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Research and Innovation Observatory Country Report 2016 Italy

The 2016 series of the RIO Country Report analyses and assesses the development and performance of the national research and innovation system of the EU-28 Member States and related policies. It aims at monitoring and evaluating the EU policy implementation as well as facilitating policy learning in the Member States.

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Foreword

This report offers an analysis of the R&I system in Italy for 2016, 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 January 2017. The report contents are partly based on the RIO Country Report 2015 for Italy (Nascia et al. 2016).

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HIGHLIGHTS

- Italy's GDP has not yet returned to its pre-crisis values. In autumn 2016, IMF, OECD and the EC forecasted an increase of GDP in 2016 of 0.7-0.8% lower than the Eurozone area.
- Public investments remained subdued in 2016
- Economic stagnation has also reduced private investment and R&I efforts.
- In all R&I activities, Italy's austerity policy has led to a reduction of resources, worsening the previously existing gap with EU.
- Italy's fiscal policy has continued to reduce the budget deficit, from 3.0% of GDP in 2014 to 2.6% in 2015; a further reduction is expected for 2016, in spite of the government's request for greater 'flexibility' to EU authorities

MAIN R&I POLICY CHALLENGES

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

The Italian economy is characterised by an overwhelming majority of small and micro enterprises active in industries with a low R&D intensity. On top of that, 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.

- **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 and uncertainty regarding budget availability and allocations.

- **Addressing territorial inequalities**

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 recession's impact has been more severe in the South and several policies – including the allocation of university funds – have reduced available resources for the South.

MAIN R&I POLICY DEVELOPMENTS IN 2016

- National Research Programme ([PNR](#)) for 2015-2020
- The '[Industria 4.0](#)' strategy, released in September 2016
- A [tax credit scheme](#), available for 2015-2020
- The '[Patent box](#)'
- [The National Smart Specialisation Strategy](#)
- [Merit-based funding](#) arrangements for universities based on research evaluation

1 Main R&I policy developments in 2016

National Research Programme (PNR)

(05/2016)

The main policy novelty of 2016 is the National Research Programme (PNR) for 2015-2020 that provides a new strategic framework for the country's R&I policy after the end in 2013 of the previous PNR. PNR resources are available for the years 2015-2017 only, totalling €2.4b. Sources that are considered include EU ones – the PON funds coming from FESR and FSE - and national funds such as FISR, FIRST, FFO, FOE, SSC. The PNR allocates funds for the following objectives: human capital, €1.02b; public private partnerships, €487m; territorial inequalities, €436m; Research Infrastructures programme, €343; internationalisation actions, €107.

The 'Industria 4.0' strategy

(09/2016)

It is aimed to boost private innovative investments in the manufacturing sector. A policy mix based on fiscal incentives, venture capital benefits, high tech infrastructures and university and secondary education support is expected to encourage adoption and diffusion of new technologies. The stability law approved by Parliament in December 2016 defines regulations and funding for the implementation of 'Industria 4.0'.

A new Tax Credit Scheme

(02/2016)

A tax credit scheme, available for 2015-2019 allows a 25% tax credit for incremental investments in R&D (50% if R&D is carried out in cooperation with public bodies), up to a maximum annual amount of €5m for each beneficiary. The stability law approved in December 2016 extended the R&D tax credit scheme to 2020, increased support to 50% of incremental R&D investments and set a maximum amount of €20m for each beneficiary.

Patent Box (06/2016)

The 'Patent box' (2015) allows the tax deduction of 50% of the revenues originated from direct/indirect use of intellectual property (IP) rights (patents, trademarks, industrial designs and models).

National Smart Specialisation Strategy

In 2015 MISE and MIUR defined the National strategy of smart specialisation 2015-2020 based on the territorial analysis of Invitalia and defined 5 thematic areas - Aerospace and Defence; Health, nutrition and life quality; Smart and sustainable manufacturing, energy and environment; Tourism, cultural heritage and creativity industry; Digital agenda, smart communities, infrastructures and smart mobility.

Merit-based funding for universities

For universities and PROs further increases in performance-based funding has been introduced. MIUR's financial planning of FFO for 2016-2018 envisages a share of merit-based funds increasing from 20% in 2016 to 24% in 2018. Moreover MIUR envisages an increase of the project based funding for Universities. Additional measures provide special funds to 'high quality' researchers (starting from 2017) and Departments (starting from 2018).

New Research Quality Evaluation (VQR)

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.

1.1 Focus on National and Regional Smart Specialisation Strategies

Description and timing: In 2013, the Government agency Invitalia managed - in cooperation with MISE and MIUR - the project 'Support and definition of regional R&I policies (Smart Specialisation Strategy)'; the goal was to define the smart specialisation strategy for Italian regions under the guidelines of the RIS3.

In 2014 Invitalia released the list of regional and sectoral specialisations, the set of monitoring indicators and supported the government for the selection of the thematic areas included in the new partnership programme 2014-2020, the new PONREC and the new PNR.

New developments: In 2015 MISE and MIUR defined the National strategy of smart specialisation 2015-2020 based on the territorial analysis of Invitalia and defined 5 thematic areas to focus on. The national strategy of smart specialisation has been approved in April 2016 by the EU Commission and is finalised to trigger innovation and improve competitive advantages for the country. The five national areas include Aerospace and Defence; Health, nutrition and life quality; Smart and sustainable manufacturing, energy and environment; Tourism, cultural heritage and creativity industry; Digital agenda, smart communities, infrastructures and smart mobility.

The PNR 2015-2020 is based on the five national areas and on the 12 regional thematic areas of specialisation.

Outstanding issues: The monitoring of the national and regional specialisations is not yet implemented. The PNR 2015-2020 envisages the monitoring of the activities with compliance with RIS, but the strategy is still at initial stages.

2 Economic Context

The Italian economy appears unable to move out of a long stagnation started in 2008 and the country's GDP has not yet returned to its pre-crisis values. The crisis started in 2008 has accelerated a weakening of Italy's economic structure. The larger losses were suffered by Italian industry in medium-high and medium-low technology sectors (-29% and -32% in output from April 2008 to July 2015), while the reduction is less dramatic in low technology industries (-19%), and is limited in high tech sectors (-2%) that however account for a modest share of Italy's output (Lucchese et al., 2016).

In this context, Italy's fiscal policy has continued to reduce the budget deficit, from 3.0% of GDP in 2014 to 2.6% in 2015; in 2016 the Italian government has asked EU authorities for greater 'flexibility' in order to limit the further reduction of public spending. The continuing austerity, however, has failed to reduce the public debt-to-GDP ratio due to the lack of economic growth. It has instead led to widespread public budget cuts, a fall of public investments and serious constraints on public R&D expenditure.

In Italy total factor productivity is stagnant and investment has not yet recovered after the sharp fall experienced during the crisis. The continued presence of structural obstacles to the efficient allocation of resources within the economy remains a major issue for Italy.

2.1 Structure of the economy

Italy's economic structure shows a lower presence in high technology manufacturing and service industries, compared to other major EU economies.

In 2015 the service sector accounts for 74.2% of value added, with manufacturing producing 15.8%. In the same year knowledge-intensive services account for 33.8%, whereas the total value added in high and medium tech manufacturing represents 6.3% only. The concentration of the Italian business sector in the typical activities of the 'Made in Italy' is generally associated with low and medium technology activities.

2.2 Business environment

The low demand – particularly in the domestic market – appears to be the key problem faced by Italian firms. 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 in 2015 and 2016 have included tax reduction plans on business taxation, fast track decision procedures on public project and expenditure ('Sblocca Italia'), labour reforms that reduced employment protection and limited the importance of national labour contracts ('Jobs Act'). The above mentioned actions did not focus on high tech industries, nor did they target innovative activities. In a context of a sluggish economy, these actions have failed to stimulate a revival of investment and private R&I.

2.3 Supply of human resources

Data from the 2016 Innovation Union Scoreboard (IUS) show that in 2015 24.9% of the population aged 30-34 had tertiary education, putting Italy at the bottom of the ranking, well below the EU28 average of 38.5%. Conversely, 80% of people aged 20-24 had completed upper secondary education, not so far from the EU average of 82.6% (European Commission, 2016a).

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 (MIUR, 2011; 2012; 2016).

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 has been allocated to programmes fulfilling "Innovative criteria". The Ministerial guidelines for the accreditation of PhD programmes are being revised according to the same principles.

In 2015, the Jobs Act (D.lgs 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.

3 Main R&I actors

In Italy's R&D and innovation system a key role is played by the central government, namely the Ministry of education, university and research (MIUR) and the Ministry of economic development (MISE). Total R&D in 2015 was €21,892m, 1.33% of GDP. The share of business performed R&D (BERD) in GDP was 0.74%, that of universities 0.38%, that of government – mainly public research organisations - 0.18%, that of non profit institutions 0.04%. In terms of funding, 2014 R&D funded from abroad accounted for 0.13% of GDP, of which 0.04% came from EC sources. The evolution of R&D resources (at constant 2005 prices) is shown in Figure 1 below.

In 2013 large business with more than 500 employees concentrated around 62.5% of R&D performed by private business; small firms with less than 50 employees performed 10.3% (ISTAT, 2015a). In 2013 multinational firms recorded around €2.7b of R&D investments with a slight increase from 2012 (ISTAT, 2015b).

The funding flows from abroad are originated by three relevant sources: FDI-associated R&D, EU Framework Programmes and EU Structural Funds. Framework Programmes (FP6 and FP7) are becoming a relevant channel for the European funding of research in Italy. The participation to FP7 calls is widespread with a success rate of Italian proposals of 18.3%. Italy is the fourth highest financed country in FP7 (more than €3.6b from 2007 to October 2014¹), after the UK, France and Germany; business participation is strong, with six Italian firms among the top 50 recipients of signed grants for firms in 2007-2013, two universities in the top 50 for HEIs and six research centres in their top 50².

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

In 2015 Italy's total R&D personnel, in full time equivalent units, amounted to 248,140, of which 120,677 researchers, with a stable pattern compared to 2014. With respect to 2014 the reduction of around 1,327 units is concentrated in the business sector (-708), in universities (-343), and in the government sector (-294) (Eurostat, 2016).

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, 2016d). 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 has been 23.2 billion euros, a 4.3% fall compared to 2012. R&D accounts for close to half total expenditure. On average, in 2014 Italian firms have spent for new products and processes €6,200 per employee, against €6,300 in 2012. Close to one quarter of firms has obtained public incentives for innovation. The economic impact of the new products that have been introduced is modest; in 2014 products that are 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 technology 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, the Netherlands - have much higher shares (Hölzl, 2016, p.250). A higher share of 'high growth firms' has been shown to be associated to a greater dynamism of national economies and to a more efficient reallocation of resources.

4 R&I trends

4.1 Public allocation of R&D and R&D expenditure

Since the start of the crisis in 2008, total (civilian) government appropriations for R&D (GBAORD) exhibit a declining trend (see Figure 1) and in 2014 they are significantly lower than their pre-crisis levels. This reduction is at the root of several trends,

¹ http://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile

² Seventh FP7 Monitoring Report 2013 11/03/2015

including the sharp fall in the number of researchers and university professors that from 2008 to 2104 has decreased by 20% (involving 10,000 people), a fall higher than in other public institutions.

The reduction of funding has affected public expenditure targeted at both the public and the private sector. The competitive calls for "non-targeted" research PRIN and FIRB had to face delays and reduction of resources. The new competitive research call SIR has not been re-funded after the 2014 round. In 2013 FAR, the larger fund for industrial R&D was suspended for lack of available funding.

The public sector and universities are by far the main recipients of government direct funding. In the period 2005-2014 only about 10% of public funds have been used to fund R&D performed by the business sector.

In order to partially compensate for budget cuts, Italy has set in place a set of measures that introduce tax reductions on a range of R&I activities. An R&D tax credit scheme for expenditure carried out in the period 2015-2019 has become operational in the summer of 2015. It allows a 25% tax credit (that goes up to 50% when R&D is carried out in cooperation with public organisations) for incremental investments in R&D, up to a maximum annual amount of €5m for each beneficiary. The foregone tax revenue has been estimated at approximately €2.5b for the 5 years 2015-2019. The stability law approved by Parliament in December 2016 extended the R&D tax credit scheme to 2020, increased support to 50% of incremental R&D investments and set a maximum amount of €20m for each beneficiary.

In 2015 Italy has introduced the 'Patent box', allowing the tax deduction of 50% of the revenues originated from direct/indirect use of intellectual property (patents, trademarks, industrial design and models). No specific data are currently available for an assessment of the impact of these measures.

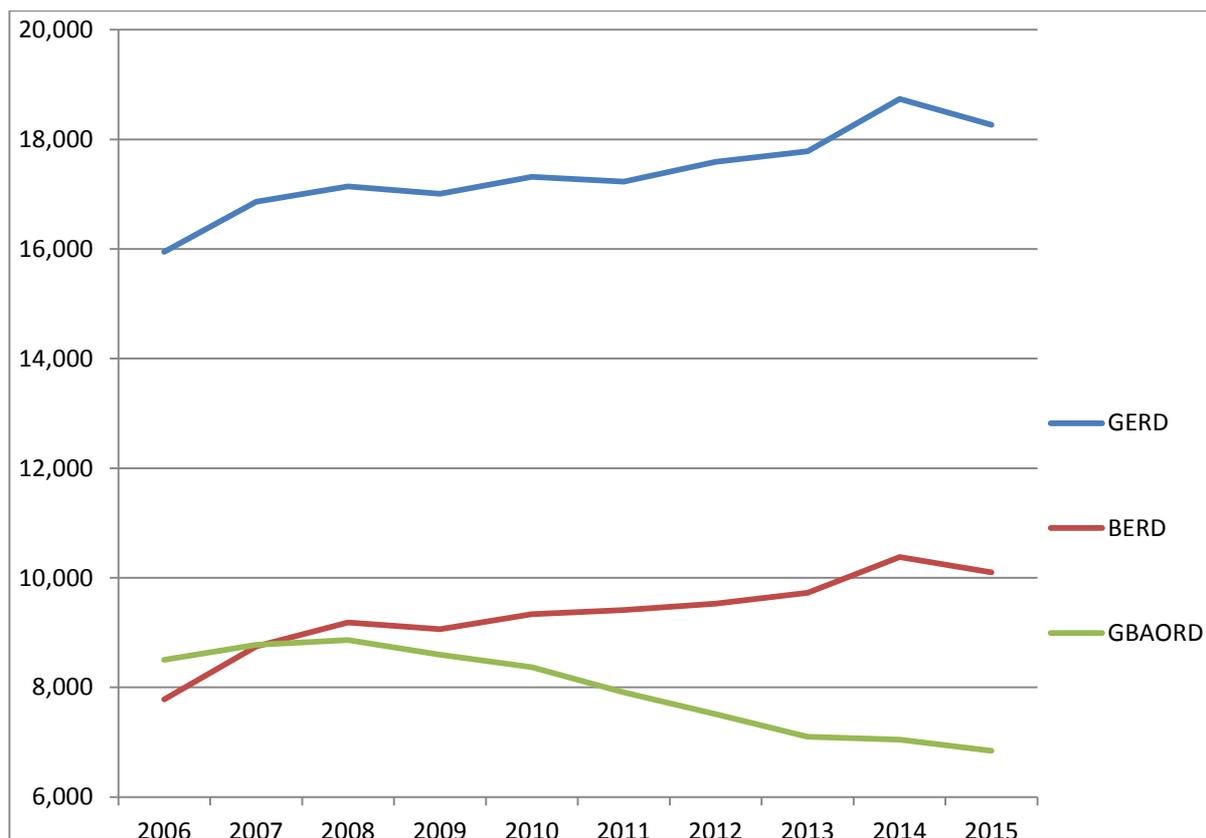


Figure 1 Total R&D in Italy (GERD), R&D performed by business (BERD) and appropriations in government budget (GBAORD). Million euros at 2005 prices.

4.2 Private R&D expenditure

Business performed R&D (BERD) as a share of GDP is 0.74% in 2015, showing a modest increase over the last decade. However, Italy remains far from other EU large economies such as France or Germany, where it is close to 1.5% and 2% of GDP respectively.

Manufacturing and services account for more than 95% of BERD. The contribution from manufacturing is more than twice that of services and has been on the rise since 2007, while BERD in the service sector stagnated (Figure 2, left graph). The business sector is the main funder of Italian BERD.

Manufacturing maintains a significant role in the composition of Italy's value added, with machinery being the most important sector (electronic and optical products rank sixth within manufacturing); a large role is played by 'traditional' and low R&D sectors in both manufacturing - such as food, beverages, textile and clothing, etc. - and services (see Figure 2, right graph).

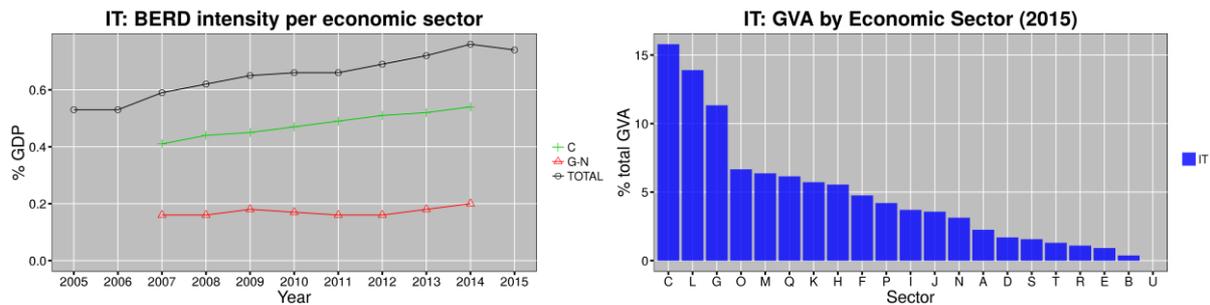


Figure 2: Left: BERD intensity broken down by most important macro sectors (C= manufacture, G_N=services). Right: economic sectors as percentage of the total GVA. Top 6 sectors in decreasing order: 1) Manufacturing; 2) Real estate activities; 3) Wholesale and retail trade; repair of motor vehicles and motorcycles; 4) Public administration and defence; compulsory social security; 5) Professional, scientific and technical activities; 6) Construction.

4.3 Public sector innovation and civil society engagement

A number of projects have been launched for promoting public sector innovation. AgID (Agenzia per l'Italia digitale – Agency for Digital Italy) has an agenda focused on innovation in the public sector taking advantage of the use of Information Technologies to provide services to citizens.

The National Forum on Open Government – established in June 2011 – aims to encourage the participation of different stakeholders (universities, NGOs, firms) in the definition of public sector innovation policies. It was involved in the 2016 consultation for the third Action Plan for the implementation of 33 open data policy measures.³ The release of a growing amount of open data from the government and current progress in the data mining of large databases - 'big data' - could open up the possibility to develop national open source collaborative communities as a resource for the software and digital industries, but also for social innovation. Although a chapter of the Action plan is focused on participation and open public administration, few measures are effectively targeted to spreading an innovation culture. Specific measures to promote cooperation with the scientific community are also missing, with the exception of the support for new modalities of 'open' research: open science, open data and open repositories.

Innovation and industrial policies do not address in a relevant way the development of open source and collaborative communities that can be complementary to new industries, or the extension of open source practices to manufacturing industries such as vehicles and machinery.

The current landscape shows a limited civil society engagement in innovation in Italy. The most active platforms include Che fare, StartupItalia, Italiastartup, Sitizen and Socialfare, based on cooperation between public, private and non-profit actors.

5 Innovation challenges

5.1 Challenge 1 The low level of business R&I activities and unfavorable framework conditions

Description

Despite the presence of some innovative firms, the Italian economy is characterised by an overwhelming majority of small and micro enterprises with a low R&D intensity. As a consequence, Italy has traditionally specialised in low- to medium-technology products.

³ <http://www.funzionepubblica.gov.it/articolo/ministro/01-06-2016/nasce-opengov-forum-una-palestra-tra-istituzioni-e-cittadini>

Such small firms are unable to invest significantly in R&D. This is exemplified by the latest 2015 industrial scoreboard. More than 60% of BERD of the Italian companies listed therein is accounted for by four firms alone: Finmeccanica (aerospace and defense), Telecom Italia (telecommunications) Unicredit and Intesa Sanpaolo (financial sector). Fiat, despite being a primary actor in the Italian BERD, is now registered as a Dutch company; hence its R&D contribution cannot be estimated from the scoreboard.

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.

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 and the 'patent box' with tax reductions of IPR income – already mentioned above. In addition, government policy has introduced accelerated depreciation allowances for investment in machinery amounting to 140% of the cost of machinery acquired. In the context of the 'Industria 4.0' strategy such measures have been extended to 250% of the value of machinery related to 'Industria 4.0' high tech areas of action.

'Industria 4.0' measures also support venture capital investment and start up capital with tax reductions. Broader tax reductions have concerned the revenue and capitalisation of firms, regardless of their R&I activities (MISE, 2016).

Policy measures continued to target innovative start-ups (with actions started in 2013) and innovative SMEs (with measures introduced in 2015). These companies are defined on the basis of their R&D expenditure (15% of costs for innovative start-ups and 3% for innovative SMEs), qualified personnel (proportion of personnel holding a PhD and/or a master's 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.

Policy Assessment

Italian policy-makers have been trying to establish a consistent framework to support R&I activities carried out by Italian businesses, whereas past support measures were characterised by their limited time span and uncertainty in terms of budget availability. The new tax credit scheme might have a positive impact also on the emergence of non-reported R&D.

Italy's policies in this field show a shift towards a support system dominated by indirect funding. 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. As a consequence, Italy does not appear to move towards a more balanced (direct and indirect) approach towards BERD funding.

5.2 Challenge 2 The public sector funding of R&I

Description

In 2015 the Italian R&D performed by the government is equal to 0.18% of the GDP, well below the EU average of 0.24%. Also the R&D funded by the government is below the EU average: in 2014 only 0.56% of the GDP respect to an EU average equal to 0.66% of the GDP.

The resources devoted to the university system have experienced a major reduction. Considering state universities, total resources (in current euros) reached a maximum of €13,570m in 2008, followed by a continuing fall, down to €12,258m 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 2016 the government allocated €6,900m for general university funding (FFO) - the same as in 2015; in 2014 funds were €7,000; in 2008 funds were €7,500m. The share of merit-based funding is expected to increase from 20% of 2016 to 24% of 2018, based on the results of the Research Quality Evaluation, on recruitment practices and on overall quality indicators (MIUR, 2016b). Additional measures have been introduced in the stability law approved in December 2016 (see below).

A major novelty in university recruitment was introduced in 2012 with the new system of habilitation ('Abilitazione scientifica nazionale'). In the 2012 habilitation round 56,539 applications were presented from 26,943 scholars. The number of habilitations 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 habilitations that were granted (ibid.). In 2015 the regulations for the 'Abilitazione' have been revised, introducing five evaluation sessions between December 2016 and April 2018, increasing the opportunities to present candidatures.

In late 2016 the preliminary 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 (ANVUR, 2016b).

Funds for competitive calls have also been drastically reduced: resources for Progetti di interesse nazionale (PRIN) decreased from €100m in 2009 to €38.2m in 2012. Resources for the Fondo per gli investimenti nella ricerca di base (FIRB) amounted to €29.5m in the call launched at the end of 2012. In 2013 and 2014, MIUR did not launch any new FIRB or PRIN call. In January 2014, MIUR published the competitive funding call Scientific Independence of Young Researchers (SIR) with a budget of just €47m. Only in November 2015 a new PRIN call was launched, with a budget of €91.9m. More than 4300 proposals participated to the selection that led to the financing of 300 projects only.

In spite of these funding reductions, Italy's research output in terms of scientific publications is strong and has systematically improved. Italy's performances in terms of scientific productivity - as measured by publications per million R&D expenditure, articles per researcher, and citations per R&D units or researcher - are generally better than those of Germany and France⁴.

Preserving the extent and quality of its research base is a serious challenge for the Italian R&I system, in particular in a context of budget cuts and limited job opportunities for researchers in the public sector.

Policy response

Italian policy-makers have been taking steps towards a more efficient 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 of 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 Valutazione della qualità della ricerca (VQR), the research evaluation exercise carried out

⁴ See ANVUR (2014, 2016) and Nascia et al. (2016) for an analysis of scientific publications and productivity indicators.

by ANVUR, the state agency responsible for the evaluation of universities and research organisations⁵.

In the stability law approved in December 2016 new measures are introduced for universities. A "Fund for research activities" of €45m, starting from 2017, will provide grants of € 3,000 per year to 15,000 'best researchers' that will be identified through a selection carried out by ANVUR;

A fund for 'Departments of excellence' of €271m per year, starting from 2018, will provide additional financial support to 180 university Departments that will emerge as the best performers from the last Research Quality Evaluation (VQR)

The stability law 2017 includes the revision of the limits set for the turnover in universities; from 2017, all State universities will be able to recruit up to 50% of retirements and, for the ones with a more stable financial situation, the limit is increased to 80%.

Funds for €245m have been made available for the recruitment and career advancement of university personnel.

A programme to introduce 500 positions for highly qualified full professors ("Cattedre Natta") had been planned with allocations of €38m in 2016 and €75m in 2017; it envisaged a novel recruitment channel, under the authority of the prime minister rather than through the usual procedures based on academic selection committees; the plan has been highly controversial and its implementation is uncertain.

The major policy novelty of 2016 is the introduction - with considerable delay - of the National Research Programme 2014-2020 which defines the country's strategy for R&I. PNR resources are available for the years 2015-2017 only, totalling €2.4b. Sources that are considered include EU ones - the PON Research and Innovation funds coming from FESR and FSE but also PON Enterprises and competitiveness and the Regional OPs under TO1 coming from ERDF - and national funds such as FISR, FIRST, FFO, FOE, SSC. The PNR allocates funds for the following objectives: human capital, €1.02b; public private partnerships, €487m; territorial inequalities, €436m; research infrastructures programme, €343; internationalisation actions, €107.

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. It is not clear from the PNR structure the size of the additional share of financing for R&D and the share coming from a reallocation of current resources on research.

Policy Assessment

The public budget constraints faced by Italy have had a considerable impact on public R&I expenditure. The Council of the European Union⁶ has recommended safeguarding investments in R&I, but public expenditure has continued to be reduced. Despite the improved performance of the Italian research base, the country is facing a serious risk of brain drain, given the limited labour opportunities for researchers in the public sector and low absorptive capacity of the business sector (see Challenge 1). It is estimated that about 50,000 Italian researchers are already working abroad, although an official estimate is missing. The new PNR focuses on three programmes for about €520m during the period 2017-2020 to attract researchers from abroad.

In addition, relying on the availability of EU (Horizon 2020) funds as a substitute for the reduced national resources would mean that Italian applicants in Horizon 2020 should significantly improve the performance recorded during the Seventh Framework

⁵ <http://hubmiur.pubblica.istruzione.it/web/ministero/cs070516>

⁶ http://ec.europa.eu/europe2020/pdf/csr2015/csr2015_council_italy_en.pdf

Programme (FP7) phase. The first results of Horizon2020 show that the success rate of Italian applicants is the fifth lowest in the EU.

5.3 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. 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 2014-2020 to co-finance projects through the European Social and Regional funds.

During the 2007-2013 programming period, Southern regions also showed a very low absorption capacity of their Structural Funds. Delays are also affecting the approval and/or implementation of recent measures developed by MIUR like the new PNR 2015-2020.

Policy response

Actions have been taken by Italian policy-makers to streamline and rationalise the system of PROs. For example, in January 2015, a new PRO, the National Council for Agricultural Research and Analysis of the Agricultural Economy (CREA), was created by merging two organisations, the Istituto Nazionale di Economia Agraria (INEA) and Consiglio per la Ricerca e la Sperimentazione in Agricoltura (CRA), CREA is in charge of a multiyear research programme on agriculture that is not included in the PNR 2015-2020.

An attempt at tackling 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 PONREC funds were merged with Structural Funds. Building on this, Italy announced in August 2013 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 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.

The governance bodies of the PNR, a national direction body and a specific committee for the ERA initiatives - Coordinamento della Rappresentanza Nazionale (CRN) managed by MIUR - do not include the public research institutions falling under the control of other ministries.

Policy Assessment

Italy is still suffering from governance issues affecting its R&I system. For instance, the delay in the approval of the PNR, which was planned to be aligned with the time span of Horizon 2020, has left Italy without a national research strategy for nearly 2 years. As several PROs are outside the supervision of MIUR and depend from other Ministries, a

weak coordination within the new PNR has emerged and a diversity of funding and evaluation criteria remain.

However some improvements in the governance system have emerged in 2016 with the introduction of the PNR 2015-2020 as a policy framework for research, with the greater coherence of tax incentives provided to firms in a range of R&I and economic activities, and with the 'Industria 4.0' programme. New rules have been introduced (Legislative Decree 218, 25 November 2016) for the reorganisation of Public Research Organisations (PROs); they envisage greater homogeneity in governance arrangements, but differences in research functions, procedures and evaluation persist. In the new major initiatives of the PNR and 'Industria 4.0' new coordinating bodies have been introduced.

On a more positive note, the reformed system for firms' incentives aims to provide a stable and consistent package addressing the different phases of the R&I cycle, from investments (R&D tax credits) to IPR revenues (Patent box) (De Vincenti, 2014). However, no ex-ante assessment exercise on the additionality of the new schemes was performed, with a risk of a negative impact on the state budget in terms of tax expenditures.

5.4 Challenge 4 Addressing territorial inequalities

Description

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

Serious divergences emerge between Northern, Central 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 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, 2015c, 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 less 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, student trends. Southern regions have shown poorer performances and greater reductions in student enrolment, staff and funding (De Angelis et al., 2016). Student support funds, managed at the regional level, have also shown differing performances, leading to unequal opportunities for the young in Southern regions (ANVUR, 2016).

Policy response

The PONREC has been the main strategy to support R&I-driven competitiveness of Southern regions, with a total allocation of nearly €4.136b 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 €436m, 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.

The results of the Research evaluation exercise (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 inequalities in Italy have dramatically deepened during the recession, as highlighted by recent analyses that warned about the risk of further lagging behind.⁷

R&I-related initiatives in recent years have had mixed effects on the R&I system of the Southern regions. On the one hand, the Cohesion Action Plan, launched in 2011, helped improve the very low take-up 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 had particularly negative repercussions in the South.

Problems in Southern Italian universities persist. The ANVUR report (ANVUR, 2016a) 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 decrease in students' numbers has further lowered attractiveness and budget pressure.

6 Focus on creating and stimulating markets

In Italy demand driven innovation has been constrained by budgetary policies that have reduced the role of public expenditure and procurement programmes. The funds mobilised for Italy's new PNR do not address the need to create and stimulate markets for innovative goods and services through demand-side policies. The most relevant R&I action that has a potential in this direction is the Digital Agenda. At the same time, most public procurement programmes in other policy areas pay little attention to the R&I dimension, although an important potential can be found in environmental sustainability initiatives.

The constraints from reduced expenditures have been serious. In the European Semester fiche devoted public expenditure the Commission showed that from 2008 to 2015 Italy's share of public investment in total government expenditure has fallen from 6.2 to 4.5% (EU-28 data were 7.4 and 6.2%); the share of education in GDP from 2009 to 2014 fell from 4.6 to 4.1% (EU-28 data were 5.3 and 4.9%); the share of government budget outlays for R&D in GDP over the same period fell from 0.62 to 0.50% (EU-28 data were 0.75 and 0.64%). In all fields, Italy's austerity policy has led to a reduction of resources, worsening the previously existing gap with EU-28 averages (European Commission, 2016b)

⁷ See Fondazione Res (2016).

An overall indicator of the role of public action in the economy – including the role of procurement initiatives aiming at creating markets - is the relevance of 'State aid' to firms that also includes various forms of demand-led policies that may support innovation. Between 1992 and 2013 for the EU28 countries State aid as a share of GDP fell from 1.2% to 0.5% (European Commission, 2014). Public intervention in industry and services in Italy amounted in 2013 to €3.5b, 0.2% of GDP in 2013, as opposed to 1.6% in 1992; in 2014 the amount increased to €4.9b (MISE, 2015). Italy, Germany, Spain and Portugal are the countries that reduced State aid faster. Conversely, Northern European countries maintained higher expenditure; in France in 2013 State aid amounted to €13b (0.6% of GDP), almost four times Italy's funds. In Northern Europe most State aid goes to horizontal policies for environmental protection and energy saving; in Italy action of this type is among the lowest in Europe and the same applies to sectoral aid. The fall of State aid has slowed down during the crisis after 2008, but it played no counter-cyclical role in supporting demand and investment (Lucchese et al., 2016).

In spite of these limitations, a debate is emerging also on the importance of demand driven innovation, innovation-related procurement programmes and a more active role of public policy (see Lucchese et al., 2016 and the contributions in the same journal special issue). These arguments build on several policy studies showing the importance and effectiveness of public procurement programmes in R&D, strategic acquisition of high technology goods and services by governments that have played a major role in the development of new production capabilities in other countries (Mazzucato, 2013).

Initiatives for the creation and stimulation of markets for innovative goods and services are not limited to demand-side actions and procurement programmes; they include also regulatory action, that has led to a significant reduction of product market regulation in Italy. In addition, environmental regulations and standards could provide an important framework and incentive for R&I in Italy, especially in the fields of renewable energy, reduction in the use of non-renewable resources, waste disposal, sustainable mobility, etc. However, policy actions in these fields have rarely include a full consideration of the potential effect on R&I.

As markets for innovative goods and services have an increasingly international dimension, Italy's position in international production system has to be considered. We have already documented above the low level of business R&D funded from abroad and the limited R&D efforts carried out in Italian affiliates of multinational corporations. An additional aspect to be considered is the increasing integration in global value chains of Italian supplier firms. A study of manufacturing firms over the 1998-2006 period found that they tend to have lower productivity than firms selling to final markets – controlling for similar levels of innovation and export activities - although such gap disappears for firms with higher technological and export competences (Agostino et al. 2015).

In fact, in the context of falling production pointed out above, Italy's firms are increasingly involved in international production in a weaker hierarchical position. Rather than managing the value chain and controlling final markets, a growing number of firms acts as subcontractor in the emerging production system centred in Germany and extending over a number of neighbouring European countries (Simonazzi et al. 2013; Cirillo and Guarascio, 2015).

As Italy is characterized by a modest flow of foreign direct investments compared to many other European countries, the government announced in 2013 the plan 'Destinazione Italia', envisaging fifty actions aimed at attracting foreign capital inflows and at supporting the business environment; they include simplified bureaucratic

procedures, custom reform, an Agency devoted to supporting foreign investment, favourable investment rules and tax incentives.⁸

The above measures are important components of the broader industrial policy of Italy's government. Its main directions include the continuation of liberalisation in markets characterised by positions of rent; the provision of context conditions such as education and infrastructures; "horizontal" support for R&D and innovation by firms; "vertical" support to dynamic production systems ("filières") identified by the European Commission through rule-setting; environmental regulation and encouragement of private investment; the new role as a sort of public investment bank of Cassa Depositi e Prestiti (CDP - a joint-stock company owned by the Italian Ministry of the Economy) that can acquire shares of private firms operating as "market oriented" investors (De Vincenti, 2014).

⁸ For a detailed list of implemented policies see Nascia et al. (2016), Lucchese et al. (2016) and MISE (Ministero dello Sviluppo Economico), (2015).

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Abbreviations

AgID	Digital Italy Agency (Agenzia Digitale Italiana)
ANVUR	National Agency for the Evaluation of Research (Agenzia Nazionale per la Valutazione della Ricerca)
ASN	National Scientific Habilitation (Abilitazione Scientifica Nazionale)
BERD	Business Expenditures for Research and Development
CIS	Community Innovation Survey
CRA	Consiglio per la Ricerca e la Sperimentazione in Agricoltura
CREA	National Council for Agricultural Research and Analysis of the Agricultural Economy
D.lgs	Legislative Decree (Decreto Legislativo)
EU	European Union
EU28	European Union Including 28 Member States
FAR	Fund for Applied Research (Fondo per la ricerca applicata)
FCS	Sustainable Growth Fund (Fondo crescita sostenibile)
FDI	Foreign Direct Investments
FFO	Ordinary Fund for Higher Education
FIRB	Future in Research (Fondo per gli investimenti nella ricerca di base)
FIRST	Basic Research Investment Fund
FP6	6th Framework Programme
FP7	7th Framework Programme
FTE	Full-time equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GVA	Gross Value Added
HEI	Higher Education Institutions
HIT2020	Horizon Italia 2020 (HIT2020)
INEA	Istituto Nazionale di Economia Agraria
IP	Intellectual Property
IUS	Innovation Union Scoreboard
MISE	Ministry of Economic Development (Ministero dello sviluppo economico)
MIUR	Ministry of Education, University and Research (Ministero dell'istruzione, università e ricerca)
OECD	Organisation for Economic Co-Operation and Development
PNR	National Research Program (Programma nazionale della ricerca)
PONREC	National Operational Program 'Research and Competitiveness'
PON	National Operational Program (Programma Operativo Nazionale)
PRIN	National Interest Research Program (Progetti di ricerca di interesse nazionale)
PROs	Public Research Organisations
R&D	Research and Development
R&I	Research and Innovation
SF	Structural Funds
SIR	Scientific Independence of Young Researchers
SME	Small And Medium Sized Enterprise
VQR	Five-Year Research Evaluation Exercise (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	26500	26900	
Value added of services as share of the total value added (% of total)	73.77	73.68	73.72	73.96	74.06	74.34		
Value added of manufacturing as share of the total value added (%)	15.16	15.8	15.78	15.37	15.31	15.43		
Employment in manufacturing as share of total employment (%)	17.36	16.82	16.65	16.38	16.19	16.18		
Employment in services as share of total employment (%)	69.83	70.36	70.82	71.46	72.11	72.4		
Share of Foreign controlled enterprises in the total nb of enterprises (%)	0.34	0.33	0.33	0.32	0.32			
Labour productivity (Index, 2010=100)	97.8	100	100.5	100.2	101.1	100.7	100.5	
New doctorate graduates per 1000 population aged 25-34			1.12	1.16	1.16	1.12		
Summary Innovation Index (rank)	22	21	21	21	20	20	22	
Innovative enterprises as a share of total number of enterprises (CIS data 2012) (%)				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	
Ease of getting credit (WB GII) (Rank)						80	81	
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	24	25
E-Government Development Index Rank		38				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	
GERD (as % of GDP)	1.22	1.22	1.21	1.27	1.31	1.29		
GBAORD (as % of GDP)	0.62	0.59	0.56	0.55	0.53	0.52		
R&D funded by GOV (% of GDP)	0.51	0.51	0.51	0.54	0.54			
BERD (% of GDP)	0.65	0.66	0.66	0.69	0.72	0.72		
Research excellence composite indicator (Rank)				11				
Number of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		9.71	9.47	9.98				
Public-private co-publications per million population	24.78	26.68	27.61	22.97	21.83	18		
World Share of PCT applications	1.98	1.89	1.76	1.71	1.66	1.71		

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