutions all over the world. The innovative system allows the issue of certified digital documents, thereby ensuring that they are not falsifiable. The University of Cagliari and the University of Roma TorVergata are both experimenting with the use of blockchain technology in relation to the certification of digital diplomas. The University of Cagliari uses the Ethereum blockchain, while the University of Roma TorVergata uses Bitcoin blockchain technology. Started as two pilot projects, both universities want to progressively extend the service to all degree programmes.

Another interesting initiative is Bestr (www.bestr.it.), the first Italian digital platform for open badges to enhance lifelong learning, an initiative launched in 2015. In 2018, the CRUI identified open badges and Bestr as national references for the representation and certification of competencies. In 2018, to develop the full potential of open badges, CINECA and the HEIs participating in Bestr decided to focus on six core phases of students' university life cycle: guidance; admission and enrolment; exams; credit acquisition and recognition; diploma achievement; and alumni. The platform is used mostly by HEIs for assessing competencies and skills of students, but there are also badges issued by private organisations to assess skills acquired in training courses.

Language skills are the most common badges to be acknowledged, also thanks to the Common European Framework of Reference for Languages (CEFRL) that standardised language skills at the European level. The presence of frameworks and standards, such as CEFRL, help the adoption and spread of open badges as users have a clearer understanding of the meaning of a certain level of knowledge. In Italy, several HEIs are using open badges to assess language competencies, such as the University of Milan-Bicocca, the Free University of Bozen/Bolzano, the University of Padua, the Luigi Bocconi University of Commerce, the University of Trento, the University of Palermo, the University of Turin and the University of Siena, for a total of around 60 badges published and more than 19 000 assignments.

Open badges are also used to recognise the acquisition of soft skills. For example, the University of Trento and the Free University of Bozen/Bolzano adopted open badges to recognise soft skills developed in educational activities related to techniques for active job search and to the work done by students in the university career guidance service.

Open badges can also be used to promote the acquisition of new skills from HEIs internal staff. They can be used to recognise and follow the enhancement and development of the competencies of staff members. For instance, this is the case of the University of Padua, which has promoted the Teaching4Learning@Unipd project to certify the competencies developed by the teachers who take part in the training course for didactic innovation.

Open science

Open science refers to the process of making research results and output more widely accessible in digital format to the scientific community and a wider audience. Digital technologies are the accelerator of this process, which is also embedded in the historical

openness of science (OECD, 2015). Digital technologies allow publishing and distributing the results of scientific research to a wider public, with very low marginal costs. Wider access to scientific results and data can make science more inclusive and help transfer scientific results to society. Importantly, the new open science/open access paradigm implementation must ensure the high-quality scientific publications and opportunities for authors to publish in quality journals (OECD, 2019a).

In Italy, efforts are being made to move toward open access, but open access policies are still to be implemented widely. In 2004, during a Conference in Messina, CRUI promoted the subscription of the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (2003), which promoted access to knowledge and open access. The Berlin Declaration has to date been signed by 74 Italian universities. In 2013, with Decree No. 91 of 8 August 2013 and with the following Law 112/2013, the Italian government established that the publication of results from research funded publicly for at least 50% should be stored in free-access repositories. However, in 2016, open access publications in Italy was between 13% and 15% of the total Italian publications. CINECA developed IRIS (Institutional Research Information System) as the information system for Italian HEIs to store records of their publications and it has been adopted by almost all universities in Italy.

Policies at the level of individual institutions are currently being developed in some Italian HEIs. Together with national authorities and agencies, individual HEIs have a role to play to encourage researchers and staff towards an open science model (Box 5.5).

Box 5.5. The Liège model of open access

The University of Liège developed a well-recognised and successful model for open access, internationally known as the "Liège model". The University of Liège adopted its mandatory open access policy in May 2007. The policy requires that researchers must self-archive their outputsin the institutional repository of the university, ORBi, following the "Immediate-Deposit and Optional-Access" (IDOA) principle, as soon as the paper is accepted by a scientific editor. ORBi serves also as the primary source for research performance assessment and the evaluation of researchers within the university. In addition, the internal grant distribution process is based on ORBi publication records statistics. During the initial phase of transition, the university organised seminars and classes to train staff and researchers in the use of ORBi. The deployment of ORBi offered the university and researchers an early advantage regarding the dissemination and visibility of scientific results, together with the conservation of publications for multiple purposes.

Source: OECD (2015), "Making Open Science a Reality", *OECD Science, Technology and Industry Policy Papers*, https://doi.org/10.1787/5jrs2f963zs1-en.

The Polytechnic of Milan, where open access has been active since 2014, and the University of Bologna are two of Italy's leading examples. At the Polytechnic of Milan, professors, researchers and collaborators feed the university's institutional open access archive by self-archiving their scientific products in the Re-Public@polimi institutional repository. Furthermore, a working group for open access has been established to define archiving and intellectual property management technical tasks. The University of Bologna, together with its policy on open access and the development of an institutional repository for publications, also invested in the definition of an open data policy; it has been the first Italian university to implement a tool that makes available datasets distributed

under a Creative Commons license via a dedicated university portal (https://dati.unibo.it). While only datasets related to the organisation (e.g. budget, courses, list of degree) are currently accessible, a pilot project on open research data aims to identify projects that can contribute datasets to be made publicly available to the whole scientific community (Box 5.6).

Box 5.6. University of Bologna open data

The University of Bologna is the first university in Italy to implement an online portal that aims to collect, organise and freely provide open data regarding the activities and organisation of the university. The university made the net packages of indexed and navigable data available, distributed under a Creative Commons license, a choice in line with the principles of transparency and participation that are typical of the idea of open government. The first datasets in open data format made available information such as the list of degree programmes, single course details, class schedules, university social budgets and updated facts and figures of the alma mater. In the future, the aim is to open significant scientific datasets from public-funded projects to the entire scientific community.

Contact: https://dati.unibo.it/

HEI third mission and digital transformation

Digital technologies represent an opportunity to foster digital culture as a means for innovation and entrepreneurship. Universities could help actors in their surrounding ecosystems adopt and use digital technologies to become more innovative. Policies and initiatives to support the digital transformation of universities can include third mission activities and knowledge exchange with non-academic institutions. In 1999, the School of Management at the Polytechnic of Milan launched Digital Innovation Observatories. Since then, the polytechnic has established more than 30 observatories, with the contribution of more than 90 researchers and analysts. The Digital Innovation Observatories platform has become a point of reference for a network of more than 150 000 professionals from within and outside academia. The observatories actively disseminate good practices, experience and culture of digital innovation by organising events, publishing papers, press releases and articles.

Many other practices, focusing on digital innovation, have followed the establishment of the observatory. Good practices are scattered across the country, illustrating that digital technologies also provide new development opportunities in HEIs that do not operate in areas where digital technologies are common among local actors. In these cases, HEIs represent drivers of innovation and can avoid a given ecosystem being cut off from the process of digital transformation.

From an internal management point of view, strategic and performance plans of HEIs are putting a lot of emphasis on the use of digital tools. An increasing amount of processes, including student careers, are increasingly becoming fully digital. Data analysis, indicators and databases are at the centre of university activities, as public administration entities. An example of this transformation comes from the University of Siena that started projects to improve internal decision support systems through business analytics and data visualisation tools. For example, the university would like to adopt modern data visualisation and analysis technology for analysing locally the information centrally collected by MIUR,

enhancing this data with others collected locally for better benchmarking and informed strategic decisions.

Box 5.7. Example of good practices in digital capabilities and transformation in Italian HEIs

VidyaSoft – University of Salento spin-off

VidyaSoft is a spin-off from the Department of Innovation Engineering of the University of Salento (Lecce), which was founded in 2015. The spin-off originated from the efforts of four PhD students interested in software architectures, cloud computing and mobile systems, together with the scientific director of graphics and software architecture. The focus of the company was originally about creating a contactless payment system, but later on, the team pivoted toward the creation of an application programming interface (API) platform for fintech called WoX (Web of Topics). In 2016, VidyaSoft won the Sellalab Fintech programme, an international competition supported by Banca Sella. VidyaSoft is then accelerated for 6 months by Banca Sella in the "Internet of Things" sector (IoT), with the aim of achieving integration of smart environments, payment systems and open banking. VidyaSoft acquired a strong knowledge in the development of cross-platform mobile applications, consolidated in a portfolio of projects that embrace risk management, insurance, fintech, tourism, business-to-business (B2B) and eLearning. Today, VidyaSoft has ten employees and the company is located in the Ecotekne campus of the University of Salento. The development of WoX platform is now at the core of its business model.

Contact: www.vidyasoft.it

Another major initiative supporting digital innovation in Italy is the National Plan Industry 4.0 (I4.0). The Ministry for Economic Development (MiSE) launched this plan in 2015. The plan is a step forward toward the diffusion of digital technologies and digital innovation. I4.0 aims to support companies offering assistance in investments, digitisation of production processes, enhancement of labour productivity, training and development of new products and processes. Within the different policies and actions identified by the plan, two are worth mentioning regarding the role of HEIs in the digital innovation ecosystem: digital innovation hubs and competency centres.

Digital innovation hubs are hosted by regional branches of Confindustria, the Italian employers' association, with the aim of enabling networks of local actors (e.g. universities, scientific and technological parks, incubators, local institutions…) in order to improve company awareness of opportunities in the I4.0 area and to support access to funds and investments.

Competency centres are poles of excellence created by universities together with enterprises to raise awareness of I4.0 by providing practical demonstrations of new technologies and best practices. Another important goal of competency centres is to provide services to SMEs in order to strengthen their innovation by offering consulting and services linked to I4.0 opportunities. Universities, in partnerships with companies, provide services and guidance about the opportunities of digital transformation. Eight competency centres, with the involvement of 70 universities and 500 companies, are in the process of being financed with an investment of more than EUR 70 million. Almost all of the visited universities are involved in one of the eight competency centres, some of them (Politecnico

of Milan, Politecnico of Turin, University of Bologna, Scuola Superiore S. Anna, University of Napoli Federico II) project leaders of their competency centres.

Challenges in the Italian HE system

Make digital transformation strategic for the future of HEIs

The Strategy for Digital Growth 2014-20 defined a roadmap toward a digital transformation of Italian public services, and stronger digital skills of citizens and within companies. The national strategy, also pursued thanks to the work of AgID, still lacks a specific component on the role and the actions through which HEIs can participate in the digitalisation of Italy. Some policies, such as in the case of the National Plan Industry 4.0 with the establishment of competency centres, already recognise a central role for universities in relation to the diffusion of new technologies. However, a more integrated and specific strategy for HEIs is needed. Similarly to the National Plan for Digital Schools, the CRUI Manifesto – the National Plan for Digital Universities could become the starting point of a wider strategy for a digital future of Italian universities; efforts will be required to find resources and strengthen co-ordination among all the relevant actors present in the system, from the ministry and the National Agency for the Evaluation of University and Research (ANVUR). The strategy can support actions to reduce the gap between the Italian higher education (HE) system and those in other European countries but also to foster and strengthen the role of HEIs as active players for the digitalisation in the country. It could also promote synergies among the different pillars of the digitalisation of HEIs being:

- the new digital teaching methods, training and development of digital skills
- the use of digital technologies to support the development of research and the contribution of research to investigate the new frontiers and challenges of digitalisation
- the contribution of digital tools in the management of HEIs and support organisational change
- the role that digital technologies can have in the pursuit of HEIs' third mission.

During the study visits, some universities demonstrated having the capacity to kick off processes of digital transformation: many bottom-up initiatives started to arise. A national strategy can help to consolidate and promote successful individual actions developed by the universities to the wider HE system. Some of the bottom-up initiatives at HEI level are part of a broader digital strategy of the university. This is the case for example of the University of Bologna: it has a strategy about the development of its information system as a driver for innovation and organisational change. This process is supported by the presence of a Vice-Rector for Digital Technologies and a single IT organisational unit, lead by a specific manager with the role of "Digital Transition Officer". Universities with a less focused vision and without a clearly defined strategy may struggle to embrace the full potentiality of digital transformation.

The implementation of new digital processes should go together with the creation of a fertile environment that can foster innovation, where HEIs play a crucial enabling role. However, the lack of certainty in national policies such in the case of competency centres is a critical element for the whole system. Also, the Manifesto – National Plan for Digital Universities could be a first step where HEIs, together with MIUR and other relevant actors

at the national level, put the issue of Digital Transformation of Universities at the centre of a national strategy that is now missing.

Invest in digital learning

Investing in the training of staff, technical equipment, technological infrastructure is central if Italian HEIs want to put digital learning as a driver for development and innovation. So, the challenge is twofold: first, training academic staff and helping the developing of new digital competencies, and second, redesigning programmes to include innovative methods and digital tools to help students develop the skills required nowadays. The combination of those two aspects is a challenge for Italian HEIs.

While MOOCs and open badges can improve the capacity of HEIs to engage and attract new stakeholders, one should consider that there are obstacles to overcome for their successful implementation. For instance, completion rates of MOOCs are very low and certification and recognition remains a challenge. Open badges and similar approaches are not yet mature and fully embraced. This is also due to the difficulties in assessing the quality of the large number of courses and material available online. There could be issues regarding the recognition and certification of ECTS for students completing online courses, despite many innovative approaches (OECD, 2016). The CRUI coordinated an agreement among Italian universitis in 2017 to let the students enrol in MOOCs and enable the recognition of ECTSs in a co-ordinated manner, but problems still arise with courses from international institutions or on other platforms not included in the agreement.

The creation of MOOCs requires the capacity to deliver attractive quality contents. New teaching methodologies and communication skills must be acquired by staff and professors. Costs are an important barrier: producing a MOOC is a costly process in terms of hiring profressionals, traning staff and investing equipment and infrastructures. CRUI initial analysis (Paleari et al., 2015) highlighted the lack of a shared methodology for the design and implementation of MOOCs, as no national guidelines existed at the time. To overcome this issue, the CRUI, with its project “MOOCs Italia”, identified national guidelines for the provision of good quality MOOCs for Italian universities.

Spread open science and open access practices

Despite recent regulation (Law 112/2013) stating that at least 50% of the publication of publicly funded research should be stored in free-access repositories, only 13% to 15% of total publications in Italy were open access in 2016. Open science and open access policies have been adopted in the last years by several Italian universities, but they are still a minority: as of December 2017, only 27 out of 97 HEIs had an open access policy. These data show that despite some effort toward the diffusion of open science and open access, these practices are not yet widely adopted by institutions and researchers.

At the national level, several developments have recently taken place. The CRUI Working Group on Open Access, which is part of the CRUI Library Committee is currently working on these issues. The working group supported the definition of guidelines and recommendations for universities. The Italian Association for the Promotion of Open Science (AISA) was established in 2016. AISA is supported by some HEIs. One of the first initiatives of AISA has been a proposal to change the actual copyright law to grant the authors the right to freely make available their work to the public no later than one year after first publication, following what has been implemented in countries such as France and Germany.

A more co-ordinated effort is needed to spread the open science paradigms to the whole HE system. The abovementioned Law 112/2013 is not yet fully applied and the numbers of open access publications are still low. The adoption of research data sharing is even more problematic. Also, the law was originally promoted by the Ministry of Cultural Heritage and Activities for a wide range of other purposes concerning the protection of cultural heritage and just contains a paragraph about open access. The open science paradigm, together with the digitalisation processes, can help the establishment of major co-operation initiatives, through new research infrastructures and the training of researchers. As already mentioned, scientists and researchers already have a strong positive sentiment about the effect of digitalisation on scientific collaboration; this feeling can be a driver for guiding the HE system toward open science.

A more focused national strategy, developed by MIUR in collaboration with the CRUI and other relevant actors could help the promotion and adoption of open access and open science, following, for example, the ATT (Box 5.8) initiative of Finland, where a clear roadmap has been defined, including an evaluation of results. Another interesting example can be found in the Netherlands: to reach the goal of 100% open access by 2024, the National Universities Association negotiated deals with major publishers for open accesse to Dutch publications. European frameworks can help boost open access in Italy: this is, for example, the case of Horizon2020 that has specific clauses regarding the open access policy for access to funding.

Box 5.8. Finland open science and research initiative

The Federation of Finnish Learned Societies co-ordinates the open science activities in all the country, in close collaboration with all actors of the research community. Guidelines and policies for open science are discussed by the Open Science National Strategic Group, formed by representatives of research organisations, libraries and funders. Even if it works with the Ministry of Education and Culture, the strategic group is independent and managed by the research community itself. The Open Science and Research Initiative (ATT) was launched in 2014 by the Ministry of Education and Culture with the goal of creating a national open science and open access policy, and building the proper infrastructure to reach this goal. Beteween 2014 and 2017, open science became more visible to innovation system actors, and transparent, collaborative research has been promoted; together with the necessary skills and knowledge. The impact of the Open Science and Research Initiative was evaluated by external evaluators in 2016 and then by the ministry in 2017.

Source: Open Science (n.d.), *Open Science Coordination in Finland*, https://openscience.fi/en/frontpage; OECD (2015), "Making Open Science a Reality", *OECD Science, Technology and Industry Policy Papers*, https://doi.org/10.1787/5jrs2f963zs1-en.

Digitalisation and third mission: An opportunity not to be missed

As previously discussed, digital technologies are not only changing the way teaching and learning is delivered or research undertaken: they are also offering new opportunities for HEIs to engage with external stakeholders. Digital technologies can be used to establish platforms and networks of HEIs partners and reach out companies of the innovation ecosystem.

When it comes to technology transfer, digital technologies can be deployed to look for financing opportunities: crowdfunding is a possibility that some HEIs in OECD countries are embracing to finance projects in various fields, from research spin-offs to student services. While this practice is already used in many universities, it is still lagging in Italy. An interesting example is offered by the University of Pavia's own crowdsourcing platform Universitiamo. This platform has collected approximately EUR 500 000 in just 3 years, financing about 40 research and third mission projects. Italy has been also the first country in Europe to approve regulation allowing for so-called "equity crowdfunding", which allows donors to receive equity from the financed innovative start-ups. This offers the possibility of collecting funding from a greater range of investors, rather than from institutional and classic investors, an opportunity that could also be used for financing university spin-offs and start-ups.

Italian HEIs, while developing numerous initiatives linked to the digitalisation of different aspects of their activities, rarely integrate third mission in their digitalisation strategy, generally mostly focused on developing infrastructure, offering new digital services to staff and students or creating MOOCs. A reflection on how to integrate these different services with HEI third mission agendas is certainly needed in order to fully integrate digital technologies within the whole organisation and use digital technologies to better support all HEI missions. A more co-ordinated effort at both national and HEI levels can be beneficial in this sense.

There is a need for specialised staff supporting digital transformation. While almost all HEIs already have dedicated staff responsible for third mission activities, less present is the figure of a dedicated person in charge of digital transformation (a notable example already mentioned is the University of Bologna with its dedicated structures and organisation for digital transformation). In addition, full integration between digital and "knowledge exchange and collaboration" is not yet present. People responsible for third mission do not always co-ordinate with those responsible for digital transformation or digital technologies, and vice versa. Integrating these two areas but also more generally with other dimensions and functions, and thinking strategically about digital transformation in all aspects of HEIs, can then make full use of the potential digital technologies have to transform HEIs, making them more innovative and dynamic, ready to be drivers of innovation.

Digital technologies and tools can spur organisational change in HEIs. Fully digitalised processes are drivers of organisational change and make HEIs more innovative. All stakeholders, including students, faculty and administrative staff can take advantage of the availability of data and data analysis. The challenge is to provide good and intelligible data and data analysis. To do so, as previously mentioned, there is a need for specialised and specifically trained staff. helping the implementation of digital processes. Identifying internal champions among different stakeholders can help support the transition to a digital paradigm within HEIs.

Concluding remarks and policy recommendations

As in many OECD countries, HEIs in Italy are using and exploiting the opportunities offered by digital technologies. There is a strong dynamism in terms of actions and initiatives being developed and offered to students and staff. Some HEIs are greatly investing in digital infrastructure, some are leaders in the development of new digital services for students and staff, others are devoting efforts in the development of MOOCs. However other "building blocks" of the digital transformation in HEIs are currently less on

the radar or not immediately linked to digitalisation strategies: these include, for instance, open science and open data or the skills required to maximise the benefits of digital transformation.

National relevant actors, as well as individual HEIs, would need to adopt a broad idea of digitalisation, including, but going beyond, the emphasis on MOOCs and digital infrastructure and services only. This broad conceptualisation needs to take into account that digitalisation affects all HEI missions and activities, from education and skills development to research and engagement. For example, important elements to include in the narrative are, as mentioned above, open science, open data and more generally how digital technologies can support both internationalisation and third mission (collaboration with the business sector, supporting the creation of spin-offs, etc.).

As can be expected, recent developments in the area of digital technologies are unevenly spread across the Italian HE ecosystem, with some universities taking the lead while others are lagging behind.

Given the dynamism and the proliferation of actions and services, it is important for national actors to map and monitor recent developments to understand what works and what does not in an attempt to promote good practices and peer learning, including from international peers.

While mapping the system, it is also important to define overarching strategic goals vis-à-vis the digitalisation of the HEI system. Digitalisation is high on the agenda of Italian policymakers and strategies and actions have already been developed, around the digitalisation of the Italian business sector (*Impresa 4.0*) and public administration for example. Despite being part of the public administration, HEIs are, nevertheless, different types of public actors requiring in some cases more flexibility and ad hoc approaches.

It is therefore important to develop a co-ordinated strategy that takes in to account CRUI proposals and which sets long-term goals around digitalisation. The strategy needs to take into account all the aspects of digitalisation (infrastructure, services for students and staff, MOOCs and education, skills development, open science, open data and the digitalisation of research processes, digital technologies and third mission, etc.) and provide and promote an integrated comprehensive vision.

Notes

[1] "Digitisation", which is the conversion of analogue data and processes into a machine-readable format, represents a first outcome of digital technology. "Digitalisation", represents a second structural step and results from the interconnection of digital technologies, which results in new activities or in profound modifications of existing ones.

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Chapter 6. Organisational capacity: Funding, people and incentives

This chapter expands on the findings presented in Chapter 2 with a focus on organisational capacity, funding, people and incentives. It discusses actions that steering actors and higher education institutions (HEIs) are undertaking in Italy to increase the efficiency and the effectiveness of the system, in order to reach their targets with respect to all missions and dimensions of higher education – in particular the ones discussed in the previous chapters. The chapter also presents several good practices at the national and international levels, focusing mainly on the funding system built in recent years.

Introduction

Improving the organisational capacity of Italian HEIs would positively affect their capacity to generate societal and economic value. Based on international evidence, this chapter presents the institutional arrangements in Italy's higher education system in connection with third mission, identifies specific challenges and discusses policy recommendations for the national higher education policy as well as for higher education institutions (HEIs).

This chapter highlights the multifunctional roles of HEIs beyond teaching and research, incorporating entrepreneurship and innovation, social outreach and contributions to their respective ecosystems. The potential of HEIs – including researchers, students, departments and other (administrative) entities – to engage in entrepreneurial activities and innovation processes depends on internal and external factors. These enabling factors include: the commitment of the rectorate and the quality of its strategy; the organisational structure and the degree of autonomy of actors; the availability of resources; the quality of research; the absorptive capacity of the business sector surrounding the HEI; and, of course, the features of HEI ecosystems. Italian universities show a great deal of heterogeneity regarding these enabling factors.

This chapter focuses on the organisational capacity of institutions to formulate strategies and related goals, and develop governance models and incentives schemes that can facilitate the implementation of the strategy and its goals. The chapter is based on the analytical framework of HEInnovate and in particular its five guiding principles – or "statements" – concerning the "organisational capacity" dimension.[1]

The organisational capacity of Italian HEIs has been affected by a series of recent reforms targeting the governance of the higher education sector and its funding mechanisms. These reforms are:

- the 2010 "autonomy reform", providing institutions with a great degree of freedom in designing their institutional structures and strategic processes
- the three-year strategic planning exercise, which strongly connects funding schemes with the performance of research activities (ANVUR's evaluation scheme, VQR)
- competitive public funding schemes, such as Departments of Excellence being recently introduced
- ongoing developments in order to better monitor and reward third mission as another strand of universities activities.

The national policy framework for HEIs' innovation activities

National reform processes as the basis for organisation capacity development: The 2010 reform

The 2010 "Autonomy Reform" represented an important milestone to increase universities' degrees of freedom for structural and innovative processes, and entrepreneurial and innovation activities. The reform increased interdisciplinary and inner-institutional co-operation in research and teaching. Following the reform, departments became the main substructure in which university is organised. Departments ought to be composed by at least 40 professors and researchers, responsible for teaching and research and all the activities involving external stakeholders. Before this reform, the responsibilities for

research and teaching duties were split between departments and faculties (*facoltà*), causing inefficiencies to both strands of duties. Faculties or schools have become transversal structures co-ordinating teaching activities, offered under the responsibility of the department.

The quality of study programmes offered in departments or in their co-ordinating structures is assessed by a committee equally composed of teachers and students. The Ministry of Education, Universities and Research (MIUR) has to approve the new governance and related regulation. However, the Italian government did not allocate additional funding to universities to support the transition of the governance system.

Based on the reform, universities have adopted organisation systems based on their different needs and features. As mentioned before, large universities can use faculties or schools to co-ordinate departments in offering study programmes and promote interdisciplinarity. It is the case of the matrix structure, applied by the University Federico II in Naples, the second-largest university in the country. The Federico II is now organised in 26 departments, divided into 13 disciplinary areas that together provide interdisciplinary education programmes in 4 schools: the School of Agriculture and Veterinary Medicine, the School for Human and Social Science, the Polytechnic School of Basic Sciences, and the School of Medicine. This organisation offers students transversal knowledge and promotes the efficient use of the university's competencies.

In addition, the 2010 reform has allocated to departments the responsibilities for recruitment, technology transfer and third mission. Some universities have created new administrative positions within departments to ensure that the overarching institutional goals are conveyed throughout the organisation and affect individual activities. The organisational structure of the University of Bari provides a good example of this governance arrangement, which could be described as multidivisional-form (M-form).[2] The university has 7 central divisions – institutional affairs; procurement, construction and heritage; education and student services; co-ordination of departments; research, third mission and internationalisation; financial resources; human resources – and 23 research and teaching departments. All the departments have seven operational units mirroring the seven central divisions, allowing a continuous "core-periphery" communication in each process. A similar approach has been adopted at the University of Bologna. Each research department hosts a delegate (chosen among faculty staff) that has the responsibility to align activities in the areas of international relations, research and third mission activities to the university strategy. Delegates operate in co-ordination with vice-rectors heading thematic areas, and with relevant administrative divisions. A similar governance arrangement features the University of Rome "Tor Vergata": all departments host a general manager for third mission.

University autonomy enables HEIs to define their strategic goals, including vis-à-vis entrepreneurship and innovation

University autonomy has provided HEIs with the possibility to develop their own tools to ensure that the academic community moves towards the strategic goals identified by the institution. As discussed in Chapter 1, every three years MIUR sets the priorities for the strategic planning of the university system, after consultation with the main academic stakeholders. HEIs develop their institutional strategies within the framework of the national strategy and discuss with the ministry a co-funding application for implementation.

For the period 2016-18, the resources allocated by MIUR to support institutional strategic planning amounted to EUR 150 million for public universities and EUR 400 000 for private, state-recognised universities. Universities matched these resources with their own funding. In particular, national strategic priorities encompasses three areas:

- access and completion in universities, student employability and internationalisation
- modernisation of infrastructures, the innovation of teaching methodologies
- young researchers and incentives for university teachers (state universities only).

Universities have adopted these priorities areas in their strategic documents and shared the national goals. For example, contributing to regional development through the provision of relevant skills tops the agenda of many of the case-study universities.

Based on the experience of the previous period, the resources allocated by MIUR to support institutional strategic planning in public universities have increased and total EUR 165 million in 2019-20. National strategic priorities include the following areas:

- teaching and learning
- research and technology transfer
- students' services
- internationalisation
- recruitment.

The relative scarcity of highly educated individuals in the workforce and the low level of literacy and numeracy skills, including among individuals holding a university degree, compared to other countries are amongst the main challenges of the Italian economy (OECD, 2017a). To respond to these challenges, Italy has introduced important innovation in the tertiary education system: the *Lauree professionalizzanti* or professional bachelor's programmes; the *Instituti Technici Superiori* (ITS), short-cycle professional/vocational tertiary education institutions;[3] competence centres, an important innovation in the national innovation system, especially regarding the capacity of HEIs to engage with the private sector.

Competence centres are embedded in the Industria 4.0 (I4.0) initiative, developed under the aegis of the Italian Ministry of Economic Development (MISE). I4.0 represents another important policy aiming to improve national skills and encourage and facilitate the transition to digital technologies of Italian firms, including small- and medium-sized enterprises (SMEs). Competence centres are private-public partnerships that provide firms with technology transfer services, guidance and training on technologies enabling the I4.0 paradigm. Since 2015, MISE has invested approximately EUR 73 million to promote 8 national competence centres. In 2019, these centres are in the process of being established and involve a network of more than 70 Italian universities and research centres, and about 500 companies. Italian competence centres take on the form of education labs promoting collaborative training. This is different to international experiences, such as competency centres in Sweden or Austria, which put emphasis on research (Box 6.1). All competency centres are physically hosted by universities in the centre/north of Italy, with the exception of the University of Napoli Federico II.

Box 6.1. Austrian Competency Centres for Excellent Technologies (COMET)

Austrian Competency Centres for Excellent Technologies (COMET) – launched in 2006 – combine collaborative research with technology transfer and related training and development. The strategic focus of the COMET programme is the collaborative development of new competencies and the initiation and support of top-level long-term strategic research agendas for science and industry, as well as a desire to establish and secure technological leadership in Austrian companies. The programme aims to make Austria more attractive as a research location in the long run.

In terms of annual budgets, the COMET programme is the largest funding scheme for knowledge and technology transfer in Austria. COMET has funded two types of centre as well as individual projects. The programme is funded by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and administered by the Austrian Research Promotion Agency (FFG). About half of the funding for COMET initiatives is provided by the business sector. The COMET programme includes three different schemes:

- K1 centres: focus on strategic science-industry research agendas, maximum EUR 1.7 million of national funding per year, for a maximum duration of 8 years.
- K2 centres: equal to K1, but with higher risk and international visibility; maximum EUR 5 million of national funding per year, for a duration of 10 years.
- K-projects: development of new science-industry initiatives or collaboration between K-centres, maximum EUR 0.675 million of national funding per year, for a duration of 3 to 5 years.

A recent impact assessment (Dinges et al., 2015) showed that the programme has been successful in creating new skills. The programme has proved effective in achieving high-impact publications, innovation outcomes, qualification of young researchers and the establishment of long-term (international) partnerships and mutual trust.

Sources: Dinges, M. et al. (2015), "Wirkungsanalyse 2015 des österreichischen Kompetenzzentrenprogramms COMET Endbericht", Austrian Institute of Technology and Joanneum Research; FFG (2018), *COMET Competence Centers for Excellent Technologies*, https://www.ffg.at/comet; OECD (2018), *OECD Reviews of Innovation Policy: Austria 2018*, https://doi.org/10.1787/9789264309470-en.

Within the framework of the 2010 reform, those universities that have identified entrepreneurship and innovation as goals of their institutional development strategy have to generate an entrepreneurial vision for the future of the institution. The institutional strategic plan connects with the performance plan of the organisation. The two plans are monitored on a yearly basis. The Polytechnic of Turin provides an example of an HEI that has defined knowledge exchange and technology transfer as a goal in its strategic plan (Box 6.2).

The reform of HEI autonomy has paralleled the introduction of scientific and pedagogic innovations in many universities, as well as the increasing demand for collaboration from the society and the economy. These forces have generated the need for more co-ordination among teaching activities, research, entrepreneurship, internationalisation and digitalisation actions and respective institutional bodies. Accordingly, the commitment of the rectorate is a necessary condition for efficient organisation arrangements. The results of these co-ordination efforts emerge in the Evaluation of Research Quality (VQR)

2011-14. According to this report, Italian universities have paid close attention to their governance arrangements. In particular, most universities have started monitoring their own activities. Half of the universities have put in place specific efforts to harmonise and integrate under a common strategic vision different functions that had been created independently, including patent offices, career services, industrial liaison offices, technology transfer offices and fundraising structures. Three universities out of four have established a top third mission figure, almost always a vice-rector or a delegate (ANVUR, 2018a).

Box 6.2. Strategic targets regarding knowledge and technology transfer from the Polytechnic of Turin's Strategic Plan 2016-18

- Intellectual property creation: increase by 50%.
- Spin-off companies (companies for the commercialisation of technology resulting from the Politecnico Torino's university): further strengthening and trebling of employment and resources for keeping venture capital.
- Focus on refining innovation processes to promote the area's visibility and credibility for attracting new companies and investment.
- Share of students involved in innovation and entrepreneurship: increase by at least 25%.
- Reinforcement of competencies from the field of Humanities and Social Sciences for research and technology transfer.
- Development of new models of technology transfer in architecture, planning and design.
- Promote activities with regard to the UN's 2030 Agenda for Sustainable Development.
- Realisation of a series of events to increase outreach for Politecnico's activities.
- Realisation of a cultural centre in the "Cittadella Politecnica" on the campus: this should also be open on weekends and holidays and become a symbol of the city of Turin.

University strategies and entrepreneurial activities reflect a broad understanding of innovation practices going beyond technology transfer only

The organisational autonomy granted to Italian universities has generated many different governance arrangements supporting efforts to promote innovation and engagement with external actors. Governance diversity also reflects the heterogeneity of HEIs' approaches to entrepreneurial and innovation activities. In particular, university approaches differ and take into account factors such as geographic location, endowment with resources or age of the institution. Bronstein and Reihlen (2014) developed an intuitive typology to account for different aspects of entrepreneurial universities according to various institutional and ecosystem characteristics. This typology could be used to classify all case-study HEIs discussed in this report (Box 6.3).

Box 6.3. Typology of entrepreneurial universities

Bronstein and Reihlen (2014) – using the framework of the entrepreneurial university put in place by Etzkowitz et al. (2008) – developed four categories identifying four different types of entrepreneurial university. The typology takes into account different institutional features such as governance and organisation models, human resources, financial resources, infrastructures, missions and strategies, location and the characteristics of the ecosystem. The four types are discussed, in turn, below.

- The research-preneurial type puts emphasis on the advancement of knowledge and scientific excellence. It characterises traditional academic organisation structures (departments, faculties) with a high share of public funding (basic and competitive funds). Due to their nature as basic research providers, research-preneurial universities often host large research infrastructures. Outreach activities and industry-science relations take place through the commercialisation of basic research, resulting from specialisations and reputations in specific areas of excellence and take place on the level of projects or joint research centres with the help of industrial liaison offices (ILO) and technology transfer offices (TTO).
- Techni-preneurial institutions focus mostly on applied science and rely on strong linkages with surrounding firms. Relations with the business community can depend on institutional or individual (staff) initiatives. In this case, HEIs fulfil their role as local embedded knowledge providers for specific purposes. This setting allows for a high degree of mobility between the business sector and academia: tailor-made academic programmes in co-operation with business, entrepreneurship education and on-the-job training.
- The inno-preneurial model is characterised by flexible structures supporting HEIs in their relations with external (market) stakeholders. Inno-preneurial HEIs are able to provide innovative services and solutions to the business sector. Typically, the organisation of inno-preneurial HEIs incentivises staff to promote innovation and entrepreneurial attitudes and behaviours. Due to their proximity to business stakeholders, inno-preneurial HEIs often benefit from a high degree of private sponsoring (e.g. professional schools) and are typically located in metropolitan areas and industrial clusters.
- Finally, commerce-preneurial institutions support the commercialisation of innovations and marketable products. These institutions work closely with the private sector in specific high-tech sectors. These collaborations generate joint projects and joint ventures of entrepreneurial infrastructures, including business units, incubators and technology parks. As a result, commerce-preneurial institutions focus on market-oriented projects and develop specific capacities in public relations and marketing. The internal governance arrangements of this type of HEIs follow managerial principles.

Sources: Etzkowitz, H. et al. (2008), "Pathways to the entrepreneurial university: towards a global convergence", *Science and Public Policy*, Vol. 35(9), pp. 681-695; Bronstein and Reihlen (2014).

In reality, it is quite difficult to find HEIs that are a perfect fit for one of the categories of Bronstein's and Reihlen's typology. In most cases, HEIs actually fall into more than one category, due to their multifunctional roles, stemming from path dependencies in their

development, governance structures, environment and culture (Unger and Polt, 2016). Yet, Bronstein's and Reihlen's typology is useful to classify Italian institutions, such as Rome Tor Vergata, which fulfils many characteristics of the research-preneurial model (acquisition of European Research Council [ERC] grants and Departments of Excellence) or the University of Bologna, which combines techni- and commerce-preneurial attributes (Box 6.4).

Box 6.4. University of Bologna – Strategic governance model

Since 2015, following the election of a new rector and some innovative governance arrangements, the University of Bologna has been focusing on academic entrepreneurship. The new leadership found a situation in which many interesting initiatives were in place; yet due to the lack of central co-ordination, the implementation of these different initiatives was not efficient and generated duplication of efforts.

To eliminate duplications and promote synergies among different initiatives, the university created a new organisational unit in charge of addressing university-industry engagement. In particular, the new unit had a threefold objective:

1. Increasing the number of institutional university-industry agreements.
2. Enhancing the capacity to generate value from research results by creating spin-off companies.
3. Strengthening student entrepreneurship and, generally, promoting the development of entrepreneurial mindsets.

The university created two separate subunits/divisions, each staffed with a director and three administrative units to work on the three objectives mentioned above. The new rector nominated the first Vice-Rector for Entrepreneurship in the history of the University of Bologna. The rector put in place a new plan to enhance linkages with the ecosystem and with global stakeholders, with the specific aim to create a network able to support university start-ups in their development.

As a result, the University's Strategic Plan for 2016-18 focuses on promoting cultural development, economic and social innovation and strengthening relations with external stakeholders at the regional, national and international levels, as well as enhancing services to support entrepreneurial students. Actions include:

- The AlmaEClub initiative, which aims to increase awareness of entrepreneurship and promotes networking related to entrepreneurship among its faculties. AlmaEClub involves more than 200 faculty members from all departments. AlmaEClub members get together periodically to discuss and contribute to specific projects concerning entrepreneurship carried out in the university.
- AlmaLaBOr, a co-working space and a digital manufacturing workshop (makerspace).
- The Alma Cube incubator, founded by the University of Bologna together with Confindustria Emilia-Area Centro (a regional branch of the Italian industrialist association), which assists aspirant entrepreneurs in starting up their initiative and creating conditions for their growth through relations with institutional investors at the national and the international levels.

Many Italian universities, however, have enlarged the scope of their engagement and go beyond the commercial activities that the Bronstein's and Reihlen's taxonomy takes into account. This is in line with the model that Goddard (2009) and Henke et al. (2015) have developed to discuss the "civic" (or engaged) university. This approach considering HEIs as public good providers has also been adopted in the Italian evaluation model of third mission where not only technology transfer activities – for which universities have a long tradition – are assessed, but also new forms of knowledge valorisation in the fields of health research, cultural activities and heritage and lifelong learning (see section "Evaluating the third mission"). Such a *broad* definition of third mission evaluation is deeply influencing universities' culture on engagement and societal impact, enhancing a better awareness of their cultural role and social mission. Besides being evaluated in terms of quantities and excellence, research and education outcomes also need to be assessed in terms of their relevance for society. This includes the ability to help solve societal challenges such as ageing, sustainable energy production, smart mobility solutions, etc. Many HEIs in Italy are developing activities to contribute to these missions. For example, several case-study universities have been organising their engagement/third mission activities on the basis of the 17 Sustainable Development Goals (SDG), as defined by the United Nations. SDGs provide universities with a co-ordination platform and facilitate interaction with external stakeholders that are also using sustainable development goals to inform their strategies. Social inclusion represents a core function of civic-oriented HEIs. Universities can promote social inclusion by providing access to higher education to all social groups. Universities can also promote greater employability of graduates by generating skills profiles that match the needs of (local) labour markets. Increasing student employability, for instance, is a core target of Italian education policies. Other measures to promote social inclusion target the ecosystems; HEIs can engage with social or cultural activities and open their campuses and facilities to their communities.

The civic engagement of universities has typically a strong place-based dimension. HEIs focus on their direct impacts with their regional ecosystems. This place-based approach to engagement characterises most case-study universities in Italy. The aim to contribute to the skills and the cultural development of local communities tops their engagement agenda and makes universities important actors (or even drivers) in local development dynamics.

The new campus of the University of Naples, in San Giovanni a Teduccio, represents a good example of this link between the university and its community. The campus is located in an impoverished neighbourhood of Naples and was built on the brownfield of an abandoned industrial site. This was a strategic choice aiming to support the development of the local environment of the campus by attracting companies and other actors to this location. The presence of the university has generated positive spillovers, i.e. university employees, students and national and international visitors have generated a new demand for goods and services. For instance, to favour the positive spillovers for the local community, there are no restaurants or cafes on campus.

The social responsibility programme "Polisocial" of the Polytechnic of Milan represents another example of civic engagement. Polisocial connects ethical and social challenges to research and teaching activities in the university. The aim is to create a linkage between the activities undertaken within the university, and social issues and needs arising in the ecosystem (the surrounding community) and at the global level. Polisocial promotes multidisciplinary approaches and projects for human and social development. It represents an umbrella for a variety of initiatives carried out under the aegis of Polytechnic of Milan, in collaboration with public and private foundations, non-governmental organisations (NGOs), companies and public authorities. These activities should contribute to the

development of capabilities and values for future generations to cope with societal and ecological challenges.

The University of Cagliari is another case in which the civic engagement tops the strategy of the institution. The university's core mission is to contribute to the social and economic development of Sardinia. The university has established close collaborations with the regional government and local private investors. The overarching goal inspires various activities, including: i) co-operating with local business – especially SMEs –; ii) tailoring teaching activities to local needs (for example, in the field of information and communication technology [ICT], which represents a key industry in the local ecosystem); iii) supporting spin-offs and start-ups in the CLab contamination lab; and, finally, iv) helping unemployed individuals get back on the labour market by developing their own entrepreneurial activity. In addition, the University of Cagliari has also organised information campaigns to raise awareness about violence against women.

The University of Bari, among others, has put in place a service to facilitate the integration of immigrants and refugees in the labour market. The university delivers this service through its Centre for Lifelong Learning (*Centro per l'Apprendimento Permanente*, CAP), which was created to promote lifelong learning and certify formal and informal skills of individuals. In its activity to support refugees, CAP helps with the accreditation process of foreign education certificates and supports inclusion into the respective study programmes at the University of Bari.

Italian universities are also important cultural actors, conducting research activities and protecting and promoting regional cultural and historical assets. There are several examples of such efforts (see Chapter 2), which are often supported by regional authorities (regional governments) that allocate financial resources to local universities to strengthen their capacity to promote cultural activities. This is the case of the University of Siena, particularly embedded in its local ecosystem, which acts as a provider of cultural and archaeological services for both the Tuscany Region and the municipality.

In general, entrepreneurial and civic HEIs contribute with all their missions – teaching, research and engagement – and innovation capabilities to the economic and societal development of their local, regional and national communities (Meissner, Polt and Vonortas, 2017). To function holistically and generate impact, however, HEIs requires new institutions and organisational changes. HEIs have to adopt innovative management models that allocate resources based on the performance of commercial, research and teaching activities. This also requires innovative and flexible structures, and entrepreneurial skills and mindsets in the administration and strategic choice of actions. At the same time, it is important to allow for new and innovative management solutions in public interest institutions (Klofsten, 2018) to promote innovation. In that respect, the way universities such as Bari, Cagliari and Federico II Napoli are challenging their structures and processes – as described above – could be assessed to fit attributes of the "inno-" or "commerce-preneurial", though not solely emphasising commercial activities.

Mainstreaming gender diversity as facilitating factors for innovation

Gender diversity, i.e. the participation of women in institutional leadership and research groups, has become a prominent factor in the assessment of higher education institutions. Evidence from the business sector points to a correlation between diverse leadership and better economic performance (see Hunt, Layout and Prince, 2015).

From a research and innovation perspective, mixed teams are keener to innovate, more creative in problem-solving activities and more competitive with regard to publication

performance, acquisition of competitive grants, etc. (see Powell, 2018; Campbell et al., 2013; Pollitzer and Schraudner, 2015). Gender equality and gender mainstreaming have become core dimensions in the European Research Area (ERA). The aim is to translate national gender legislation into effective actions to address gender imbalances in research institutions and decision-making bodies, and integrating the gender dimension better into research and development (R&D) policies, programmes and projects (ERAC, 2015). In a dedicated meeting held on 1 December 2015, the Council of the European Union recommended member states strengthen measures to strive for gender equality in this field, especially in leadership and decision-making positions, through the identification of specific targets and quantitative objectives for better gender balance in decision-making bodies including leading scientific and administrative boards, recruitment and promotion committees as well as evaluation panels and to encourage research funding and performing organisations to reach these targets by 2020 (Council of the European Union, 2015).

Within this context, universities are at the forefront to respond to the challenges related to gender diversity. This is due to several factors. For example, universities promote societal development. In addition, universities are confronted with growing needs with regard to changing student population, internationalisation of student flows, research and migration. Several European countries have developed policies and tools, e.g. agreements and indicators, on gender-specific targets for universities. These include specific criteria in competitive funding programmes, as well as specific programmes to promote the participation of women in the top levels of science and research hierarchies (see Evaluation Framework for Promoting Gender Equality in Research and Innovation, EFFORTI, 2017).

In Italy, however, there is the impression that national policy does not consider the promotion of gender diversity in the higher education sector as a national priority. In fact, even though female presence among professors is growing (from 2.6 out of 10 in 1988 to 3.8 in 2017), persistent inequality is reported in the opportunities to climb the ladder as well as persistence in the leaking pipeline phenomenon in women' academic careers from graduation to apical stages of professorships. Moreover, insufficient integration is still observed in the horizontal dimension, by the scarcity of women in some specific disciplines (ANVUR, 2018b). This national trend is sometimes contradicted by successful practices, at the local level. For example, the University of Cagliari aims to promote innovative start-ups within their local contamination lab, CLab, by emphasising the heterogeneity of student teams during their participation in the programme. The University of Cagliari is one out of two Italian universities where the rector is a woman. The Politecnico Milano has defined strategic targets with respect to gender equality in its current strategic plan for 2017-19. Planned activities comprise the development of a programme to foster equal opportunities by putting in place measures that increase the number of women enrolling and completing STEM (science, technology, engineering and mathematics) courses.

National policies for students are also facing the challenge of raising the share of female students in STEM disciplines. The PLS (Plan for Scientific Degrees) is intended to help students in developing their own academic path within scientific disciplines, encouraging enrolment in such programmes. As female participation in these disciplines is often low, project promoters are also asked to implement targeted measures to encourage young female students to enrol in science.

A stronger and structured approach to gender issues should become a core principle guiding the design of measures, programmes and goals in future national science, research and innovation policy planning. Italy could inspire its policies following tools and best practice examples provided, among others, by the EFFORTI project (Evaluation Framework for

Promoting Gender Equality in Research and Innovation, https://www.efforti.eu/), which is financed by Horizon 2020 and aims to model the impact of different actions to promote gender equality in research and innovation activities undertaken in European countries.

Mechanisms of selection of the university leadership: An international comparison

The recruitment processes for leading managerial and academic positions can be a key way to promote diversity and the development of new ideas. This is reflected by the fact that the performance indicators for Italian universities include the percentage of external professors hired per year.

Italy has remained one of the few OECD countries in which the appointment of the rectorate is still based on an internal election process. Although there are several examples of vital and strategically oriented university leaderships, international comparisons have provided evidence that collegial models like the one adopted in Italy tend to negatively affect institutional leadership (OECD, 2008). In particular, being elected by internal bodies and deans, it proves generally difficult for new rectors to overcome institutional path dependencies. In addition, in Italy, the share of external stakeholders seating in the board of governors is limited, when compared with international practices. There are several examples, among OECD countries, illustrating other ways to elect university leadership (OECD, 2008). Box 6.5, below, illustrates the example of Austria.

Box 6.5. The appointment process for rectors in Austria

In Austria, the rector is elected by internal and external stakeholders. The appointment of a new rector in Austria follows the decision of the university board based on a proposal of three candidates by the university senate and the university's collegial body. The university board is the institution's supervisory body. It encompasses, in equal shares, members appointed by the university senate and members selected by the ministry – who are typically externals stakeholders. There is also an external stakeholder elected consensually by both parties (for a maximum total of nine members).

The rector is appointed for a four-year term. The recruitment process has to be initiated by a public announcement of the vacancy of a rector's position at least eight months before the incumbent rectorate finalises its term.

A special commission, gathering the heads of the board and the senate, is responsible for the selection of candidates among applicants. This commission can also actively search for candidates who have not applied spontaneously. Basic selection criteria include international experience, and organisational and economic management capabilities. Four months after the publication of the call for applications, the commission selects three candidates and presents them to the senate. The senate may either approve the proposal or ask for adjustments. After this stage, the board receives a final shortlist of three candidates for the final decision. The appointed rector has to propose a team of vice-rectors to be approved by the senate.

Rectorates can be re-appointed with a qualified majority of two-thirds of votes in the senate and on the board. In this case, no appointment process is initiated. There is no limitation to the number of times a rectorate can be re-appointed.

Source: BMBWF (2002) University Act of 2002; Section 2, Vienna.

Competitive funding mechanisms for Italian HEIs

Italy put in place a new funding system of higher education institutions in parallel with the reform of universities' autonomy. The Italian higher innovation system encompasses 67 public universities. The public funds allocated by the central level, however, seems to be undersized compared with the relatively large dimensions of the system. In 2015, Italy allocated public funding equal to 0.9% of gross domestic product (GDP) to tertiary education. This level is well below the EU average of 1.3% (OECD, 2018). Research expenditures of Italian higher education institutions (higher education investment in R&D, HERD) represent 0.35% of GDP, a level in line with Korea (0.39%), Spain (0.35%), Greece and Ireland (0.31% each), but below the OECD average of 0.43% (OECD, 2016). In more general terms, although the downturn in public funding allocated to the higher education sector in the aftermath of the crisis has been brought to an end in 2016, recovery has not yet brought it back up to 2009 levels (EUR 7.36 billion in 2018 compared with EUR 7.83 billion in 2009).

The funding system encompasses three components, following different allocation criteria to state universities. These components are: i) a mixed allocation based on the historic cost faced by HEIs and the standard cost per student; ii) an allocation based on the performance of research; and iii) a smaller share to help HEIs deliver better services to students. These three dimensions are listed and discussed in turn below.

- The first and largest share represents 55% of the total fund allocation (as of 2018). To allocate resource, the funding mechanism takes into account the structural features of HEIs. First of all, the historic allocation of funds – about 55% of funds in this component are allocated following this path dependence principle. Second, the average standard cost per student (CSTD) is calculated based on: programmes offered; number and qualifications of academic staff; number of non-academic staff and services offered; socio-economic conditions of the students (i.e. average income of the region and potential fees to be collected); and finally, the availability of public transportation. The aim of the reform in the near future is to phase off path dependence and allocate funds to HEIs only on the basis of the CSTD. This should improve the provision of tertiary education and highly skilled graduates entering the Italian job market. In addition, this would help the country increase the number of workers holding diplomas from universities, as Italy ranks on the lower end of the OECD country ranking regarding share of tertiary educated people in the 24-34 age group (OECD, 2017a).
- The second funding stream is the so-called *Quota premiale* (performance-based funding) and represented about 24% of overall public funding to HEIs in 2018. The largest share (about three-fifths) of *Quota premiale* is allocated on the basis of the periodical Evaluation of Research Quality *(Valutazione della Qualità della Ricerca*, VQR), undertaken by the National Agency for the Evaluation of University and Research (ANVUR). The remaining two-fifths of funding allocated by the *Quota premiale* are equally distributed for the quality of recruitment (one-fifth) and for self-defined targets concerning the quality of research environment, quality of teaching and internationalisation (one-fifth). Compared to international standards, the share of public funding allocated on the basis of *ex post* performance indicators to Italian HEIs is very high (OECD, 2017a). For example, similar systems, in place in Denmark, Finland, the Netherlands or Sweden allocate a total of about 2% of public funding or even less, based on performance evaluation.

- The third component of the funding system is the so-called *Quota interventi specifici* (funding for ad hoc initiatives). This component allocates additional funding to compensate for "shocks" (i.e. volatility) in state transfers (21% of total public funding in 2018) and to support targeted measures. These measures include funding of institutional strategic plans, resources for students' welfare and services, grants for doctoral students and incentives for the recruitment of academics and young researchers. The *Quota interventi specifici* allocated EUR 900 million to these measures in 2017.

Aside from being a central pillar for public university funding, VQR results are also the basis for the allocation of additional competitive funding for the implementation of Departments of Excellence (*Dipartimenti di Eccellenza*). Departments of Excellence receive targeted financial support from the Ministry of Education for a period of five years. The selection system ranked the best 350 departments according to their VQR performance between 2011 and 2014. Departments of excellence can use these extra funds to recruit academic and non-academic staff, build infrastructures for research, and provide financial incentives to the personnel to develop 2nd and 3rd-cycle study programmes.

Italian universities have become acquainted with evaluation processes. Several case-study universities – while not being enthusiastic about the funding framework – pointed out that mechanisms such as the system of performance indicators and the VQR evaluation procedure, implemented by ANVUR, have become important vehicles to increase the acceptance of performance monitoring and then the efficiency of tertiary education institutions. It also allows each university in Italy to be able to benchmark its positioning in the system. Additional competitive funding streams exist but they are limited in scale and fragmented

A specific feature of the Italian research system is the absence of large (public) intermediaries or funding institutions. In many OECD countries, these entities serve as vehicles for the steering of the academic system by the provision of financial incentives, allocated through competitive bottom-up or thematic programmes. The Italian Fund for Investments in Scientific and Technological Research (FIRST), which operates under the aegis of MIUR, can provide HEIs with financial incentives for industrial research and pilot projects. However, FIRST's budget is small compared with the size of higher education in Italy: about EUR 84 million in 2018. For example, the Austrian Fund for Scientific Research (FWF) – an independent body that finances excellent research activities – has an annual budget of about EUR 220 million. Likewise, the Swiss National Science Foundation (SNF) – another entity supporting mainly basic research – supported HEIs' R&D projects with about EUR 880 million in 2017.[4] Agencies such as the Swedish VINNOVA, the Austrian Research Promotion Agency (FFG) or the Research Council Norway (RCN) would be examples for independent intermediaries with a broader set of missions, including applied research and development, innovation support as well as strategic task and knowledge creation.

Italian universities partly compensate the relative scarcity of public funding allocated by the centre with alternative sources. HEIs receive funds from students, the private sector, regional governments, funding agencies and from the European Union's Framework Programmes for R&D. These sources of funds are particularly important for activities in the areas of entrepreneurship and innovation. As an example, in some case-study universities, funding from these sources nearly equals the amount of funds allocated to them by the *Quota premiale* system. While the diversification of funding sources is generally a positive feature of national systems, the fact that Italy displays large variations

in the economic performance of regions penalises universities localised in the south of the country. In addition, some structural features of the Italian economy, such as the large quantity of SMEs, cause the R&D expenditure of business to be generally low compared to the European average (1.33% of GDP in 2016), with the sole exceptions of Piedmont (1.78% in 2016) and Emilia-Romagna (1.49% in 2016).[5] Consequently, many universities find it difficult to attract funds from local businesses in their ecosystems.

Italian HEIs' capacity to engage is negatively affected by the vast regulatory framework they are subjected to as public bodies. Based on evidence collected in case studies, there may be a disconnect between the formal institutional autonomy of universities and the cumbersome regulations and specific (sometimes conflicting) incentives offered by the government (cf. European Commission/EACEA/Eurydice, 2015; Claeys-Kulik and Estermann, 2015).

An example of this disconnect is that the evaluation system takes only into account the research performance of HEIs. It provides an adverse incentive for diversifying institutional strategies, *de facto* limiting the internal steering autonomy of universities. Bibliometric indicators are quite common in performance-based allocation mechanisms in use in other European countries. However, in Denmark or Finland, for instance, the performance-based mechanism that assesses research outcomes allocates about 2% of the total public funds to HEIs. Conversely, in Italy, the funding scheme emphasises research at the expense of other HEI missions. The current emphasis on scientific excellence at the level of individual entities and researchers is widely perceived to have a crowding-out effect on entrepreneurial and third mission activities.

In addition, the system rewards HEI performance at a given point in time, taking into account only, to a limited extent, positive trends. Gaps between HEIs, in terms of their financial endowments, crystallise and the divide between northern and southern universities may risk getting bigger and bigger. In the same vein, the Department of Excellence scheme – with the majority of these departments located in northern universities – generates conflicting incentives, especially with regard to the promotion of inter-disciplinarily and transversal competencies. In order to maximise the number of citations, researchers may adopt a risk-averse attitude and prefer to continue publishing in "safer" scientific domains rather than initiate new (interdisciplinary) areas of research that may not guarantee the same number of citations in the short run.

Not only do funding schemes provide limited resources to HEIs, they are also fragmented. One example – particularly important for the entrepreneurial and innovation agenda – is represented by the lack of co-ordination between the Research Projects of National Interest Scheme (PRIN), and the cluster initiatives connected with Italy's Industry 4.0 strategy. PRIN is a MIUR initiative and totals EUR 3 million (as of 2017). National technological clusters depend on the Ministry of Economic Development and have a total endowment of EUR 73 million, which funds 8 competence centres. Co-ordination between these two policy actions would help technological progress in Italy's productive sector.

There is also duplication of efforts to promote vocational educational training at the tertiary level. For instance, some Italian universities have started implementing the *Lauree professionalizzanti.* These programmes may overlap with those provided by *Instituti Tecnici Superiori*, since their basic orientation towards market-oriented tertiary education is similar (OECD, 2017a). To manage the development of vocational educational training at the tertiary level, Italy could take into account the example provided by the Netherlands' Top Sector Approach, launched in 2011 (Box 6.6).

Box 6.6. The Netherlands' Top Sector Approach: Adopting a market-oriented approach to tertiary vocational education and training (VET)

The Dutch government launched the Top Sector Approach in 2011 to align public resources for R&D and innovation strategically, along with nine "top sectors". This policy marks a significant evolution in the Netherlands' innovation policy, which adopts a "demand-driven" perspective. Stakeholders in the business sector, tertiary education and research sector are encouraged to join forces, explore new markets, technologies and products.

The nine strategic sectors, considered as a priority by the policy include agri-food, horticulture, high-tech systems and materials, energy, logistics, creative industry, life sciences, chemicals and water. These sectors together account for over 80% of the Netherlands' business sector R&D expenditures, 55% of exports, but only 30% of value added and employment share. The policy promotes collaborative research of science-based entities and business, including SMEs. The policy has adopted a sectoral approach for two major reasons: i) to overcome existing barriers between several government departments and ministries involved; and ii) to leverage private investments through close co-operation between public and private actors in the respective fields. The annual estimated budget has been about EUR 1.1 billion per year between 2013 and 2016.

"Top teams" encompassing high-level representatives from industry, public research and the government, identified the top sectors to become the target of the policy. These top teams formulated strategic agendas for each of the top sectors. The implementation of the strategic agendas was handed to "top consortia for knowledge and innovation" (TKI), based on public-private partnership of businesses and higher education and research institutions. The government has reimbursed private partners in the TKIs for their engagement, allocating EUR 83 million in 2013.

The innovation contract signed in 2013, allocated a total investment of EUR 2 billion for the 9 top sectors over a 2-year period, of which EUR 970 million from the private sector. EUR 36 million are invested to harmonise top-sector activities with the societal challenges formulated in Horizon 2020 and to promote parallel implementation.

The top-sector initiative includes the so-called Technology Pact. These are a cluster of targeted measures and funding along all stages of education cycles, to increase skills and human resources in areas related to the top sectors.

Sources: Polt, W. et al. (2015), *The Leverage Potential of the European Research Area for Austria's Ambition to Become One of the Innovation Leaders in Europe – A Comparative Study of Austria, Sweden and Denmark*, Studie im Auftrag des ERA Council Forum Austria; OECD (2014), *OECD Reviews of Innovation Policy: Netherlands 2014*, https://doi.org/10.1787/9789264213159-en.

The lack of long-term planning is an obstacle in the development of partnerships with external stakeholders

The funding system is also challenged by the lack of long-term planning, which negatively affects the sustainability of the initiatives and policies put in place by HEIs. Uncertainty about the availability of resources generates pressure on HEIs which have to fundraise to sustain their innovative activities. Contamination labs represent a good example of the negative effect of the lack of strategic funding and provide students with entrepreneurial education programmes. These programmes are often pre-incubation support for the creation of business start-ups. Contamination labs promote interdisciplinary exchange

among students, organised in small teams generating and implementing innovative ideas. Experts from the private sector support students in developing business ideas and, eventually, their start-ups. To participate in the contamination lab programme, students have to go through a competitive process. The programme lasts six months. In some cases, as in the University of Cagliari, the contamination lab has gone beyond its original scope and has generated linkages with the local community supporting lifelong learning and entrepreneurship programmes for unemployed individuals.

There are 19 contamination labs in Italy and these entities have created the CLab Network (http://clabitalia.it/contamination-lab). National programmes support start-up creation. For example, the national award for innovation, PNI Cube (*Premio Nazionale Innovazione*), selects academic start-ups among the winners of the regional business plan competitions (Start-Cups). Pre-incubation activities of contamination labs rely on institutional and regional funding, including the European Union's structural funds, and private investors. Contamination labs can be considered a successful practice in terms of entrepreneurial education, which would benefit from strategic funding. Italy could take inspiration for its policies to support academic entrepreneurship from the Austrian "AplusB" (Academia plus Business) initiative.

Box 6.7. Promoting academic entrepreneurship: The Austrian AplusB programme

Austria created the Academia plus Business – AplusB – Programme in 2001, with the aim of promoting academic start-ups. In particular, the policy promotes the creation of academic start-ups that mirror the local requirements in terms of innovation and skills. The AplusB programme receive funds from regional/state governments and the private sector. The federal government generates around one-third of the overall funding for the centres: approximately EUR 32 million over the decade 2002-12. The Austrian Research Promotion Agency (FFG) created seven AplusB centres in the 2012-17 funding period.

AplusB centres are incubators and function in close collaboration with universities. The centres offer a wide range of support services, which include individual advice and coaching, provision of office premises, raising public awareness and support with funding and internationalisation. The incubators have a different thematic direction against the background of the relevant priorities and directions of the universities and Universities of Applied Sciences (UAS).

AplusB centres focus on academic spin-offs by scientists, students and graduates, although the target group was expanded in the second funding period from 2007 to include academics with professional experience, coming from the business sector. Since 2016, the updated programme "aws AplusB scale-up" has generated incubators specialised in supporting start-ups with high-growth potential.

Sources: BMWFW/BMVIT (2016), *Austrian Research and Technology Report 2016. Report under Section 8(1) of the Research Organisation Act on Federally Subsidised Research, Technology and Innovation in Austria*, http://www.bmwfw.gv.at/ftb.

HEIs and the regional dimension

In Italy, the regional dimension is particularly important for HEIs. Regional governments, agencies and local businesses represent sources of financial support. Regional stakeholders finance activities related to: i) knowledge transfer, entrepreneurship and innovation; ii) the

protection of local cultural heritage; and iii) the provision of tailored education programmes, matching the skills needs of local ecosystems. Knowledge dissemination, on the model of the "European Researchers' Night", is another activity HEIs carry out at the regional level, by opening their facilities to the public.[6] The very presence of university buildings and campuses may represent a driver for development in regional ecosystems, as illustrated by the examples of the University Federico II in Naples (San Giovanni a Teduccio neighbourhood) or the Cesena campus of the University of Bologna. Due to an increasing understanding of their role as agents of socio-economic development in regional ecosystems, several Italian universities have adopted a "*bilancio sociale*", an annual report discussing the results achieved in terms of local impact.

HEIs have embraced the smart specialisation paradigm and, especially in the south of the country, they have become acquainted with the use of European Structural Funds and in particular, the European Fund for Regional Development (ERDF). This represents an important evolution compared with the past when the local "engagement" agenda of HEIs was limited to the inclusion of representatives from regional communities in governing bodies such as the administrative board. As mentioned in several interviews with stakeholders met on study visits, the new approach – inspired by the smart specialisation agenda and financed by European Structural Funds – generates a new framework for regional engagement, which involves HEIs in ambitious and structured policy actions promoting development (triple/quadruple-helix). Box 6.8, below, illustrates the case of Cagliari in this perspective of local engagement.

Box 6.8. Example for regional engagement: The University of Cagliari

The University of Cagliari's mission statement aims to create knowledge and innovation capabilities for the regional ecosystem. The university is at the centre of a dense regional network that generates strong ties with main Sardinian stakeholders including from the regional government, the business community, venture capitals and social agents.

The regional ecosystem formalised this network in 2018, by creating a centralised stakeholder committee, which is based on a "triple helix" model involving university leaders, the regional government, the business community and other stakeholders. The committee, which should function for at least a year, sets development targets to improve Sardinia's economic and social performance.

The committee, however, is not the sole example of the University of Cagliari's regional engagement agenda. For instance, another important institution is represented by the university's Centre for Innovation and Entrepreneurship Activities (CREA). CREA operates in direct collaboration with regional businesses and is co-funded by European Structural Development Funds. CREA supports the following activities:

- "Unica&Imprese" (www.unicaimprese.it), an annual event involving more than 100 researchers and more than 200 companies, with the aim of establishing new collaborations. Unica&Imprese displays the research activities of the University of Cagliari giving companies the possibility to familiarise with recent technological progress.
- "Emerging organisations" (EOS) offers university know-how and intellectual property management via training, consulting and technical assistance. EOS aims to advance the creation of businesses in the ICT sector. With the support of

European Structural Funds, the project targets unemployed individuals and residents in Sardinia with high-school diplomas. Half of the positions in the training programme are reserved for women.

- "Imprinting" is another initiative, funded by the Sardinian regional government, targeting unemployed individuals and, in particular, the long-term unemployed to support them in starting their own business or engage in small- and medium-sized enterprises.
- "Nemo", also funded by the structural funds, aims to activate new economic dynamics in rural Sardinia, by creating a platform for the creation of businesses and self-employment projects in information and communications technology, agri-food, tourism and cultural heritage.

Ecosystems, while local, are not confined to a given territory; they can use local linkages to develop broader networks of stakeholders and provide specialised services to different communities. An example of this kind of "ecosystem" is represented by the federation of the *Scuola Superiore Sant'Anna*, the *Scuola Normale Superiore* in Pisa and the *Istituto Universitario di Studi Superiori*, IUSS, in Pavia. These "schools" have been characterised by the excellence of their research, but also by their small size (a result of their highly selective recruitment process). The aim of the federation is to maintain "excellence" while at the same time gaining critical mass by sharing some services/activities in order to generate a common culture, including for engagement, which capitalises on the features of the three institutions. In other words, the federation should bring about sustainable innovation in these institutions. In particular, by joining forces, these three schools aim to become more visible and competitive at the international level, a dimension in which their size has increasingly represented a handicap. This new organisational solution, based on "institutional innovation", is a result of the 2010 autonomy reform and is a good illustration of the possibility to generate "critical masses" in research and teaching without the need to merge institutions. The federation between the Pisa-based schools and the IUSS is the result of a three-year programme (2016-18), approved and supported by MIUR.

Individual incentives and recruitment mechanisms supporting engagement

Reforms introduced in 2010 have created new institutions and practices that are positively affecting the performance of the Italian HEIs in their three main missions. So, for instance, while the VQR and the tri-annual strategic planning exercise have contributed to increasing awareness of the academic staff for performance and research quality, the creation of the position of "general manager" has spurred business-oriented processes and structures within institutions.

In the same vein, the autonomy reform has provided HEIs with the possibility of rewarding staff for their support of the overall development of the institution (e.g. the third mission results, the amount of third-party funding, etc.). In other words, HEIs can set the criteria for salary progression of academic staff by taking into account factors that go beyond performance in research and teaching. In particular, Law 240/2010 put in place a new financial tool that provides salary incentives to academic and administrative staff contributing to the development of the institution – the so-called *Fondo per la Premialità* (Fund for incentives). HEIs can decide on the criteria to assign rewards to staff but the law requires that HEIs define these criteria in their tri-year strategic development plan. The *Fondo per la Premialità* depends on institutional funding and matching funds provided by

the Ministry of Education. The *Fondo* can also be supported by resources allocated to Departments of Excellence.

However, despite the possibility of rewarding staff for their engagement activities, only 9 out of 67 public universities applied for additional funds for the "Fondo Premiale" in the 2016-18 planning period. Based on study visits and interviews with stakeholders, it seems that HEIs share a common practice to provide financial incentives only to administrative staff, who are hired on private law basis and, differently from academic staff, do not have to fulfil the same regulations as civil servants.

To incentivise staff undertaking activities related to third mission, there is a need for new indicators in the evaluation system. In interviews with university stakeholders, it was unanimously stated that the national funding system, including incentives for individual researchers, is very much biased towards research in terms of publication and citation indicators. This situation provides little incentives to HEIs to connect scarce resources with many different priorities. The same holds true for the recruitment process. According to stakeholders, when hiring, universities cannot take into account social skills and experiences with respect to entrepreneurship. Based on the information collected in the field, a crucial factor hampering the implementation of a reward system as prescribed by Law 240/2010 was also often reported to be the lack of a standardised, transparent and effortless monitoring system to allow a fair assessment of the results reached by universities in the area of third mission.

Stakeholders look with great interest at ANVUR's efforts to develop a new model supporting the evaluation of third mission activities and of the impact of academic research (see subsequent section) and are requesting performance-based incentives.[7] Universities themselves are also very proactive in contributing bottom-up to the construction of the evaluation model proposing as standards their promising experiments (such as some promising experiments in the reward systems) and good practices (for example, the inclusion of music activities for the local community and institutional sustainability initiatives). Nonetheless, there is the impression that formal institutional autonomy is jeopardised by constraints set by rules and bureaucracy: universities have to balance a variety of objectives at the same time. Despite this background in which there are scarce resources supporting engagement and impact, Italy is home to some good practices. For instance, creative non-monetary incentives for academic staff include the provision of sabbatical years, to put in practice innovative ideas, or a different computation of working hours, when the academic staff works in a spin-off. Some universities such as the University of Bari consider that the work undertaken by academic staff in a spin-off company does not conflict with research and teaching duties, this to circumvent the regulation that allows academics to carry out professional activities and consultancies in part-time positions only with the authorisation of the rector.

Other incentives include rewards for inventors of intellectual property rights (IPRs) owned by the university. By law, universities have to give inventors a minimum of 50% of the revenues generated by university-owned patents. The inventor has to use these revenues for research or other academic activities. In some institutions, the share of revenues allocated to the inventor is higher. For instance, the University of Cagliari gives inventors 65% of the revenues generated by patents owned by the institution. In other cases, the additional revenue is allocated to departments that can use it to incentivise patenting activities of the university or to increase the share of the university in the ownership of a given patent. Due to the so-called professor's privilege, patents owned by universities represent only 36% of all academic patents (ANVUR figures for 2011-14 period). The

patenting activity, however, is highly concentrated in a few institutions, about 50% of patents in 12 universities, while in the case of university-owned patents the same share is concentrated in 9 institutions (ANVUR, 2018a).

University stakeholders met by the OECD delegation have been particularly vocal about the new regulation (*Legge sulle participate*) that prohibits universities holding shares in new spin-offs. According to stakeholders, this regulation may challenge academic entrepreneurship, due to the fact that the performance evaluation carried out by ANVUR consider patents and spin-offs on the same level. In addition, by reducing their participation in spin-offs, the university may lose an important source of income that finances other activities. Finally, another argument put forward by stakeholders to criticise the new regulation is that the university's participation in a spin-off is a sign of credibility and stability for potential investors interested in the business. So, the regulation, which aims to avoid university participation crowding out private investments, would actually have the opposite result (Netval, 2017).

HEIs propensity to the entrepreneurship and innovation agenda depends also on students' attitudes and demands. In particular, academic staff seems to be characterised by an age gap. "Older" researchers tend to have a lesser drive towards innovation and market exploitation of research. Vice versa, younger researcher and students are generally more open-minded towards innovation and entrepreneurship. Another key factor driving entrepreneurial attitudes is the increased internationalisation of academia. This includes student exchange programmes and international research collaboration, which challenge traditional practices and promote innovation (see also Chapter 4 on internationalisation).

A good example is that of the University Tor Vergata, which has created mixed teams of academic researchers. Individuals of different age groups and level of hierarchy work together to promote cross-fertilisation of mindsets. To create these mixed teams, the university undertook an activity to map the "professional" skills of academic and administrative staff (about 800 people surveyed). The initiative took place as a basis for further career development plans and training programmes. Information about skills needs within the university informed a large hiring programme for non-academic staff and, in particular for professional skills in areas such as business and technology transfer management.

The University of Bologna has created its incubator – AlmaCube – to promote open innovation and create opportunities for collaboration and professional development. The university and incubator launched an open innovation programme to promote the development of entrepreneurial careers among students and young researchers. The open innovation programme puts in place actions that bring together multidisciplinary students from different universities and challenge them to solve real industry problems. Several international good practices engage students in innovation processes, as in the approach of the University of Bologna. For instance, a well-known example is that of DEMOLA in Tempere (Box 6.9).

Box 6.9. DEMOLA Tampere – An open innovation platform of co-creation and agile experiments for students, businesses and universities

The Finnish 6City programme, with the support of European Structural Funds, launched the New Factory DEMOLA in 2008. DEMOLA aims to facilitate joint business-academia creation processes. DEMOLA adopts the paradigm of open innovation to support the process that turns an idea or a need into a working demonstration, prototype or business concept.

At its start, DEMOLA benefitted from the support of the three universities in the region of Tampere: the University of Tampere (UTA), the Technical University Tampere (TUT) and the Tampere University of Applied Sciences (TUAS). The primary focus of DEMOLA was on local business requirements and collaborations. Since then the initiative has grown into a global innovation ecosystem that works in 15 countries and that involves approximately 60 universities worldwide.

The basic principle of DEMOLA is engaging students in development processes for companies. Companies and universities start co-development projects. The former get the opportunity to involve university students in their problem-solving activities. The latter can offer students real-life training experiences.

DEMOLA co-creation projects typically last three to four month and include:

- A challenge defined by the partner company or other organisations.
- A call for a team of multidisciplinary and multicultural students. The company can also identify participants in the project.
- An eight-week facilitated development process and a set of milestone outcomes such as a value creation workshop, pitching workshops and a testing afternoon.
- Value/demo created by the team. IPR owned by the team.

Today DEMOLA is funded by universities in Tampere and the City of Tampere and project fees by companies. About 100 DEMOLA projects with 450 students are carried out every year.

Sources: OECD (2017b), *Knowledge Triangle Synthesis Report – Enhancing the Contributions of Higher Education and Research to Innovation*, OECD, Paris; DEMOS Helisinki (n.d.), *Demola Tampere: An Open Innovation Platform of Co-Creation and Agile Experiments for Students, Businesses and Universities*, https://www.demoshelsinki.fi/wp-content/uploads/2018/06/demola.pdf.

Evaluating third mission (TM)

The performance evaluation of TM activities is a challenging task across OECD countries, especially when it should inform the allocation of funds. The Italian agency, ANVUR, has developed an evaluation model for TM activities and the impact of academic research, where "third mission" is defined as the openness of the university towards the socio-economic context through the valorisation and transfer of knowledge.

The model divides TM activities into two main areas and identifies associated standardised indicators. First, the capacity to generate value from research results, which is by definition the transformation of goods supported by public funding (public research) into private goods. Second, the production of public and social goods, i.e. other forms of knowledge

transfer and exchange producing impacts on the social, cultural and economic context. Concerning the first area, the evaluation takes into account indicators concerning intellectual property management (patents and plant variety registrations), academic entrepreneurship (spin-offs), third-party research activities and intermediaries' activities. Regarding the production of public and social goods, ANVUR uses indicators measuring the creation and management of cultural heritage (museums, archaeological excavations and cultural heritage), clinical research and training (registered clinical experimentation, biobanks), lifelong learning activities and public engagement intended as the production of advice, expertise, informed opinion, contributions to controversies, communication of science. Evaluation methods are based on informed peer review. ANVUR has collected data on all third mission activities run by Italian universities in 2011-14 within the framework of the Italian research assessment exercise called VQR 2011-14 (Evaluation of Research Quality 2011-14). Some universities have developed their own methodologies to measure and finance TM activities; Box 6.10, below, illustrates the example of the University of Bologna.

Box 6.10. The Third Mission Observatory and incentives to personnel

In 2017, the University of Bologna Alma Mater launched its Third Mission Observatory. The aim of the observatory is to collect and analyse the activities related to the third mission of the university community, with particular attention to relations between the university and the social environment, both locally and internationally.

The observatory looks at all initiatives intended to apply the results of research in each of the contexts addressed by the knowledge areas of the university and the skills developed in working environments, including the transfer of technology and the production of goods and services, via which the university contributes directly or indirectly to the well-being and evolution of society.

The Third Mission Observatory, therefore, encourages the teaching and administrative staff of the university to think and develop scientific and social projects that create ever-stronger links between the university and society at all levels. The observatory also enhances the staff capable of making their knowledge available to the society, including through dissemination initiatives for the new generations.

The main challenge to implement an evaluation system for TM activities is to identify good standardised indicators. There are several international practices illustrating different solutions to this problem. The Swedish Developmental Pilot, undertaken between 2013 and 2016, is an example of a process to develop and test national indicators based on qualitative as well as "tailored" approaches to measurement (Box 6.11).

Box 6.11. Experimenting methodologies to evaluate the third mission, the Swedish Development Pilot

Referring to a long tradition of societal and economic outreach activities of Swedish HEIs, the ecosystems between institutions and socio-economic has been part of an official "third task" in the national Higher Law since 1997. This policy has generated a series of activities, support structures and funding instruments, to promote the third mission at the national, institutional and agency levels to actively support development according to this mission.

Despite this support framework, the social engagement of HEIs was still an add-on to research and teaching, representing HEIs' prevailing core missions. The level of engagement of individual HEIs was affected by path dependence and organisational features.

As a result, the government introduced new regulations in 2012 to promote the development of evaluation mechanisms assessing the efforts and initiatives put in place by HEIs to improve their interaction with society. The new regulation included new incentive mechanisms.

In 2013, VINNOVA and the Swedish Research Council were assigned to implement a programme, running until 2016, to develop and test an evaluation model for HEI's societal interaction. The government allocated a total of EUR 21.3 million over 3 years. The process included three major building blocks:

1. Two pilot calls for dedicated strategic projects to be implemented by single HEIs or consortia of HEIs, in 2013 and 2014. The budget allocated to these pilot projects was approximately EUR 16 million (government funds and VINNOVA co-funding). All Swedish HEIs were asked to participate and 27 received funding.
2. A stakeholder dialogue – including HEIs, national and regional authorities, agencies, industrialist associations – aiming to identify common characteristics of HEI's societal engagement (to inform indicators in the evaluation process).
3. Two additional pilot calls to test the developed evaluation process and assessment mechanisms, focusing on the HEI's strategies and implementation plans as well as on the quality and results of interactive activities. The pilot evaluation process received funds totalling EUR 12.8 million.

This process sheds light on the status of the way in which Swedish HEIs engage with society and on the quality of these interactions. Some key lessons from the process might provide learnings for other countries, in particular:

- HEIs should involve several levels (leadership, departments and faculties, staff and researchers) in engagement activities. This to generate a better understanding of the subject and higher consensus about the outcomes.
- Funding is a basic requirement but the Swedish experience illustrates that even small amounts of funding can leverage resources and mobilise people, activities and organisational learning.
- Evaluation tools can stimulate the organisational development of HEIs but they should take into account differences existing among different types of HEIs.

Source: Wise et al. (2016) in OECD (2017b), *Knowledge Triangle Synthesis Report – Enhancing the Contributions of Higher Education and Research to Innovation*, OECD, Paris.

Conclusions and policy recommendations

Heterogeneity is a key feature of the Italian university system. Differences among regional ecosystems affect HEI strategies and approaches to entrepreneurship and innovation. These differences are exacerbated by the lack of a national policy perspective on engagement/third mission. Central authorities have focused on teaching and research missions. However, especially after the 2010 autonomy reform, several institutions have developed a range of innovative practices to fulfil their third mission.

Institutional initiatives are quite diverse, though they share the characteristic of being closely related to the conditions and demands of their regional ecosystem. University engagement mirrors the local firm structure, the availability of other higher education or research institutions and funding, specific regional needs regarding knowledge and skills, and the presence of social or cultural issues.

Within this framework, there is a need for a broad definition of entrepreneurship and innovation activities, which goes beyond business development and commercialisation of academic knowledge. Academic entrepreneurship should also refer to universities' contribution to societal development, i.e. exploiting the idea of a third mission. In addition, academic entrepreneurship should fertilise teaching and research activities. For instance, it could inspire new pedagogic systems promoting interdisciplinary learning, transversal capabilities, new organisational models and respective incentive schemes. Likewise, institutional marketing and brand development should be mentioned in this vein.

The experimental work of ANVUR to develop an evaluation model for third mission and an associated scheme of standardised indicators is based on a broad definition of academic entrepreneurship and should be considered positively. However, this effort is not paralleled by a discussion about the financial incentives and support scheme to be provided to third mission activities.

Funding for HEI engagement is scarce and fragmented. This causes the Italian system to lag behind vis-à-vis international OECD and EU good practices. A relevant share of funding for third mission activities stems from regional governments – which often mobilise the European Union's structural funds – or in some cases from the private sector. At the same time, national authorities define performance measurement, quality assurance schemes and relevant regulations with regard to recruitment, IPRs and economic activities of universities among other things. Besides generating fragmentation, this complex governance may generate incoherence in targets and incentives provided to HEIs.

Summing up, the lack of alignment between national policies concerning entrepreneurship and innovation, scarce and fragmented resources and tight (and sometimes limiting) regulation challenges HEIs and researchers to balance their activities between multilayer incentives and sometimes conflicting targets. As adjustment processes in universities usually take time, there is a need for developing a long-term vision to allocate resources capitalising on the strengths of Italian universities. This strategic approach should go beyond the current three-year planning horizons of the national and institutional strategic programmes.

In particular, concerning the developed of a long-term vision, Italian authorities could consider the following recommendations:

- Creating a long-term national vision/policy conducive to university entrepreneurship and innovation activities. One of the key limits of the Italian system is the lack of a coherent long-term vision that orient the decisions and

behaviours of stakeholders. In particular, the long-term vision should serve as a sustainable mid-term planning horizon for ministerial and institutional strategy development, allocation of funding and implementation of activities in line with the overall strategic targets.

- Adopting a broad definition of "engagement" or "third mission" incorporating entrepreneurship and innovation from multiple perspectives. As discussed extensively in this report, university "engagement" is a very broad concept that encompasses a range of activities higher education institutions can put in place to generate value for their own networks. Promoting the engagement agenda requires adjusting the performance-based funding scheme to take into account all these new activities and actions HEIs can put in place. This could be done by applying both standardised indicators and selected individual qualitative targets, to be negotiated at the individual level with each HEI.
- Consider broadening the emphasis on bibliometric indicators with other indicators capturing different activities. Based on a broader definition of "engagement" and "third mission", the Italian government could define new indicators and a framework of incentives and funding on the national level conducive to higher education innovation. Italy (ANVUR) has done some interesting experiments in this field and could capitalise on these experiences to develop a broad evaluation framework in the future.
- Reducing the current fragmentation of the national incentive structure for entrepreneurial and innovative activities by better aligning initiatives co-ordinated by different ministries (in particular MISE and MIUR but also the Ministry for Foreign Affairs and others). As flagged by other OECD reports (see for instance OECD, 2017a), Italy's government framework suffers from governance fragmentation both at the national level and between the centre and regional levels. There is great potential for improvement in the way policies are co-ordinated between ministries. Italy should capitalise on the experience done in the field of Industry 4.0 to improve its capacity to co-ordinate policy agendas in the future.
- Establishing a funding entity that could serve as an intermediary managing national competitive programmes, provided that funding is allocated in a stable and long-term manner to this entity. This should be done to: i) increase stability and duration of programmes vis-à-vis the three-year planning cycles; and ii) provide transparent and sound selection criteria matching international standards (peer review processes, etc.). Such an entity could be formed as a truly independent body with its own purpose (e.g. as a fund or trust) or with a closer connection to the enforcement of government strategic targets (e.g. as an agency administrating public programmes or provision of strategic intelligence in terms of data analysis or evaluations). In both cases, the provision of sufficient and sustainable resources is crucial.

Concerning the governance of higher education institutions, there is a need for the following improvements:

- Introducing innovations in the selection of university leadership. For instance, concerning the collegial selection, the country could take into account international practices for the appointment process of the rectorate such as incorporating multi-level applications processes. In addition, stakeholders could consider gender

aspects as criteria for appointment processes and working conditions at all levels of university hierarchy.

- Evaluating the new legislation regarding subsidiary companies to avoid adverse incentives negatively affecting the creation of universities' spin-offs. There is a need for "proofing" the regulatory framework and avoiding it can negatively affect academic entrepreneurship, and university engagement. Italian authorities may need some form of co-ordination, within the centre of government to capitalise on the many successful experiences and allow them to generate more value for their own ecosystems and the country as a whole.
- Assessing the impact of the professor's privilege on incentives. Based on international good practices that handle this issue, Italy could start an evaluation of the professor's privilege to assess the need to modify this policy.

Notes

[1] See www.heinnovate.eu for an overview of principles and statements.

[2] "M-form", or "M-firm", defines the model of a multidivisional organisation, with strong leadership and semi-autonomous units controlled by (financial) incentives and targets (Palmer et al., 1993) https://www.jstor.org/stable/2393256?seq=1#metadata_info_tab_contents.

[3] For a discussion of the *Instituti Tecnici Superiori*, see Chapter 2, and OECD, 2017a.

[4] http://www.snf.ch/en/theSNSF/profile/facts_figures/statistics/pages/default.aspx.

[5] Eurostat (2019), "Intramural R&D expenditure (GERD) by sectors of performance and NUTS 2 regions [rd_e_gerdreg]".

[6] http://ec.europa.eu/research/mariecurieactions/actions/european-researchers-night_en (accessed on 28 February 2019).

[7] This element was reported and commented by several panellists ("there is an appetite for third mission evaluation incentives") at the HEInnovate meeting with the steering group of the project, MIUR, Rome, 10 December 2018.

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Supporting Entrepreneurship and Innovation in Higher Education in Italy

Universities' entrepreneurship and innovative practices are burgeoning all over Italy. Some of these practices resonate at the international level while others have a local impact. Italian higher education faces some important challenges and actions need to be taken to unleash its full potential. Promoting the entrepreneurial and innovation agenda can help Italy improve the overall performance of the higher education system, and of individual universities, in all regions. The government has started providing a strategic support to engagement, which could catalyse Italy's innovation capacity, human capital endowment, and well-being.

This review illustrates policy actions promoting the entrepreneurial and innovative activities in the Italian Higher Education System, and focuses on 11 case study universities. It discusses strategies and practices adopted by Italian higher education institutions to innovate, engage, and generate value for the society and the economy. This review is part of a series of national reports implementing the HEinnovate framework. HEinnovate is a guiding framework that the OECD and the European Commission have developed to promote the "entrepreneurial and innovation agenda" in higher education.

Consult this publication on line at ***https://doi.org/10.1787/43e88f48-en***.

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Co-funded by the European Union

ISBN 978-92-64-62081-0