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# RIO Country Report 2017: Italy

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Nascia, L., Pianta, M, La Placa, G.

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#### **RIO Country Report 2017**

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

## Summary

### Main R&I challenges and policy responses

- The low level of business R&I activities and unfavourable framework conditions

Business R&I activities have remained low, far below EU averages. The Italian economy is characterised by an overwhelming majority of small and micro enterprises active in industries with a low R&D intensity. The tight lending conditions and the small scale of the venture capital market are also hampering innovation activities, especially for new, small, innovative companies

- The public sector funding of R&I

Preserving the activities of the public research system and of Italy's universities is a serious challenge, in particular after the budget cuts affecting R&D expenditure and university staff; limited job opportunities are currently available for researchers in the public sector; and outward migration of researchers and Italians with tertiary education is increasing.

- Governance and management of the R&I system and policies

The Italian R&I system has been characterised by a number of issues affecting the management of R&I policies: fragmentation of strategies, with many initiatives at both national and regional levels; delays in the implementation of measures; and instability regarding budget availability and allocations. For universities and PROs evaluation activities have expanded and are used as the basis for merit-based funding.

- Addressing territorial disparities

Italy has long suffered from large divergences between the North and the South with respect to economic structures, technological activities, incomes, unemployment, female participation, etc. The impact of the recession has been more severe in the South and several policies – including the allocation of university funds – have reduced available resources for the South.

### Smart specialisation

In 2015, MISE and MIUR validated the national Strategy of Smart Specialisation 2015-2020, approved in April 2016 by the EU Commission. The Strategy identified five national thematic areas and twelve regional thematic areas of specialisation. The PNR 2015-2020 has been organised accordingly around the five national areas and twelve regional areas of specialisation.

In 2016, the agency for territorial cohesion, in charge of monitoring RIS3, published the national strategic document on RIS3, which outlines the efforts towards integration of policy measures and R&I programmes. The Agency has worked on the standardisation of regional monitoring indicators.

In 2016, each region released a regional strategy with a regional monitoring system, usually with attention also to other innovation policies, such as the Start-up law and innovative financing tools. The policy instruments available for the implementation of the national strategy are described in the national strategic document and are integrated with current measures for R&I.

RIS3 areas have been included in the PON (Piani Operativi Nazionali) and Regional Operational Programmes for the use of European Structural Funds.

Local research systems, including universities and PROs, are considered as a major stakeholder of RIS3 and in some cases they are included in the governance bodies. Public-private partnerships are widely encouraged by the RIS3 national framework since their weak diffusion is considered as a factor of weakness of Italy's R&I system, as argued by the SWOT analysis of the strategic document.

A large policy effort has been developed around the Smart Specialisation Strategy; however, its implementation is still at an early stage at both the national and regional levels; a proper assessment of its operation and impact is not yet available.

## **Foreword**

This report offers an analysis of the R&I system in Italy for 2017, including relevant policies and funding, with a particular focus on topics of critical importance for EU policies. The report identifies the main challenges of the Italian research and innovation system and assesses the policy responses implemented. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative data are, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in August 2017. The report contents are partly based on the RIO Country Report 2016 for Italy (Nascia et al. 2017).

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## 1 Economic context for R&I

The Italian economy is showing signs of recovery. In the second quarter of 2017, Italy's gross domestic product (GDP) registered, compared with the previous quarter, an increase in real terms of 0.4% and had a 1.5% growth compared with the second quarter of 2016.<sup>1</sup> The Italian National Institute of Statistics (ISTAT) recorded a GDP increase in 2016 of 0.9% and forecasts growth for 2017 and 2018 of 1.5% and 1.4% respectively, with an upwards adjustment of previous forecasts; data are still below the euro area average (ISTAT, 2017a). The European Commission forecasts growth of 'about 1% in 2017 and 2018, driven by stronger external demand and the recovery of investment', while consumption is expected to slow down.<sup>2</sup> In addition, the Organisation for Economic Co-operation and Development forecasts lower growth than the euro area average for the period 2017-2019. In the first half of 2017, industrial production increased by 2.2% compared with the first semester of the previous year; the level, however, is still 20% lower than 2007 values.

In this context, Italy's fiscal policy has continued to target the reduction in the budget deficit, from 3.0% of GDP in 2014 to 2.7% in 2015 and 2.5% on 2016, with a government debt equal to 132% of GDP. The unemployment rate recorded a slight reduction in 2016, reaching 11.7%, compared with 11.9% in the previous year. Labour productivity is still stagnant (index equal to 100.8 in 2016, below the 2015 level of 101.6).

The share of employment in high-tech and medium high-tech manufacturing fell from 5% of total employment in 2009 to 4.7% in 2016. Employment in knowledge-intensive service sectors is showing a decrease with respect to 2015, from 33.5% of total employment to 32.2% in 2016. The negative employment trend in high-tech and high knowledge sectors points out the structural problems of Italy's economy.

### 1.1 Structure of the economy

The Italian economy shows a lower presence of high-tech manufacturing and service industries compared with other major EU economies. In 2016, the service sector accounted for 74% of value added, with manufacturing producing 16.3%. In the same year, knowledge-intensive services accounted for 33.2%, whereas the total value added in high and medium tech manufacturing represented 6.4% only.<sup>3</sup>

Italian industry is specialised in the mechanical and machinery sectors and in the activities of the so-called 'Made in Italy' – food products; textiles, clothing and footwear; wood and furniture – generally associated with low and medium technology activities.

A recent study (Lucchese et al., 2016) using ISTAT data shows that, compared with the pre-crisis levels of 2007, the decline in output by Italian industry is greater in medium-high and medium-low technology sectors (-29% and -32% respectively from April 2008 to July 2015), compared with low technology industries where the decline is less dramatic (-19%). The decline is limited in high-tech sectors (-2%), which however account for about 9% only of total value added in manufacturing and for 6% only of total employees (full-time equivalent units in 2013). Moreover, the study has split industrial output between sales to domestic and foreign markets, finding that the fall in domestic demand appears to be the key driver of the loss of manufacturing production, while the export competitiveness of the country seems to have recovered.

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<sup>1</sup> Updated data are available at <http://www.istat.it/it/congiuntura>.

<sup>2</sup> The forecasts are available at [https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-performance-country/italy/economic-forecast-italy\\_en](https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-performance-country/italy/economic-forecast-italy_en).

<sup>3</sup> In Germany, in the same year, the total value added from knowledge-intensive services accounts for 34.3% and, in 2015, high- and medium-tech manufacturing value added represented 14.1%.

In terms of business dynamics, Italy continues to report a high level of firm creation, which has increased from 2010 to 2015, but the survival rate of these firms after three years has significantly fallen, from 62 to 52.8%. A persisting feature of Italy's business structure is the small firm size and the inadequate ability of firms to survive and grow.<sup>4</sup>

## 1.2 Business environment

The World Bank 'Doing business' ranking of countries shows a tightening of business regulations in Italy, with the country slipping from 44th position in the ranking in 2014 to the 46th position in 2018. For 'ease of getting credit', Italy fell from 80th position in 2014 to 105th in 2018. On the Digital Economy and Society Index (DESI)<sup>5</sup> Italy's ranking has been stable at a low 25th position in the EU-28 both in 2014 and in 2017.

In spite of an improved export performance in the industries of Italy's specialisation, the low demand – particularly in the domestic market – remains a key problem that Italian firms face. The institutional context for the operation of Italian firms has improved in various aspects with recent policies. Italy's government has put a strong emphasis on liberalising business activities. Actions since 2015 have included tax reduction plans on business taxation; fast track decision procedures on public projects and expenditure ('Sblocca Italia'); and labour reforms that reduced employment protection and limited the importance of national labour contracts ('Jobs Act'). However, the above mentioned actions did not focus on high-tech industries, nor did they target innovative activities. Those have been addressed in 2017 by the Industria 4.0/Impresa 4.0 strategy, a set of measures aimed at supporting high-tech investments including tax incentives and other actions (see sections 3.1, 4.1, and 4.2 below). The official assessment of Industria 4.0 for the first semester 2017 recorded an increase in orders for fixed capital goods of 9% compared with the first semester of 2016, with a peak of 10.7% for electronic machinery. The confidence index for the production of machinery in August 2017 reached the highest value since 2010 (MEF, MIUR, MISE, 2017). In spite of some positive signs, in 2016 total fixed investment were still 25% below 2007 values in real terms.

## 2 Main R&I actors

In Italy's research and development (R&D) and innovation system, a key role is played by the central government, namely the Ministry of Education, Universities and Research (MIUR) and the Ministry of Economic Development (MISE).

Total R&D expenditure (gross domestic expenditure on R&D – GERD) in 2016 was €21,611 million, 1.29% of GDP, recording a decrease from €22,157 million, 1.34% of GDP, in 2015 (Eurostat, 2017; ISTAT, 2017b). The share of business-performed R&D (business expenditure on research and development – BERD) in GDP was 0.75%, that of universities 0.33%, that of government – mainly public research organisations (PROs) – 0.17%, that of non-profit institutions 0.04%. In terms of funding, in 2015 R&D funded from abroad accounted for 0.11% of GDP, of which 0.03% came from EU sources.

In 2015, Italy's total R&D personnel, in full-time equivalent units, amounted to 259,167, including 174,327 researchers, with an increase compared with 2014, mainly in the non-profit sector (+7.1%) and in the business sector (+5.8%) (ISTAT, 2017b).

In 2015, large businesses with more than 500 employees concentrated around 60% of R&D performed by private business; small firms with fewer than 50 employees performed 10.4%.<sup>6</sup> In 2015, multinational firms carried out around €3 billion of R&D investments with a slight increase from 2012 (ISTAT, 2017c).

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<sup>4</sup> In 2014, 95% of firms employed fewer than 10 people and only 0.08% of firms had 250 or more employees; the EU average for 2013 was 93% of firms with fewer than 10 people employed and 0.19% of firms with 250 or more people employed.

<sup>5</sup> <https://ec.europa.eu/digital-single-market/en/desi>

<sup>6</sup> Dati.istat.it

The poor innovative performance of Italian firms has been documented by the results of the Community Innovation Survey for the years 2012-2014, published by ISTAT in November 2016 (ISTAT, 2016). The share of firms that have carried out innovative activities during that period was 44.6% as opposed to 51.9% for the 2010-2012 period. The firms engaged in innovations in products and processes only were 31.9%, as opposed to 35.5% in the previous period. The fall is higher among smaller firms. Total innovation expenditure in 2014 was 23.2 billion euros, a 4.3% fall compared with 2012. R&D accounts for close to half of this total expenditure. On average, in 2014, Italian firms spent €6,200 per employee for new products and processes, against €6,300 in 2012. Close to one quarter of firms have obtained public incentives for innovation. The economic impact of the new products that have been introduced is modest: in 2014 products that were new to the market accounted for 7.6% of sales of innovating firms; another 7% was due to products that are new to the firms only (including imitation of products by competitors).

New attention has been devoted to the relevance of 'high-growth firms' defined as those recording for three subsequent years a growth rate of turnover above 10%. These firms tend to be more present in high-tech manufacturing activities. Data for Italy show that such firms account for 5.8% only of the total number of firms, accounting for 9.7% of total employment. Most major EU countries, including Germany, the UK, France and the Netherlands, have much higher shares (Hölzl, 2016, p. 250). A higher share of 'high-growth firms' has been shown to be associated with a greater dynamism of national economies and a more efficient reallocation of resources.

### 3 R&I policies, funding trends and human resources

#### Main R&I policy developments in 2017

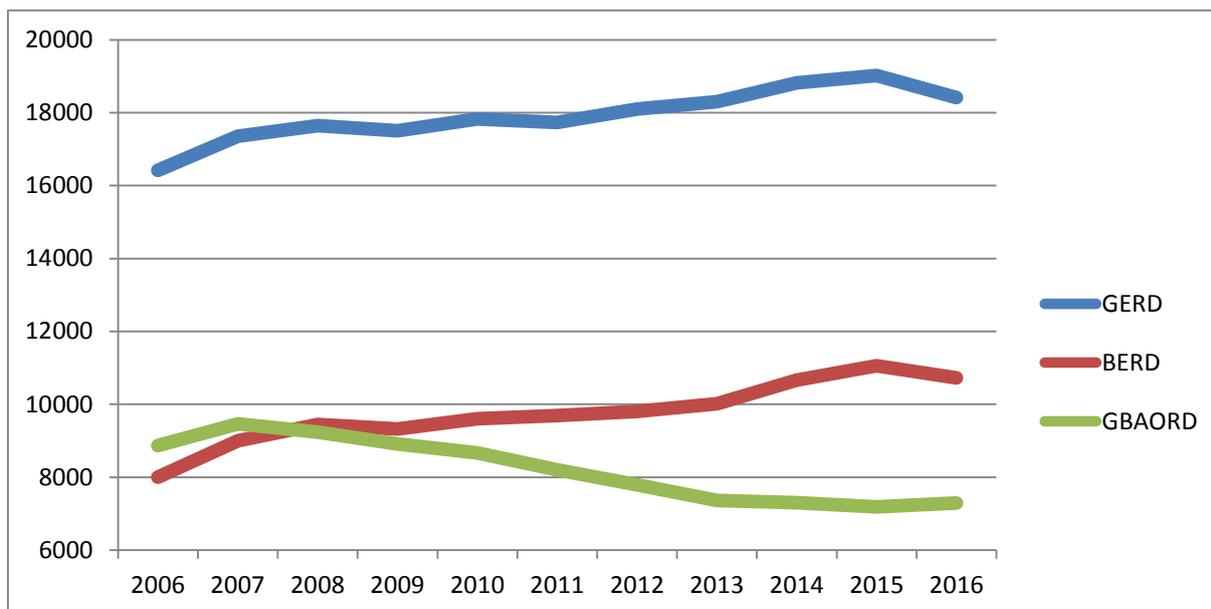
Impresa 4.0 ( <a href="#">Assessment September 2017</a> )	Impresa 4.0 is the latest version of Industria 4.0. A first assessment of Industria 4.0 for the first semester of 2017 was published. The stability law 2018 introduces new measures for Impresa 4.0.
<b>Stability law 2018</b> ( <a href="#">December 2017</a> ) <b>RIS3 implementation strategy</b> ( <a href="#">Directive 10/05/2017</a> )	In 2017, the Ministry of Social Cohesion set up a strategy for the implementation of the Research and Innovation Strategy for Smart Specialisation (RIS3), including the procedures adopted for validating the strategic plans for implementation.
MIUR Industrial research call ( <a href="#">July 2017</a> )	Industrial Research call to implement the PNR 2015-2020 adopting the RIS3 specialisation areas of the national strategy. Total funding is €497 million.
<b>MIUR PRIN</b> call ( <a href="#">December 2017</a> )	A new call has been launched for three-year research projects (Projects of National Interest, Progetti di ricerca di rilevante interesse nazionale – PRIN) for universities and PROs with a funding of €391 million.
<a href="#">ANVUR VQR</a> ( <b>May 2017</b> )	The results of the new Research Quality Evaluation (VQR) for the years 2011-2014, covering universities and PROs, have been published and will be used for merit-based funding.
<b>Implementation on merit-based funding of University Departments</b> ( <a href="#">May 2017</a> )	Additional funding has been provided to 180 'excellence' university departments after a merit-based selection process. Annual funding is €271

	million from 2018 to 2022.
<b>Implementation of basic research support for university staff (July 2017)</b>	Funding of basic research activities for university professors and researchers. Annual funding is €45 million; maximum per capita grant of €3,000.
<b>Implementation of the 'Evaluation of accountable autonomy'</b>	20% of performance – based funding to universities (€300 million) has been allocated for the first time taking into account indicators chosen by universities themselves and concerning quality of research, teaching and internationalization. The methodology includes coefficient to balance inequalities between different Regions.
<b><u>National Programme for Research Infrastructures - PNIR (February 2017)</u></b>	The National Programme for Research Infrastructures (PNIR) is the Italian multiannual strategy for Research Infrastructures, in the meaning of the European Strategy Forum for Research Infrastructures. It also fulfils the ex-ante conditionality for the European Structural and Investment Funds.

### R&I funding trends

The evolution of R&D resources (at constant 2005 prices) is shown in Figure 1 below. Total R&D (GERD) has slowly increased, with a fall in 2016. R&D performed by firms (BERD) has driven the increase in spending, with a similar fall in 2016. Conversely, budget appropriations for public R&D (government budget appropriations or outlays on R&D –GBOARD) in 2016 had lost about €2,000 million out of the €9,000 million of 2007.<sup>7</sup>

**Figure 1:** Total R&D in Italy (GERD), R&D performed by business (BERD) and appropriations in government budget (GBOARD). Million euros at purchasing power standard at 2005 prices.



<sup>7</sup> GERD and BERD are data on performed R&D; GBOARD includes all budget appropriations that fund research activities, including General University Funds.

The funding flows from abroad come from three relevant sources: foreign direct investment, EU Framework Programmes and EU Structural Funds.

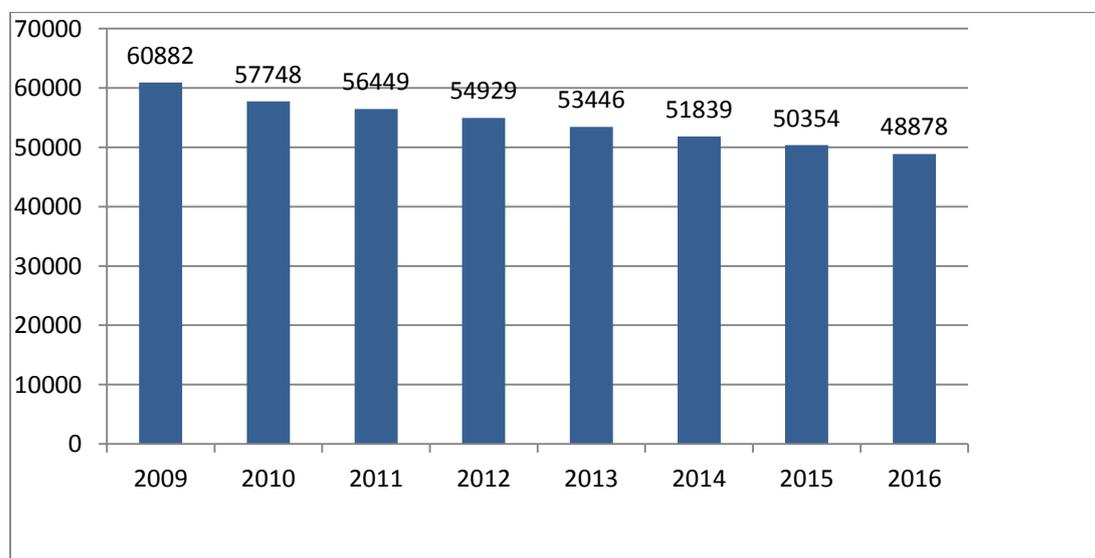
Italy is showing an active participation to Horizon 2020, according to a report published in 2017, obtaining 4,780 awarded grants, equal to 9.5% of total grants awarded by the programme (APRE, 2017). Until February 2017, Italy has been financed for €1.7 billion, equal to 8% of the available budget. The success rate of Italian applications is below the EU average; around 75% of the awarded budget is allocated to regions of Italy's North and Centre regions. These results are lower than Italy's performance in the previous EU FP7 research programme, where the success rate of Italian proposals was 18.3%; Italy was the fourth-highest financed country (obtaining more than €3.6 billion from 2007 to October 2014<sup>8</sup>), after the UK, France and Germany; six Italian firms were among the top 50 recipients of grants for firms in 2007-2013 and two universities were among the top 50 higher education institutions (HEIs).<sup>9</sup>

### 3.1 Public allocation of R&D and R&D expenditure

Since the start of the crisis in 2008, total (civilian) GBAORD have seen a major reduction (see Figure 1) and in 2016 they were about 23% lower than in 2007. This reduction in public expenditures is at the root of declining resources for universities and other R&D activities.

The number of researchers and university professors has decreased by 17% between 2009 and 2015, with a loss of 10,000 people out of a total of about 60,000 in 2009, a fall higher than in other public sector activities. Figure 2 shows this decline.

**Figure 2.** Professors and researchers employed by universities in Italy, 2009-2016. Data include full professors, associate professors and researchers with a permanent position. In 2016, universities employed an additional 5,357 fixed term researchers (Source: MIUR).



The reduction in public R&D expenditure has affected public and private research programmes. After several years of delays, cancellation of funding programmes and reductions in resources, in 2017 new funds were made available. A new call for research projects for universities and PROs (PRIN) was launched with €391 million; industry

<sup>8</sup> [http://ec.europa.eu/research/fp7/index\\_en.cfm?pg=country-profile](http://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile)

<sup>9</sup> Seventh FP7 Monitoring Report 2013 11/03/2015.

research has been funded with a new call in 2017 for €497 million. Both are part of the initiatives of the National Research Programme (PNR) 2015-2020.

For universities, the 2017 stability law made available a basic research fund for individual scholars (Fondo per il finanziamento delle attività base di ricerca), with €45 million each year, to finance research activities of the university personnel with a maximum individual amount of €3,000. In July 2017, the National Agency for the Evaluation of Research (ANVUR) launched the first call and has awarded 9,466 grants (as of December 2017) out of the 15,000 available.<sup>10</sup> The conditional access to the fund based on merit indicators has limited the number of participants and could be revised in the future.

During 2017, again as foreseen in the stability law for 2017, the Ministry concluded the procedure to allocate €271 million per year in the period 2018-2022 to 180 'excellent departments', selected on the basis of the results of the VQR and of proposals containing a development strategy for the department in terms of recruitment, infrastructures, second and third cycle education, and incentives to academic personnel. The projects awarded started on 1 January 2018.

The 2018 stability law created a new fund for the support of R&D projects of firms and institutions aiming at expanding intangible capital, productivity and competitiveness. The fund makes available €5 million in 2018, €125 million in 2019 and €175 million from 2019 onwards. It also includes a new recruitment fund for 1,300 researchers in universities; and funding to revise, as from 2020, salary increase for researchers and professors and 300 researchers in Public Research Institutions.

Support for business R&D has mainly taken the form of tax reductions. An R&D tax credit scheme for expenditure carried out in the period 2015-2019 became operational in the summer of 2015. In 2015, rules allowed a 25% tax credit for incremental investments in R&D (rising to 50% when R&D is carried out in cooperation with public organisations), up to a maximum annual amount of €5 million for each beneficiary. The foregone tax revenue had been estimated at approximately €2.5 billion for the five years 2015-2019. The stability law of December 2016 extended the R&D tax credit scheme to 2020, increased support to 50% of incremental R&D investments (eliminating the incremental incentive to extend public-private cooperation) and set a maximum amount of €20 million for each beneficiary. The stability law of December 2017 maintained such tax incentives and extended the support for investment in new technologies through the Industria 4.0/Impresa 4.0 initiative, with new tax incentives for firms carrying out advanced training programmes for the workforce (see below). The aim is to increase private business investments in R&D by a total of €11.3 billion over the years from 2017 to 2020 (MEF; MIUR; MISE, 2017).

The new PNR 2015-2020 provides financing for human capital for around €1 billion in three years; however, the effective additional financing for human resources is not clear yet; the spending limitations introduced by public budgets targets – including the turnover of research personnel – are still in place and these resources appear to be inadequate to achieve the 2020 target for a national R&D intensity of 1.53% of GDP.

### **3.2 Private R&D expenditure**

Business-performed R&D (BERD) in 2016 was €12,590 million, with an increase from 2007 of €3,135 million and a slight fall compared with 2015 of €296 million. The business sector is the main funder of Italian BERD, with growing internal financing by firms.

BERD, measured in real terms in euros at purchasing power standard (PPS) at 2005 prices, recorded a positive trend from 2007 (€9,001 million at PPS) to 2015 (€11,061 million at PPS), with a slight fall in 2016 (€10,726 million at PPS).

Business-performed R&D (BERD) as a share of GDP was 0.75% in 2016, showing a modest increase over the last decade and a reduction compared with 2015. Italy remains

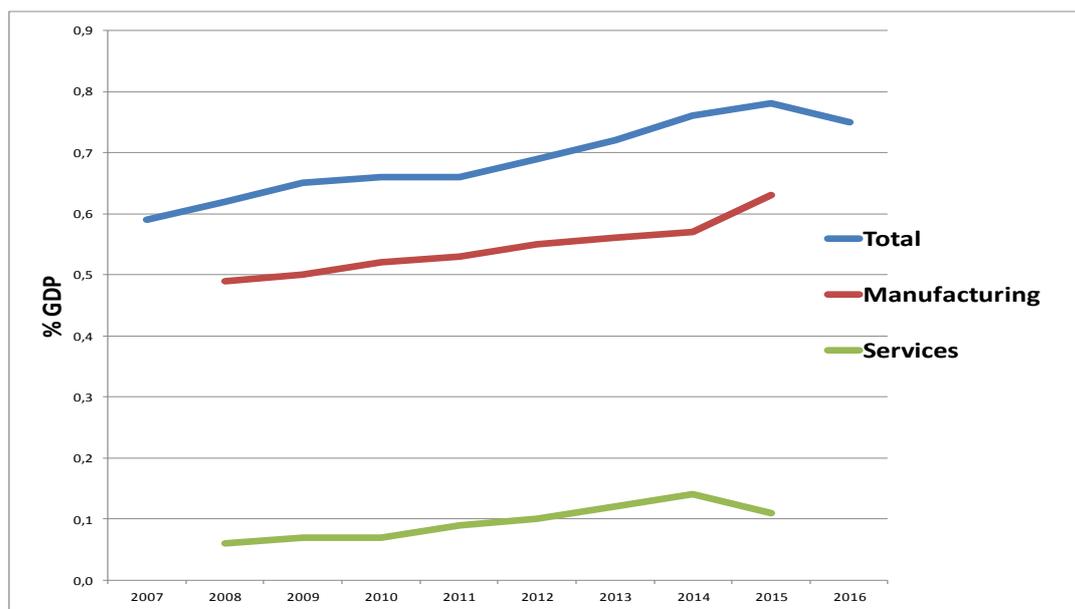
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<sup>10</sup> [http://www.anvur.org/attachments/article/1204/FFABR\\_commenti\\_21122017.pdf](http://www.anvur.org/attachments/article/1204/FFABR_commenti_21122017.pdf)

far from the R&D efforts of firms in other large EU economies such as France or Germany, where the share is close to 1.5% and 2% of GDP respectively.

Manufacturing accounts for a large and increasing share of BERD, while R&D in the service sector has stagnated (see Figure 3). In Italy's economy, manufacturing maintains a significant role – higher than in the EU-28 average – with a large contribution to value added coming from mechanical engineering and machinery. A large role is played by 'traditional' and low R&D sectors, such as food, beverages, textiles and clothing.

**Figure 3:** Business-performed R&D in manufacturing and services as a share of GDP



### 3.3 Supply of R&I human resources

In 2016, only 25.6% of the Italian population aged 25-34 attained tertiary education, putting Italy at the bottom of the ranking of European countries, well below the EU-28 average of 38.2%. Conversely, 80% of people aged 20-24 had completed upper secondary education, not so far from the EU average of 82.6% (European Commission, 2016).

Public expenditure on tertiary education has been stable at 0.4% of GDP from 2009 to 2015, well below the EU average of 0.7% of GDP in 2015.

The employment rate of the population aged 25-64 having completed tertiary education in 2016 is equal to 79.8%, below the EU average of 84.8%. Moreover, the percentage of employees aged 25-64 having completed tertiary education was around 21% in 2016, below the EU average of 35.4%.

The percentage of scientists and engineers in the age group 25-64 in the active population in 2016 increased to 4.3%, but is still far from the EU average of 7.4%.

As a result of these developments, a major problem for Italy's highly-skill human resources is the growing emigration of graduates and researchers. The ISTAT survey recorded that the proportion of doctorate holders living abroad had increased by around 6% from 2009, reaching 12.9% in 2014 (ISTAT, 2015b). ISTAT data on migrations show that in 2016 81,184 Italian citizens above 24 years of age emigrated abroad, of which around 24,678 were graduates (+9% than 2015); the weight of graduates is 30% among Italian emigrants, a much higher share than in the overall population (ISTAT, 2017d).

Some initiatives have been taken in past years to make the return of Italian researchers possible. Within the PNR 2015-2020, a total of €30 million is envisaged to fund

programmes such as 'Top Talents', 'Messaggeri' and add to the 'Rita Levi Montalcini' programme, funded on national resources with €5 million per year. These programmes are targeted at researchers abroad. However, the current outlook is for a continuing large emigration of Italian scholars.

The negative trends of migrating graduates and researchers represent a serious loss for Italy's research and innovation (R&I) system, a threat to its sustainability in terms of scientific research and teaching, and a major hindrance to catching up with the rest of Europe in terms of R&I.

Problems are also evident in the dynamics of graduates. The number of first-time graduates (excluding Master courses etc.) peaked in 2005 with 291,189; fell to a minimum in 2012 with 210,208; and increased slightly to 216,430 in 2014 (ANVUR, 2016a, p. 192).

The number of newly registered university students ('immatricolati') – according to ANVUR – was 319,264 in 2001-2002; reached a peak of 338,036 in 2003-2004; and fell every year to a minimum of 252,457 in 2013-2014, followed by a modest increase to 255,293 in 2014-2015, concentrated in Northern regions (ibid., p. 74). Official MIUR data are marginally different: 269,081 in 2013-2014, 265,565 in 2014-2015, with an increase to 271,119 in 2015-2016, 274,339 in 2016-2017 (MIUR, 2011; 2012; 2016a).<sup>11</sup>

The PNR 2015-2020 introduced the 'Innovative Doctorate', based on the Principles for Innovative Doctoral Training published in 2011 by the European Commission, focusing resources on PhD programmes which are international, intersectoral or interdisciplinary. In 2016, 60% of public funding for doctoral programmes had been allocated to programmes fulfilling 'Innovative criteria'. The Ministerial guidelines for the accreditation of PhD programmes were revised by ANVUR in 2017, according to the same principles. The regulation for intersectoral mobility was released in 2013 and does not cover the PROs not falling under the MIUR supervision.

In 2015, the Jobs Act (Legislative Decree 22/2015) and the labour reform measures did not include PhDs and those awarded grants from HEIs among those eligible for unemployment income support schemes. In 2017, the unemployment benefit 'Dis-Coll' has been extended to post-docs and former grant holders.

## **4 Policies to address innovation challenges<sup>12</sup>**

### **4.1 Challenge 1: The low level of business R&I activities and unfavourable framework conditions**

#### **Description**

In the Italian economy, the limited relevance of innovative firms with large R&D activities is associated with the large presence of small and micro enterprises specialising in low-to medium-technology products, with a low R&D intensity. Few large firms concentrate a substantial part of their businesses on R&D. According to the 2017 JRC Industrial R&D Scoreboard,<sup>13</sup> 38 large firms based in Italy invested €5.9 billion in R&D in 2016: 47% of Italy's total BERD. Within the R&D carried out by such a group of large firms, 52% is carried out by two firms alone, Leonardo-Finmeccanica (aerospace and defence) and Telecom Italia (telecommunications). Fiat Chrysler Automobiles (FCA) has long been a primary actor in Italian BERD, but it is now registered as a Dutch company and cannot be listed as an Italian firm in the Scoreboard.

<sup>11</sup> Data for 2016-2017 are provided at <http://ustat.miur.it/dati/didattica/italia/atenei>.

<sup>12</sup> Besides the innovation challenges, for the preparation of the next Semester Country Reports, examples of successful practices in Member States in 2017 are also of interest – examples may be offered in relevant sections of the report and/or discussed during the Brussels visit.

<sup>13</sup> <http://iri.jrc.ec.europa.eu/scoreboard17.html>

The tight lending conditions and the small scale of the venture capital market – according to Eurostat, venture capital investment as a share of GDP is 0.002% – are also hampering innovation activities, especially for new, small, innovative companies. In Italy, bank loans play a much more important role than equity. The role of venture capital funds or business angels – private investors operating on a smaller scale than venture capitalists – is extremely limited. Access to the stock market is limited to the larger companies; and the eligibility of many small and medium-sized enterprises (SMEs) to obtain money from the banking sector is usually constrained by the lack of collaterals and by their undercapitalisation. Innovative forms to collect funds, such as crowdfunding, are not yet widespread.

### **Policy response**

The government has addressed the structural challenge of the low level of business R&D with a systematic use of tax incentives for supporting R&I activities. The main tools have included the R&D tax credit introduced in 2015 and expanded in 2016; the 'patent box' with tax reductions on intellectual property rights (IPR) income; the accelerated depreciation allowances for investment in high-tech machinery; support for venture capital investment and start up capital with tax reductions; tax reductions supporting the capitalisation of firms, regardless of their R&I activities (MISE, 2016a).

The Impresa 4.0/Industria 4.0 strategy has provided a new focus for such measures. The initiative is coordinated by a 'Cabina di regia', a multilevel body including six ministries, polytechnics, Cassa Depositi e Prestiti (CDP), business organisations and trade unions. A first assessment of the strategy and the updated guidelines for 2018 of Impresa 4.0 were provided in September 2017 (MEF; MIUR; MISE, 2017).

Impresa 4.0 has identified new targets regarding public and private investments, training, and education in the technologies included in the strategy. They include the following: €10 billion of additional private business investments in 2017-2018; €11.3 billion of R&D and innovation investments in the business sector in 2017-2020; and €2.6 billion of new early stage investments in new firms in 2017-2020.

The direct public support of Impresa 4.0 will combine a wide range of policy tools and will make the following resources available to firms, included also in the 2018 stability law (Legge 205/2017, 29 December 2017; see MEF; MIUR; MISE, 2017):

- Measures have extended the accelerated depreciation allowances for investment in machinery amounting to 140% of the cost of machinery acquired. In the context of the Impresa 4.0 strategy, such measures have been expanded to 250% of the value of acquired machinery if it is related to high-tech fields.
- Out of the €330 million allotted for 2018-2023 to tax benefits for the acquisition of machinery ('Nuova Sabatini') one third, around €110 million, is allocated to the activities associated with Impresa 4.0.
- Out of €3.5 billion of the resources for Contratti di Sviluppo, funds supporting restructuring projects in areas of industrial crisis, mainly in Southern Italy, €1 billion will be associated with Impresa 4.0 activities.
- €100 million is allocated to 'digital trade chains' supporting sales networks of 'Made in Italy' products.
- €3.5 billion is available between 2017 and 2020 for digital infrastructures; targets for 2020 include access for all firms to the 30 mbps bandwidth network; and access for 50% of firms to the 100 mbps bandwidth network.
- €250 million is allocated to tax benefits for the training of the employees involved in the technologies supported by Impresa 4.0.
- New funds are provided for expanding non-university tertiary education (Istituti Tecnici Superiori) with €10 million in 2018, €20 million in 2019 and €35 million in 2020.

Other measures, such as the Competence Centres of Impresa 4.0 and postgraduate education, are discussed below in the context of Challenge 2.

In addition to the new policy actions under Impresa 4.0, government policy has continued to provide tax benefits for R&D expenditure, 'patent box' measures and support to innovative start-ups.

*R&D tax credits.* In 2013, a new tax credit measure was introduced for incremental R&D expenditures and in 2015 the finance ministry released the operational regulations. The 2017 stability law amended the tax credit scheme, available now for 2015-2020, that allows a 50% tax credit for the R&D expenditure – both internal and external to firms – exceeding the average of 2012-2014 spending (previously the rate of tax credit for internal R&D was 25%). The maximum amount that firms may obtain as tax credit has been raised from €5 million to €20 million.

*The Patent Box.* The 2015 stability law has introduced the 'patent box', a specific tax benefit for firms' earnings coming from patents, trademarks, licenses and software. A deduction from the firm's tax base is provided for 30% of the income obtained in 2015, 40% in 2016 and 50% in 2017 and 2018.

*Innovative start-ups.* Policy measures (started in 2013) continue to target innovative start-ups and innovative SMEs (with measures introduced in 2015). These companies are defined on the basis of their R&D expenditure (R&D has to account for 15% of all costs in innovative start-ups and for 3% in innovative SMEs); qualified personnel (proportion of personnel holding a PhD and/or a Masters degree); and IPR ownership/licensing. Innovative start-ups and innovative SMEs benefit from reduced red tape, tailor-made labour law, tax relief, the possibility of raising investments through equity crowdfunding, etc.

For innovative start-ups and innovative SMEs, the 2017 stability law has extended the fiscal incentives for capital investment, with a 30% reduction in the income tax base of the investor, up to a €1 million limit. Capital gains on the long term growth of capital values of start-up companies have also been granted tax reductions.

Invitalia launched the programme 'Smart and Start Italia' aiming to support innovative start-up firms during their early stages and provides funding to cover investments and management costs for projects between €100,000 and €1.5 million. By May 2017 the programme had financed 756 start-ups for a total amount of €229 million.

## **Policy Assessment**

In 2017, a new set of actions addressed R&I issues in Italy, in particular with the Impresa 4.0/Industria 4.0 strategy. A more consistent framework to support R&I activities carried out by Italian firms has emerged compared with past support measures, which were characterised by their fragmentation, limited time span and uncertainty in terms of budget availability. On the one hand, the focus on high-technology investment, digital technologies and automation has provided some orientation to efforts in R&I. On the other hand, the systematic use of tax incentives has maintained the 'horizontal' approach to R&I policy typical of past decades, with a strengthening of indirect measures. While indirect funding lowers the bureaucratic requirements and the associated fixed costs, it is not a suitable tool to promote strategic research programmes and to develop new areas of R&I and production competence. As a consequence, Italy does not appear to be moving towards a more balanced (direct and indirect) approach towards BERD funding.

Modest evidence is available on the impact of tax incentives and other policies introduced for R&I. In consideration of the large public resources forgone through the tax benefits that have been introduced, an adequate assessment of the impact of such policy on R&I

and public budget would be required. Preliminary data on the Impresa 4.0/Industria 4.0 strategy during the first semester of 2017 have reported a large increase in orders for advanced machinery; an increase of the number of firms with additional R&D investments (but official, preliminary BERD data for Italy as a whole record a decrease of 2.2% with respect to 2016, see ISTAT, 2017b); an increase of 2% of early stage investments. The new measures about training focused on Impresa 4.0 technologies are expected to improve the qualification of employees and the productivity of new machinery investments.

Concerning innovative start-ups, MISE monitoring data on the third quarter of 2017 reported that the number of innovative start-ups reached 7,854 units at the end of September 2017, employing 10,262 people with an average production of €160,000. The 2016 MISE report does not provide an assessment of the impact of the start-up law due to the short period of time in which the incentives have been operational. The measures implemented are too recent to make a counterfactual assessment possible.<sup>14</sup>

## 4.2 Challenge 2 The public sector funding of R&I

### Description

In 2016, the Italian R&D performed by the government was equal to 0.17% of GDP, well below the EU average of 0.23%. Also, the R&D funded by the government was below the EU average: in 2015 it accounted for 0.51% of GDP compared with an EU average of 0.63%.

The resources devoted to the university system have experienced a major reduction. Considering state universities, total resources (in current euro) reached a maximum of €13,570 million in 2008, followed by a continuing fall, down to €12,258 million in 2014. In real terms, this amounts to a 14% fall between 2008 and 2014. Falling resources and limitations of turnover set by government policy have led to a serious reduction in university staff, that peaked in 2008 with 62,538 professors and researchers, falling to 54,977 in 2015 (-12%); this figure includes 4,608 temporary researchers, a new position introduced in 2010 (ANVUR, 2016a).

For universities, in 2017 the government allocated €6,981 million for general university funding (through the Ordinary Fund for Higher Education - FFO), a slight increase compared with 2015; in 2014, funds were €7,000 million; in 2008, funds were €7,500 million.

Funds for competitive calls have also experienced a lack of resources. The main initiative is the new call for PRIN addressed to universities and PROs, launched in December 2017 with a funding of €391 million. The 2017 call is for three-year projects, adopts European Research Council (ERC) scientific areas, and relies on the evaluation of external reviewers selected from a public register. An annual monitoring of the innovative impact of the awarded projects and a final assessment managed by ANVUR is envisaged. The last PRIN call was launched in November 2015 with a budget of €91.9 million. Other competitive research funds such as the Fund for Investment in Basic Research (Fondo per gli investimenti nella ricerca di base) and Scientific Independence of Young Researchers have not been funded since 2012 and 2014 respectively.

In this context, Italy is experiencing a weakening of the human resources devoted to research, science and technology. The number graduates leaving the country is increasing (ISTAT, 2017d). The career opportunities for the doctoral students in universities and PROs are very limited and are leading to a significant migration towards

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<sup>14</sup> Third quarter 2017 official MISE monitoring data: [http://www.sviluppoeconomico.gov.it/images/stories/documenti/Rapporto\\_terzo\\_trimestre\\_2017\\_trend\\_startup.pdf](http://www.sviluppoeconomico.gov.it/images/stories/documenti/Rapporto_terzo_trimestre_2017_trend_startup.pdf). ISTAT, the institution in charge of the official assessment on measures regarding start-ups, pointed out that 'a causal relationship with unequivocal statistical interpretation in terms of the action of the policy and the economic performance of the beneficiary companies', due to the short period of time in which the incentives have been in operation (MISE, 2016b).

foreign countries, on which inadequate information is so far available (see Nascia et al., 2016, 2017).

Italy's universities and PROs have been assessed by the new VQR covering 2011-2014. In 2017, the full results were published and are used for merit-based funding (ANVUR, 2017). The analysis involved 96 universities, 18 PROs controlled by MIUR and other PROs, and other 21 institutions that asked to be assessed (including research consortia and other bodies); 118,000 research products have been evaluated.<sup>15</sup>

The evaluation involved institutions and university departments rather than individual researchers. Considering the 14 fields of research activity, and the size breakdown into small, medium and large universities, the universities that appear with top positions or in the first quartile of the rankings provided by ANVUR in the higher number of fields (while avoiding positions in the bottom quartile in any field) in their own size class include the Universities of Bologna, Ferrara, Firenze, Milan, Milan Bicocca, Padua, Pisa Normale, Pisa Sant'Anna, Turin, Turin Politecnico, Trieste SISSA, Venezia Ca' Foscari and Verona. Specialised universities active in few fields with top positions in at least one field in their size group include the universities of Lucca IMT, Milan Bocconi, Milan Humanitas and Roma Luiss (ANVUR, 2017, Table 6.8a).

The VQR Report also assesses Italy's publications with respect to other countries, using the SciVal database (ANVUR, 2017, part 4). The report shows that during the four years considered for the evaluation (2011-2014) Italy's publications have increased at an above average rate, with a performance better than those of France and Germany. In 2001-2003, Italy's share of world publications was 3.3%; in 2015-2016 it grew to 3.9% (Table 3.1). The share of citations increased faster from 4.1 to 5.9% of total world citations (ibid. p. 16). The average number of citations per paper in Italy was 9.7, above the European average of 8.1 (ibid. p. 19). The analysis found out levels of productivity that in Italy are much higher than in most countries. Moreover, the country's scientific output is converging rapidly to the standards of European countries of similar size.

A report on Italy's universities has investigated the decline in the number of students, graduates, staff and funding, resulting from reduced public resources and a more uneven distribution among universities; the report focuses in particular on the divergence between Northern and Southern universities (Fondazione Res, 2016, see below Challenge 4).

A report on innovation, research and universities has been published by the foundation Italiadecide (2017; the introductory chapter has been written by the head of Italy's association of university Rectors, CRUI). The report examined Italy's university and research system documenting that, since 2008, university staff levels have fallen by 15% and university funds by 20% (Manfredi, 2017). It argued for a new policy of 'strategic investment' in research and universities, with greater resources, more attention to professional degrees and doctorates, to technology transfer and start-ups, to industrial policy, and finance for innovation (Italiadecide, 2017, Introduction).

## **Policy response**

In recent years, a large policy effort has been directed at the public research system. Attention has mainly gone to universities, which have undergone an extensive evaluation process of all their activities in parallel to a serious reduction in their funding. An increasing share of resources has been distributed on the basis of performance indicators. Between 2013 and 2018 a growing share of institutional funding for research – from 13.5% to an estimated 24% – is distributed on the basis of the results of the VQR, the research evaluation exercise carried out by ANVUR, the state agency responsible for the evaluation of universities and research organisations.<sup>16</sup>

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<sup>15</sup> However, criticism of the methods used in the VQR have led some researchers to refuse to submit their papers for evaluation, leading to a significant number of missing papers.

<sup>16</sup> <http://hubmiur.pubblica.istruzione.it/web/ministero/cs070516>

A major novelty in university recruitment was introduced in 2012 with the new system of qualification ('Abilitazione scientifica nazionale'). In the 2012 qualification round, around 56,539 applications were presented from 26,943 scholars (candidates could apply for more than one scientific field). The number of qualifications that have been granted is 24,294, 43,0% of all applications. However, the number of positions that were opened up for competition in Italian universities from November 2013 to March 2015 were 3,204, just over 10% of the number of qualifications that were granted (MIUR, 2016b; ANVUR, 2017).

In 2015, the regulations for the 'Abilitazione' were revised, introducing five evaluation sessions between December 2016 and April 2018, increasing the opportunities to present candidatures. In the first round of the qualification procedure, 22,000 applications from 16,000 candidates have been presented; preliminary data suggest a success rate above 50%.

Some new funds have been made available by recent policies and the 2018 stability law. They include the following actions:

- A new call has been launched for PRIN for universities and PROs with a funding of €391 million (see above).
- The 2018 stability law (L. 205/2017) made €14 million available for 2018 and €90 million from 2019 for the recruitment of 1,611 researchers in universities and PROs. In December 2016, the 2017 stability law L.232/2016 made €245 million funds available for the recruitment and career advancement of university personnel.
- A fund for 'Departments of excellence' of €271 million per year, starting from 2018, has provided additional financial support to 180 university departments that have been selected in 2017, also on the basis of the results of the last VQR (MIUR, 2017).
- The 'Fund for basic research support for university staff' has awarded individual grants of €3,000 per year to over than 9,400 'best researchers' identified through a selection process carried out by ANVUR; the limited participation to the call, due to restrictive criteria, has resulted in an allocation of funds that is 33% below available resources.
- A programme to introduce 500 positions for highly qualified full professors ('Cattedre Natta') had been planned with allocations of €38 million in 2016 and €75 million in 2017, with different recruitment channels. The plan has been highly controversial and its implementation stalled. The 2018 stability law shifted €15 million from the funds of the 'Cattedre Natta' to the recruitment of researchers.

Other initiatives are associated with the Impresa 4.0/Industria 4.0 strategy. Universities and firms have cooperated in Ph.D. projects, obtaining resources for 700 doctoral students in the academic year 2017-2018 in technological and digital areas.

Impresa 4.0/Industria 4.0 also envisaged the creation of Competence Centres with the key role of organising knowledge transfer. They are based on public-private partnerships between universities and firms; however by the end of 2017 they have not been implemented due to administrative delays.

A new attention has been devoted to tertiary technical schools (Istituti Tecnici Superiori) inspired by the German system; 7,618 students are enrolled in such schools in the year 2016-2017; in Germany students are 760,000 (MEF; MIUR; MISE, 2017).

In 2017, the implementation of the PNR 2015-2020 continued, after its late start in 2016. PNR resources documented for the years 2015-2017 amount to €2.4 billion. Sources that are considered include EU ones – the Programma Operativo Nazionale Ricerca e Innovazione funds coming from European Regional Development Fund (ERDF) and European Social Fund (ESF), but also PON Enterprises and competitiveness and the Regional Ops coming from the ERDF – and national funds such as the Integrated Special Research Fund (FISR); the Basic Research Investment Fund (FIRST); the FFO; and the Ordinary Fund for Research Institutions (FOE) and the Social Cohesion Fund. The PNR allocated funds for the following objectives: human capital, €1.02 billion; public private

partnerships, €487 million; territorial inequalities, €436 million; research infrastructures programme, €343 million; and internationalisation actions, €107 million.

In particular, the Framework for the Attraction and Strengthening of Research Excellences FARE is an action aiming at attracting winners of ERC grants. Universities and Host institutions will provide additional funding for researchers who have been awarded an ERC grant (Starting grant, Consolidator grant or Advanced grant) and have chosen Italian institutions as Host institutions to carry out their research, or who have opted to move to an Italian institution, taking advantage of the institute of fund transfer.

However, the PNR does not include a specific focus on the increase of public R&D resources. The funding of the PNR is largely based on the block funding lines of HEIs and PROs. The size of the additional financing for R&D that is available, and the share coming from a reallocation of current resources on research is not clear from the PNR structure.

## **Policy Assessment**

The public budget constraints faced by Italy have had a considerable impact on public R&I expenditure. Italy's public R&D expenditure continues to be far lower than the EU-28 average. In 2016, the fall in real resources in government appropriations has stopped and in 2017 some new policy actions have been developed. Also, the Council of the European Union<sup>17</sup> had recommended safeguarding investments in R&I.

Italy's research system has shown an improved performance, documented by publication patterns and the evaluation of universities (ANVUR, 2016a, 2017). However, with the current limitation of resources and their uneven distribution, preserving the extent and quality of Italy's research base appears to be a serious challenge. In particular, the country is facing a serious risk of brain drain, given the limited employment opportunities for researchers in the public sector and low absorptive capacity of the business sector (see Challenge 1).

EU research funds – from the Horizon 2020 programme – could hardly be a substitute for the reduced national resources. The first results of Horizon 2020 show that the success rate of Italian applicants is the fifth lowest in the EU, lower than in the Seventh Framework Programme (FP7). In order to substitute EU funds for national resources, Italian applicants in Horizon 2020 should significantly improve the performance recorded in FP7.

In fact, when we consider the resources used for research, Italy's performance is outstanding. The number of publications per unit of R&D expenditure grew from 3.5 in 2011 to 4.0 in 2015; 2015 values were 2.5 for the EU-28, 4.5 for the UK, 2.1 for France, 1.6 for Germany. When publications are related to R&D expenditure in the public sector and in universities only, 2015 values were 9.5 for Italy, 6.9 for the EU-28, 13.8 for the UK, 6.3 for France, 5.1 for Germany (ANVUR, 2017, Table 6.1, p.30). Similar excellent results are found when the number of researchers is used as input indicator.

As already pointed out in the 2015 Country Report for Italy (Nascia et al., 2016), these data show the high quality of Italy's research – mainly in universities and PROs – in a context of declining public resources and staff. If such inputs are not returned to pre-crisis levels and move closer to EU averages, there is the risk that these improved performances will be short-lived, due to the ageing of researchers, too few young scholars and lack of funds to sustain high quality publications.

The limited integration between public and private activities in R&I continues to be a problem; steps towards greater collaboration have been taken in the context of the Impresa 4.0/Industria 4.0 strategy, with joint research and Ph.D. programmes and an increased focus on tertiary technical education. Some measures of the PNR 2015-2020

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<sup>17</sup> [http://ec.europa.eu/europe2020/pdf/csr2015/csr2015\\_council\\_italy\\_en.pdf](http://ec.europa.eu/europe2020/pdf/csr2015/csr2015_council_italy_en.pdf)

also go in this direction. A recent important contribution to R&D and innovation policy priorities has come from the Academies of Sciences of G7 countries, who met in Rome at the Accademia dei Lincei in May 2017 on the eve of Italy's G7 summits, and who have produced the statement 'New economic growth: the role of science, technology, innovation and infrastructure' (G7 Science Academies, 2017). The document urges governments to: 'i) expand investment and capabilities in science and pre-competitive technologies; ii) increase investment in infrastructures – both tangible and intangible – that contribute to inclusive development and to progress in science and technology; iii) promote the development of capacities to design, engineer, produce and deliver products and services based on new science and technology; iv) promote open access – subject to appropriate regulations with regard to intellectual property – to advances in science and technology, while preventing the emergence of monopolistic practices'.

The document argues that 'growing levels of public and private investments in science and technology are needed to address the challenges of sustainable and inclusive growth' and that 'current gaps in R&D efforts make it more difficult to access, adopt and expand knowledge and innovation, limiting the realisation of their benefits. Public policies should recognise the key role that expenditure for the advancement and diffusion of knowledge, culture, higher education and innovation can play in supporting high quality socio-economic growth, and that these benefits outweigh many short-term concerns for balancing public finances', adding that 'governments can play an important role in stimulating new demand through targeted public research programmes, procurement for public services, and public investment in infrastructure'.

On the business side, the G7 Science Academies statement argues that 'in recent years, many corporations have limited investment in research and technology – which requires long investment horizons – and have favoured short-term returns from financial assets, thus presenting a further threat to economic growth. Well-designed public policies could encourage business investment with longer time horizons, supporting also high-risk projects'.

These arguments are developed by G7 Science Academies 'in line with Goal 9 of the UN 2030 Agenda for Sustainable Development, which is to "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation". In the aftermath of the 2008 economic crisis that has slowed down world growth, we need to make sure that investment in science, technology, innovation and infrastructure expands its contribution to sustainable and inclusive world growth', with the aim also to reducing the North-South divide (G7 Science Academies, 2017). However, official G7 documents and Italian government policy paid modest attention to this call.

### **4.3 Challenge 3 Governance and management of the R&I system and policies**

#### **Description**

The Italian R&I system has been characterised by a number of issues affecting the management of R&I policies: fragmentation of strategies, with many initiatives at both national and regional levels; delays in the implementation of measures; and instability and uncertainty regarding budget availability and allocations.

The R&I policy governance is the responsibility of MIUR, often in joint coordination with MISE. Regions can also develop their own science, technology and industry initiatives on the basis of the concurrency principle. Other ministries (health, agriculture, defence, etc.) manage research funds and PROs in their specific fields. These PROs with specific missions fall outside MIUR's sphere of control and they are not addressed by the PNR.

## **Policy response**

The initiatives of 2017 in different fields of R&I indicate an effort towards greater integration of R&I policies, both within the public sector and in public-private relationships. However, fragmentation and weak coordination persist

Actions have been taken by Italian policy-makers to streamline and rationalise the system of PROs. New rules have been introduced (Legislative Decree 218, 25 November 2016) for the reorganisation of PROs; they envisage greater homogeneity in governance arrangements, but differences in research functions, procedures and evaluation persist.

However the governance bodies of the PNR – a national direction body and a specific committee for ERA initiatives – do not include the public research institutions falling under the control of other ministries.

In order to improve coordination, the implementation of Legislative Decree 218/2016 led to the constitution of the Conper, Consulta dei presidenti degli enti di ricerca, and to guidelines for the assessment of the PROs not supervised by the MIUR on 9 June 2017.<sup>18</sup> In 2018, the PROs should revise the internal statutory rules to comply with the guidelines and with Legislative Decree 218/2016.

Under the PNR and Impresa 4.0/Industria 4.0, new coordinating bodies have been introduced, involving stakeholders and broader consultation activities.

Concerning PROs, debate on possible reforms has continued, including suggestions for a new employment status of researchers, the creation of a national agency and of a coordination body at the Prime Minister's office (Italiadecide, 2017, p. 42).

## **Policy Assessment**

The initiatives of 2017 in different fields of R&I indicate an effort towards greater integration of R&I policies, both within the public sector and in public-private relationships. However fragmentation and weak coordination persist.

The delay in the approval of the PNR 2015-2020, which was planned to be aligned with the time span of Horizon 2020, has left Italy without a national research strategy for nearly two years.

As several PROs are outside the supervision of MIUR and depend on other Ministries, a weak coordination within the new PNR has emerged and a diversity of funding and evaluation criteria remain. The guidelines of ANVUR will be used for assessment in three fields: scientific research, institutional activities, and 'third mission'.

The reorganisation of PROs is still ongoing and efforts are expected to improve their integration in the R&I system, especially for issues regarding the mobility of researchers and public-private partnerships.

The Impresa 4.0/Industria 4.0 and the RIS3 strategies have introduced new governance arrangements of R&I activities and may lead to novel experiences.

## **4.4 Challenge 4 Addressing territorial disparities**

### **Description**

Italy has long suffered from the large divergence between the North and the South of the country with respect to key socio-economic factors such as economic structures, technological activities, incomes, unemployment and female participation.

Serious disparities exist between Northern and Southern regions in terms of R&I activities. R&D expenditure on regional GDP is 1.4% in the North and 0.9% in the South; patents at the European Patent Office per million inhabitants are 106.8 in the North and

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<sup>18</sup> <http://www.anvur.org/attachments/article/1209/LineeGuidaEPR.pdf>

10.1 in the South; the share of employees in high-tech industries is 3.7% in the North and 2% in the South (ISTAT, 2015b, p. 271).

Territorial imbalances in innovation have also seriously increased, with two thirds of innovating firms and three quarters of total expenditure concentrated in five regions only – Lombardy (with 25% of innovators), Veneto, Emilia Romagna, Piedmont and Lazio. In Italy's Southern and island regions, fewer than 13% of Italian firms innovating in products and processes are located (ISTAT, 2016).

A serious divergence has emerged also in university performances, including research outputs, teaching standards and student trends. Southern regions have shown poorer performances and greater reductions in student enrolment, staff and funding. Student support funds, managed at the regional level, have also shown differing performances, leading to unequal opportunities for the young in Southern regions (Fondazione Res, 2016; De Angelis et al., 2016; ANVUR, 2016a).

The R&I policies in the five Convergence regions (Basilicata, Calabria, Campania, Puglia and Sicily) are jointly managed by MIUR and MISE through the National Operational Programme for Research and Competitiveness (PONREC) 2014-2020, that co-finances projects through the European Social and Regional funds. During the 2007-2013 programming period, Southern regions showed a very low absorption capacity of their Structural Funds. Delays are also affecting the implementation of recent measures developed by MIUR, such as those of the new PNR 2015-2020.

### **Policy response**

An attempt to tackle the delays in the management of Structural Funds in Southern regions led to the launch of the Cohesion Action Plan in November 2011, in which the government increased the share co-financed by Structural Funds in the PONREC. Building on this, in August 2013, Italy announced the creation of the Agency for Territorial Cohesion, which is in charge of the efficient management of Structural Funds for the programming period 2014-2020.

The National Smart Specialisation Strategy identified 12 areas of specialisations across Italian regions (which are consistent with the ones addressed by the new PNR) in order to stimulate cross-fertilisation and reduce fragmentation and duplications. The 21 Regional RIS3 fall within the areas of specialisation of the national strategy. The measures launched by MISE and MIUR in support of business R&I (detailed in Challenge 1) have provided a more stable framework for investments in R&I by Italian companies, which can count on, for example, the R&D tax credit for the 5-year period 2015-2019.

In 2016, a law (DCPM 25/02/2016) instituted the governing body of the RIS3 in Italy – a coordinating body for representatives of different institutions ('Cabina di regia').

In 2017, the Ministry of Social Cohesion set up a strategy for the implementation of RIS3 (Directive 10/05/2017) including the approval procedures by the 'Cabina di regia' for the strategic plans for the implementation of the National RIS3

The Contratti di Sviluppo, aimed to support large investments under the umbrella of Industria 4.0, have been implemented prevalently in the Southern regions to trigger employment and to address business towards innovative technologies.

The PONREC has been the main strategy to support R&I-driven competitiveness of Southern regions, with a total allocation of nearly €4.136 billion in five priority areas: (1) industrial research; (2) structural/infrastructural strengthening; (3) clusters and laboratories; (4) smart cities and communities and (5) social innovation.

The Agency of Territorial Cohesion was established following the PONREC experience to coordinate the management of EU Structural Funds and other cohesion policies, including R&I regional actions, for the 2014-2020 programming period (see Challenge 3).

The new national research plan (PNR) for 2015-2020 addresses the question of territorial inequalities with €436 million, funded from the Piano Operativo Nazionale (PON) for the years 2015-2017.

In order to address imbalances in university funding, MIUR introduced some corrective measures to mitigate the effects of the performance-based allocation of university funds:

- a more favourable calculation in the standard cost per student (+5%) for the universities in the South (the measure affects 28% of the core part of the FFO for 2016);
- A different weight applied for universities in the Centre (+0.1) and in the South (+0.2) of Italy in the allocation of one fifth of the performance-based state funding. In 2017, following changes in the legislation (D.L. 91/2017, art. 12, conv. L 123/2017), the reference principles for the standard cost for students have been adjusted to take into account geographical and economic disparities of the territories where institutions are located.

The results of the VQR conducted by ANVUR for 2011-2014 show some improvements in the performance of Southern Italian universities in terms of products of research and recruitment policies (ANVUR, 2016b).

### **Policy Assessment**

Territorial disparities in Italy in terms of R&I have dramatically deepened since the 2008 crisis, as highlighted by recent analyses; there is a serious risk of a further lagging behind of poorer regions (ANVUR, 2016a; Fondazione Res, 2016).

Current policies – in particular the PNR 2015-2020 and the RIS3 strategy – have the explicit goal of reducing the divide with Southern regions. Conversely, many measures of the Impresa 4.0/Industria 4.0 strategy are likely to favour stronger firms and research activities located in the North. However, an overall assessment on the effects of this variety of measures is not yet available.

R&I-related initiatives in recent years have had mixed effects on the R&I system of Southern regions. On the one hand, the Cohesion Action Plan, launched in 2011, helped improve the very low uptake of Structural Funds, and also involved civil society in the Smart Cities and Social Innovation calls. On the other hand, cuts in public R&D and university funding have had particularly negative repercussions in the South.

Problems in Southern Italian universities persist. The ANVUR report argued that the regional management of funds for university students contributes to higher territorial inequalities. The funding reductions resulting from the allocation scheme of FFO have been mitigated in some cases by the correction of performance-based indicators. In other cases, the fall in student numbers has further reduced attractiveness and increased budget pressures (ANVUR, 2016a).

Containing and reducing the divergence between the R&I systems in Northern and Southern Italy will continue to be a major policy challenge.

## **5 Focus on R&I in National and Regional Smart Specialisation Strategies**

In Italy, the Smart Specialisation Strategy has been managed since 2013 by the Government agency Invitalia in cooperation with MISE and MIUR, starting with the project 'Support and definition of regional R&I policies (Smart Specialisation Strategy)'. In 2014, with the involvement of stakeholders, Invitalia released the list of regional and sectoral specialisations, the set of monitoring indicators and supported the Government in the selection of the thematic areas to be included in the new partnership programme 2014-2020 and in the new PNR.

In 2015, MISE and MIUR validated the national Strategy of Smart Specialisation 2015-2020, approved in April 2016 by the EU Commission. The Strategy identified five national

thematic areas and 12 regional thematic areas of specialisation. The five national areas include: Aerospace and defence; Health, nutrition and life quality; Smart and sustainable manufacturing, energy and environment; Tourism, cultural heritage and creative industries; and Digital agenda, smart communities, infrastructures and smart mobility.

The PNR 2015-2020 has been organised accordingly around the five national areas and twelve regional areas of specialisation. The forthcoming programme for Research Infrastructures will also refer to the RIS3 areas of specialisations. In 2016, all 21 Regions (including the autonomous provinces of Bolzano and Trento) had set up their RIS3 strategy.

In 2016, the agency for territorial cohesion, in charge of monitoring RIS3, published the national strategic document on RIS3, which outlines the efforts towards integration of policy measures and R&I programmes. The SWOT analysis in the document pointed out the contrast between the high quality of the research output, the small size of Italy's skill-intensive industries and the lack of a common governance of the R&I system. The document describes in detail the governance system, the monitoring system and the financial framework for the implementation of the strategy.<sup>19</sup>

As envisaged in the strategic document of 2016, a Government regulation (DPCM 25/02/2016) instituted the governing body of RIS3 in Italy ('Cabina di regia') and the working groups for each of the five areas of RIS3, based on a model of multilevel governance. The governing system is expected to trigger public-private partnerships and the involvement of the HEIs and PROs in the implementation of RIS3.

In 2017, the Ministry of Social Cohesion published a directive for the implementation of RIS3 (Directive 10/05/2017) including the approval procedures by the 'Cabina di regia' to validate the strategic plans for the implementation of the national RIS3. The governing body can set up a committee to monitor each strategy and to support synergies at national, cross-border and trans-regional level. Some of the strategies envisaged aim at ensuring inter-regional cooperation and at monitoring activities and targets at national level.<sup>20</sup> Regions with intense cross-border trade such as Friuli Venezia Giulia included some initiatives for cross-border cooperation in their plans, like those envisaged in the national strategy.

The Agency for territorial cohesion has worked on the standardisation of regional monitoring indicators. Monitoring indicators, outlined in the strategic document, and the analysis of synergies between regions and areas of specialisation, are available in the final report of the Invitalia project cited above.<sup>21</sup>

In 2016, each region released a regional strategy with a regional monitoring system, usually with attention also to other innovation policies, such as the Start-up law and innovative financing tools. The policy instruments available for the implementation of the national strategy are described in the national strategic document and are integrated with current measures for R&I. In some regions, such as Lazio, Emilia, Friuli and Calabria, regional agencies and funds are involved in supporting the regional strategy. Each region has adopted a different policy mix, with tools usually targeted to support public-private partnerships; innovative projects of SMEs; networks and innovative clusters; and the implementation of pre-commercial public procurement. The region Emilia Romagna is one of the most advanced in the implementation of RIS3 and has released a scheme for monitoring the implementation of the regional strategy.<sup>22</sup>

RIS3 areas have been included in the PON (Piani Operativi Nazionali) and Regional Operational Programmes (Piani Operativi Regionali) for the use of European Structural

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<sup>19</sup>[http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/politiche\\_e\\_attivita/Program\\_mazione\\_2014\\_2020/Strategie/Strategia\\_Nazionale\\_di\\_Specializzazione\\_Intelligente\\_Italia.pdf](http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/politiche_e_attivita/Program_mazione_2014_2020/Strategie/Strategia_Nazionale_di_Specializzazione_Intelligente_Italia.pdf)

<sup>20</sup><http://www.agenziacoesione.gov.it/it/S3/Bioeconomy.html>  
[http://www.agenziacoesione.gov.it/it/S3/Piani\\_strategici/Space\\_economy.html](http://www.agenziacoesione.gov.it/it/S3/Piani_strategici/Space_economy.html)

<sup>21</sup>[http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/politiche\\_e\\_attivita/Program\\_mazione\\_2014\\_2020/Strategie/Report\\_di\\_analisi\\_12\\_Aree\\_di\\_specializzazione.pdf](http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/politiche_e_attivita/Program_mazione_2014_2020/Strategie/Report_di_analisi_12_Aree_di_specializzazione.pdf)

<sup>22</sup> <http://www.regione.emilia-romagna.it/s3-monitoraggio/index.html>

Funds. For regions this is a necessary condition in order to access resources for R&I (Thematic Objective 1) for the current programming period (2014-2020) of the EU Cohesion policy. Regional financial laws are also gradually integrating the specialisation sectors of RIS3 into broader policy rules. Local research systems, including universities and PROs, are considered as a major stakeholder of RIS3 and, in some cases, they are included in the governance bodies. Public-private partnerships are widely encouraged by the RIS3 national framework since their weak diffusion is considered as a factor of weakness of Italy's R&I system, as argued by the SWOT analysis of the strategic document.

The 2017 call for industrial research projects managed by MIUR is a first step in the integration of PON research into the PNR 2015-2020 and broader innovation policies. The call sought projects in the national strategy specialisation areas.

A large policy effort has been developed around the Smart Specialisation Strategy; however, its implementation is still at an early stage at both the national and regional levels; a proper assessment of its operation and impact is not yet available.

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## Abbreviations

ANVUR	National Agency for the Evaluation of Research (Agenzia Nazionale per la Valutazione della Ricerca)
BERD	business expenditure on research and development
ERC	European Research Council
ERDF	European Regional Development Fund
EU	European Union
EU-28	28 Member States of the European Union
FFO	Ordinary Fund for Higher Education
FIRST	Basic Research Investment Fund
FISR	Integrated Special Research Fund (Fondo integrativo speciale ricerca)
FOE	Ordinary Fund for Research Institutions
GBAORD	government budget appropriations or outlays on R&D
GDP	gross domestic product
GERD	gross domestic expenditure on R&D
HEI	higher education institutions
IPR	intellectual property rights
ISTAT	Italian National Institute of Statistics
MISE	Ministry of Economic Development (Ministero dello sviluppo economico)
MIUR	Ministry of Education, Universities and Research (Ministero dell'istruzione, università e ricerca)
PNR	National Research Programme (Programma nazionale della ricerca)
PON	National Operational Programme (Programma Operativo Nazionale)
PONREC	National Operational Programme for Research and Competitiveness
PPS	purchasing power standard (PPS)
PRIN	Projects of National Interest (Progetti di ricerca di interesse nazionale)
PROs	public research organisations
R&D	research and development
R&I	research and innovation
RIS3	Research and Innovation Strategy for Smart Specialisation
SMEs	small and medium-sized enterprises
VQR	Research Quality Evaluation (Valutazione della qualità della ricerca)

## Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016
GDP per capita (euro per capita)	26400	26800	27300	26700	26500	26700	27100	27600
Value added of services as share of the total value added (% of total)	73.75	73.66	73.69	73.94	73.97	74.46	74.22	
Value added of manufacturing as share of the total value added (%)	15.17	15.82	15.79	15.39	15.38	15.5	15.79	
Employment in manufacturing as share of total employment (%)	17.36	16.82	16.65	16.38	16.2	15.89	15.66	
Employment in services as share of total employment (%)	69.83	70.36	70.82	71.46	72.1	72.69	73	
Share of Foreign controlled enterprises in the total nb of enterprises (%)	0.34	0.33	0.33	0.32	0.32	0.34		
Labour productivity (Index, 2010=100)	97.8	100	100.5	100.2	101.1	101.3	101.1	100.3
New doctorate graduates (ISCED 6) per 1000 population aged 25-34			1.12	1.16	1.16	1.12	1.19	
Summary Innovation Index (rank)	18	18	18	18	18	17	17	19
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				56.1		48.7		
Innovation output indicator (Rank, Intra-EU Comparison)			14	14	15	16		
Turnover from innovation as % of total turnover (Eurostat)		14.9		11				
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						44	45	50
Ease of getting credit (WB GII) (Rank)						80	81	84
Venture capital investment as % of GDP (seed, start-up and later stage)	0.004	0.004	0.003	0.004	0.003	0.002	0.002	
EC Digital Economy & Society Index (DESI) (Rank)						25	25	25
E-Government Development Index Rank		38		32		23		22
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	21	23	22	19	21	23	24	24
GERD (as % of GDP)	1.22	1.22	1.21	1.27	1.31	1.38	1.33	
GBAORD (as % of GDP)	0.62	0.6	0.56	0.55	0.53	0.52	0.51	
R&D funded by GOV (% of GDP)	0.51	0.51	0.51	0.54	0.54	0.56		
BERD (% of GDP)	0.65	0.66	0.66	0.69	0.72	0.76	0.74	
Research excellence composite indicator (Rank)	10	11	11	11	11	11		
% of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		9.83	9.52	10.03	10.02	10.17		
Public-private co-publications per million population	25.58	27.18	28.05	24.01	23.77	21.09	15.2	
World Share of PCT applications	1.98	1.89	1.76	1.71	1.67	1.66	1.74	
Global Innovation Index				29	31	31	29	29

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