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SUMMARY

Financial and Tax incentives for Research, Development and Innovation[1]

The cases of Portugal, Spain and Italy

[1] *The present report was prepared through an analysis led by the Cotec Portugal Working Group, in cooperation with Cotec Spain and Cotec Italy.*

Introduction

National economies are still facing great challenges recovering from the effects posed by the recent financial and economic crisis. In Europe, the repercussions continue to be observed, with new sources of instability and uncertainty arising from a debt and a currency crisis which have been adding further constraints on the ability of governments to manage the pace of recovery, reduce high unemployment levels and continue fostering investment in areas that are key to productivity gains and long-term growth performance, such as Research, Development and Innovation ("R&D+I").
Moreover, globalization processes are deepening economic integration and leading to greater geographic fragmentation of production chains which are increasingly transnational. The dynamic growth of emerging regions is changing the patterns of global trade while putting at risk the sustainability of growth models of more established economies.
Thus, Europe is going through a time of unprecedented challenges posed by the need of structural change to strengthen competitive advantages in the global markets and guarantee growth and employment in the long-run and, simultaneously, the urgency of addressing short-term challenges of balancing public finances, reducing debt and stabilizing financial markets and ensuring the soundness and the sustainability of the Economic Monetary Union.
Portugal, Spain and Italy are no exception. The severe consequences of the multiple crisis affecting Eurozone countries, which are still being felt and add complexity to economic policy making, should not obstruct the view of long-run development.
In this context, R&D+I is increasingly seen as one of the key factors for successfully meeting these challenges, playing a decisive role in lifting economies out of recession. Furthermore, R&D+I is important to open new opportunities for both governments and firms and assist them in finding innovative ways to address the current challenges as well as sustainable sources of growth and competitiveness. To meet this agenda, it is essential that these countries maintain productive investment in knowledge creation and productivity increases, mainly through R&D+I, despite the current adversities such as the ones relating to limited credit availability and market uncertainty.
Market failures cause firms to underinvest in R&D+I as a result of the high cost and risk associated with these activities and the existence of positive spillovers and other externalities for society as a whole namely, less expensive, new or improved products and services. These market failures are the main arguments used to justify government incentive measures to promote higher levels of R&D+I investment. Within firms, decisions about the effort and nature of R&D+I are mainly guided by evaluating the return of investment, taking into account, among other factors, government financial and tax incentives.
This report aims to explore in a general way, how governments are promoting R&D+I through financial and tax incentives in three European countries - Portugal, Spain and Italy - analysing the alignment of these schemes with European and OECD policy strategies and goals, identifying national attributes, differences and points of convergence and, finally, assessing the degree in which these schemes contribute to the mitigation of national and regional gaps relating to R&D+I.

R&D+I Policy Strategies

Europe 2020 and the Innovation Union

In 2010, following the Lisbon Strategy which set out policy objectives for the period 2000-2010, and in order to give a new vision and impulse to accelerate economic recovery, foster high levels of employment and productivity and guarantee social cohesion, the European Commission ("EC") launched its Europe 2020 Strategy around three connected and mutually reinforcing vectors - *smart*,

sustainable and *inclusive* growth. The first of these priorities is more directly linked to the main theme of this report.
Smart growth is understood as the need to develop a European economy based on knowledge and innovation. Thus, innovation continues to be at the centre of European policy concerns given its growing importance in addressing the major challenges of productivity and competitiveness in a global economy.
During the last decades Europe has lost ground to other global regions both in terms of the share of world Gross Domestic Product ("GDP") and at the level of investment and outcomes of R&D+I which are critical to the economy's competitive advantage. The USA and Japan are now stronger than Europe in the fields of research and innovation performance, China has taken over European Union's ("EU") lead in the number of researchers, and both Japan and the USA currently have a much larger proportion of citizens aged 25-34 with a university degree.
One of the main concerns of European Innovation strategy is closing Europe's gap in innovation relative to the world's leading regions. A structural change towards more knowledge intensive economic activities is viewed as decisive to guarantee the creation of value added jobs and strengthen the European economy's competitiveness in global markets.
In this sense, Innovation Union was defined as one the seven flagship initiatives of Europe 2020 strategy. It aims to re-focus R&D+I policy on the challenges facing our society, such as climate change, energy and resource efficiency, health and demographic change, stating that every link should be strengthened in the innovation chain, from basic research to commercialisation, with the purpose of achieving the Europe 2020 target of 3% of the EU's GDP invested in R&D+I by 2020.

The Innovation Union seeks to turn Europe into a "world-class science performer", removing obstacles to innovation and transforming the way public and private sectors work together. To this end, the EC (*Europe 2020: a European strategy for smart, sustainable and inclusive growth*) stated its commitment to work:

- *To complete the European Research Area, to develop a strategic research agenda focused on challenges such as energy security, transport, climate change and resource efficiency, health and ageing, environmentally-friendly production methods and land management, and to enhance joint programming with Member States and regions*;

- *To improve framework conditions for business to innovate (i.e. create the single EU Patent and a specialised Patent Court, modernise the framework of copyright and trademarks, improve access of SMEs to Intellectual Property Protection, speed up setting of interoperable standards; improve access to capital and make full use of demand side policies, e.g. through public procurement and smart regulation)*;

- *To launch 'European Innovation Partnerships' between the EU and national levels to speed up the development and deployment of the technologies needed to meet the challenges identified (…);*

- *To strengthen and further develop the role of EU instruments to support innovation (e.g. structural funds, rural development funds, R&D framework programme, CIP, SET plan*) (…);

- *To promote knowledge partnerships and strengthen links between education, business, research and innovation, including through the EIT, and to promote entrepreneurship by supporting Young Innovative Companies.*

Complementarily, the EC encourages member states:

- *To reform national (and regional) R&D+I systems to foster excellence and smart specialisation, reinforce co-operation between universities, research and business, implement joint programming and enhance cross-border co-operation in areas with EU value added and adjust national funding procedures accordingly, to ensure the diffusion of technology across the EU territory*;

- *To ensure a sufficient supply of science, maths and engineering graduates and to focus school curricula on creativity, innovation, and entrepreneurship*;

- *To prioritise knowledge expenditure, including by using tax incentives and other financial instruments to promote greater private R&D investments*.

To sum up, the Innovation Union strategy is expected to help bridge the existing gap between EU and other strong and emerging world performers preventing Europe from losing ground in the field of R&D+I which is a key-factor to strong and sustainable long-run growth.

OECD Innovation Strategy

The Organisation for Economic Co-operation and Development ("OECD"), of which Portugal, Spain and Italy are members, has for decades been working with governments influencing the way they address common challenges and concerns, share good practices, compare policy experiences and enhance the effectiveness of national and international policies.
From an early stage OECD has been highly committed to fostering investment in science and technology linking it and underlining its importance to economic policy. This organization views innovation as a decisive source of economic performance and social welfare which justifies a central role for governments and the need for well-designed and effective national innovation strategies.
Thus, the main challenge for policy makers, according to OECD, is to develop an optimal policy mix and instruments to promote innovation performance taking into consideration the different positive and negative interactions between these instruments and guaranteeing support for the challenges faced by a country's innovation system and overall innovation gaps.
Though many governments have, in recent decades, made significant progress in developing and evaluating programs and instruments to promote science, technology and innovation investment, finding an adequate policy mix continues to be a real challenge considering evolving external factors and the current macroeconomic environment affecting many developed countries. In fact, empirical evidence suggests that "R&D expenditures and venture capital are among the first to be cut during recessions" (*OECD Science and Technology Scoreboard 2009*).
Recent data has added to this evidence: R&D expenditure growth in the OECD-area slowed down in 2007; patent numbers, which grew steadily between 1995 and 2008, have seen growth rates weakened in recent years; the number of OECD-area (triadic) patents fell in 2008; and, similarly, trademarks, which measure product or marketing advances, fell by 20% in 2008.
Despite a still fragile recovery of the world economy, the persistent constraints over government budgets and the uncertainty in markets, OECD continues to give a central priority to innovation, as a driver of economic growth and social development, launching in 2010 a renewed Innovation Strategy which provides analysis and policy guidance. This strategy defends an approach that considers the interaction of the different policy domains which should be brought together through supportive mechanisms at all levels of governance.
The OECD Innovation Strategy explores several important issues: the need to empower people to innovate, through high quality education and the development of a wide range of complementary skills; the importance of small and medium-sized enterprises ("SME"), which have a great capacity to

transform knowledge and ideas into jobs and wealth creation; the relevance of fundamental R&D as the foundation for future innovation; the decisive importance of Science for Innovation as a way of generating "step changes". Other highlights of this strategy report include the importance of Innovation in addressing global and social challenges, such as climate change, and the key role of governance and measurement of innovation performance.

Statistics and Indicators

Both the EC and the OECD have played a key role in the understanding and development of R&D+I policies, not only through in-depth analysis and recommendations but also by delivering very extensive and up-to-date data with international comparability.
The Innovation Union flagship initiative along with OECD Innovation strategy requires the setting in place of strong monitoring mechanisms with the view of measuring performance and progress towards R&D+I global shared objectives.
The Innovation Union's analytical strategic report provides comprehensive statistical and economic analysis concerning the effectiveness and efficiency of research and innovation systems and is expected to constitute a key tool for evidence-based policy making.
Furthermore, the monitoring of the Innovation Union involves an annually updated performance scoreboard, which will allow comparative benchmarking of EU and Member State performance against 25 core indicators around the following themes:

- *Enablers*: Human Resources, research systems, finance and support;
- *Firm Activities*: Firm investments, linkages & entrepreneurship, intellectual assets;
- *Outputs*: Innovators, economic effects.

National performance in these domains is decisive to achieve one of the five headline objectives of the Europe 2020 strategy, already mentioned: Improving the conditions for R&D+I so as to rise combined public and private investment levels in this sector to 3% of EU's GDP by 2020, which is expected to lead to the creation of 3,7 million jobs and increase annual GDP by close to Euro 800 billion until 2025.
Apart from these indicators, relating to the Innovation Union Scoreboard, Eurostat publishes every year updated Science, Technology and Innovation ("STI") statistics for all EU-27 countries. Additionally, the OECD releases the Main Science and Technology Indicators ("MSTI") which support the Science, Technology and Industry Scoreboard and the Science, Technology and Industry Outlook reports, released every two years alternately.
These indicators, reports and scoreboards address the whole cycle of innovation, including the impact of research and innovation on raising competitiveness and tackling societal challenges.
The OECD, the European Commission and the National Statistical offices are currently working on a new, single integrated indicator, based on the share in employment of the fast-growing innovative firms, which will allow a better monitoring of progress in innovation.

Case studies

Introduction - Methodology

R&D is regarded as a key investment for productivity gains, long-run growth and social progress. Considering this, an increasing number of governments have been playing an important role in promoting R&D spending through various incentive schemes. The policy-mix varies across countries and incentives are very different in nature even at the national level. However, most incentives can be divided into two major blocks: Financial and tax incentives. Financial incentives can take the form of grants or loans, while tax incentives are usually offered as tax deferrals, tax allowances or tax credits.
In order to understand the different national R&D policies, namely concerning financial and tax incentives, this section of the report will begin to explore the innovation profile of the three countries considered as well as recent policies and performance. This will allow the identification of the major challenges and R&D+I gaps for each of these countries. In order to evaluate these gaps we will consider, for the purpose of the analysis, five main key areas linked to R&D+I performance and ten chosen indicators from Eurostat and OECD databases:

- **Collaboration for R&D+I between firms**: (i) *% of firms collaborating (as a % of all firms)* and (ii) *% of SMEs collaborating (as a % of all firms)*;
- **Scientific and Technological System Co-operation**: (i) *Business-funded R&D in the higher education and government sectors* and (ii) *Firms collaborating on innovation with higher education institutions*;
- **Intellectual property**: (i) *Patent applications to the European Patent Office* ("EPO") and (ii) *Patent applications with co-inventors located abroad*;
- **Human Resources Qualification**: (i) *Researchers per thousand total employment* and (ii) *Science and engineering degrees at first-stage*;
- **Internationalization**: (i) *Share of high and medium-high-technology in manufacturing exports* and (ii) *% of Business R&D funded from abroad*.

EU-27 and OCDE area averages will be used as references to assess the major R&D+I gaps for each country.
Further on in this section, an extensive characterisation of the main financial and tax incentives will follow, with the view of revealing the main attributes, form and features of the design of each incentive scheme.
It is expected that the existing incentive schemes correlate in some degree with the main R&D+I gaps in each of the three countries. In other words, R&D+I policies and strategies are expected to be designed and oriented towards addressing the weaknesses and major challenges of each country's innovation performance given the different levels of development of their economies and innovation systems.

The case of Portugal

i. Recent developments in Portuguese innovation policies

The positive economic effects of innovation have justified its promotion through the dissemination of access to new technologies, particularly those related to information and communication, in order to strengthen the capacity of value creation by firms. This was assumed as a major priority of the

Portuguese National Action Plan for Growth and Jobs ("PNACE", 2005) which also defined as priority for R&D the increase of public and private investment in this field and stronger support for the incorporation of R&D results in the production processes of firms in order to boost competitiveness.
These priorities were also reflected in the three axes of the "Technological Plan - Knowledge, Technology and Innovation" as well as in the program "Factors of Competitiveness" of the National Strategic Reference Framework ("NSRF", 2007-2013).
Thus, recent developments in the Portuguese innovation policies are intrinsically related to the main challenges facing the innovation system and the special attributes of the Portuguese economy, dominated by SMEs which have limited access to long-term financing and, present on, average a low competitiveness in international markets, together with a serious lack of innovation culture and insufficient Human Resources with the right skills and motivation to invest in more knowledge intensive fields of work.
Additionally, the Portuguese National Scientific and Technological System is considered to have insufficiencies at the level of infrastructures and Human Resources, with its agencies normally operating in an uncoordinated approach. Finally, it is often acknowledged the weak, or in some cases even inexistent, co-operation between firms and between these and universities, public and private laboratories or technology centres.
In response to these challenges, recently implemented public policies have been based on different kinds of incentives (financial and tax incentives and other instruments), strongly supported by European structural funds, mainly oriented towards:

- Promoting investment in R&D+I, helping firms to overcome the difficulties in accessing credit and promoting the diffusion of technology and competitiveness;
- The qualification and internationalization of SMEs;
- Risk sharing in innovative investments by SMEs;
- Strengthening the material and Human Resource endowments of SMEs and implementing a stronger culture of innovation;
- Stimulating co-operation between private and public entities in order to take greater advantage of externalities generated by the existence of infrastructures, R&D+I and knowledge, as well as the positive network effects relating to the diffusion of technology and knowledge;
- The qualification of Human Resource belonging to R&D+I entities of the national scientific and technological system;
- A higher focus on simplifying public administration services and procedures relevant for market activities.

ii. Innovation profile

Portugal has made progress in recent years both in terms of elevating R&D expenditure levels and in overall innovation performance.
The sum of public and private spending on R&D has increased, reaching 1,71% of the GDP in 2009 (when it was only 0,81% in 2005 and 0,68% in 2001). Moreover, according to the "Innovation Union Scoreboard" ("IUS" 2010), Portugal belongs to the group of "moderate innovators", ranked 16th (climbed up 5 places in the last 2 years), while in 2007 it was included in the group of "catching-up countries".

However, Portugal's performance still remains below the EU average, and presents weaknesses in the following IUS indicators: Non-EU doctorate students, public-private scientific co-publications, PCT patent applications and licences as well as patent revenue from abroad.
Regarding the set of indicators defined in this section of the report as reference for analysis, Portugal's R&D+I profile reveals both strengths and weaknesses (see Appendix, Graph 1).
Concerning R&D+I intra-firm collaboration, in the period 2004-06, Portugal had approximately 25,15% of firms collaborating in R&D+I, lower than the average of 32,69%. The gap is particularly sharp when considering collaboration between SMEs - only 6,71% of SMEs were collaborating in R&D+I, far from the 12,9% EU average.
Private funding of R&D has not been very significant - in 2008, only 2,1% of total R&D performed in higher education and government sectors was business-funded, clearly distant from the OECD average of 5,54% and a figure that has even decreased in the last ten years (in 1998 it was 2,4%). However, 31,3% of total co-operation held by national firms was performed with universities or other higher education institutions, close to EU average.
Considering intellectual property, namely patent applications to the EPO, Portugal performed poorly in 2006, achieving a modest level of 10,1 applications per million inhabitants, against the EU average of 115,1. However, regarding patent applications, Portugal seems to collaborate more with external partners than most European countries - during the period 2004-06, 33,77% patent applications had co-inventors located abroad, largely above the European average level of 10,82%.
Despite a lower level of researchers per thousand of total employment (5,46 researchers per thousand of total employment in 2007), compared to most OECD countries, Portugal scores well and above average in the number of Science and Engineering degrees at first-stage university level (which represented 24,85% of all new degrees at first-stage university level in 2006, compared with 20,50% of OECD average).
Finally, in what concerns "internationalization" indicators, in 2007 high and medium-high-technologies in manufacturing exports accounted for 43,07% of the manufacturing exports, significantly below the 64,63% OECD average. On another perspective of internationalization, more relating to foreign investment, funds from abroad, as a percentage of business enterprise R&D, are substantially lower in Portugal compared to the average of European countries (4,5% in 2005 against the 10% EU-27 average).

iii. Financial and tax incentives for R&D+I

Tax incentives

Tax Incentives Scheme for Corporate R&D ("SIFIDE II")

Background	The new Portuguese Tax Incentives Scheme for Corporate R&D ("SIFIDE II") for 2011 through 2015 was approved in December of 2010. SIFIDE II makes no major changes in the previous scheme (SIFIDE was in force between 2006 and 2010), and this continuity is likely to strengthen Portuguese competitiveness in the R&D field.
Nature of the incentive	The incentive consists of a credit against the Corporate Tax ("CT") liability of expenditures incurred on R&D activities (net of any cash grants made by the Portuguese Government to the R&D project). The tax credit is both volume and incremental based, according to the following rates and limits: Base Rate: 32,5% of the R&D expenditure during the tax year. New SMEs may benefit, under certain circumstances, from a special increase of 10% of the base rate; Incremental Rate: 50% of the incremental expenditure of the period, over the simple average of the two previous tax years, up to Euro 1,5 million. Expenses of recruiting PhD's are eligible for an additional 20% and the incremental incentive limit, in these cases, is Euro 1,8 million.

Tax Incentives Scheme for Corporate R&D ("SIFIDE II") (cont.)

Eligible industries & qualifying costs	Eligibility is broad and is not limited to particular industries. The qualified activities could occur anywhere as long as the cost is incurred by a Portuguese company claiming the benefit. The eligible expenditures include: The acquisition cost of new fixed assets connected with R&D activities, except buildings and land; Wages of personnel directly involved in R&D activities; Allocated costs of directors and professionals participating in the management of R&D institutions; Operating expenses; Costs of contracting R&D activities from public entities and/or from entities recognized as possessing R&D capabilities; Expenditures incurred to raise capital for institutions that perform R&D and contributions to funds aimed to finance R&D; Costs of registration and maintenance of patents; Patent acquisition costs related to the development of R&D activities; Costs of R&D audits; Expenses of R&D projects related to the compliance with public contractual obligations.
Other Concerns	If the tax liability for the year is insufficient to permit full utilization of the credit, any unutilized tax credit can be carried forward up to six taxable periods.

Financial incentives

Incentives Scheme for Research and Technological Development ("SI I&DT")

Background	The SI I&DT aims at: Creating and/or further enhancing research and technological development ("R&TD") skills and capabilities; Promoting the participation in international knowledge networks and the co-operation with universities; Generating new knowledge and stimulating demonstration activities, technology experimentation and the dissemination and transference of technology to the business sector.
Scope	Projects involving industrial research and/or experimental development activities leading to the creation of new products, processes or systems or to the introduction of significant improvements in existing ones are considered fully eligible, namely in the following sectors: industry, energy (production), transport and logistics, tourism and services.
Types of projects	Individual; Co-promotion; R&TD Nucleus (SMEs); R&TD Centres (non-SMEs); R&TD Demonstration projects; Technology Mobilizer projects (cluster co-promotion).
Eligible expenditures	Technical staff costs; patents; raw materials and other components (used to build experimental, pilot or demonstration plants or prototypes); subcontracting of R&D activities; scientific and technical equipments and instruments; specific software acquisition; registration of patents, utility and drawing models; costs with promotion and dissemination of the project's results; travel expenses directly connected with the project; certification of R&D+I Management System; expenses with auditors; overhead costs; among others.
Nature of the incentive and applicable standard rates	Non-refundable cash grants up to Euro 1 million plus 75% of the amount that exceeds Euro 1 million in non-refundable cash grant, leaving the remaining 25% as a reimbursable financial incentive, computed by applying standard rates from 25% to 75% depending on the type of applicants and type of eligible R&DT activities.

Incentives Scheme for Innovation ("SII")

Scope	The SII is directed at supporting the following types of projects: Production and/or manufacturing of new goods and services; Introduction of new technological improvements, namely related to setting up new production units and/or lines; Expansion of production capacity in high-tech or dynamic international demand related activities; Skilled entrepreneurship and structural investment in areas in substantial economic expansion and/or with exporting potential; Adoption of new processes and methods in production, logistics, sales, marketing and organization.
Eligible expenditures	Acquisition of machinery and equipments; acquisition of specific software; computer equipment directly related to project; technology transfer through the acquisition of patent rights, licenses (to the limit 50% of eligible expenses), studies, diagnostics and investments in energy efficiency.
Nature of the incentive and applicable standard rates	The incentive to be granted, reimbursable in nature, is calculated by applying to the eligible expenses a standard rate of 45% up to 75%. However, the incentive granted may be converted into a non-refundable incentive, up to a maximum of 75%, depending on the performance evaluation of the contracted milestones.

Incentives Scheme for Qualification and Internationalization of SMEs ("SI QIPME")

Scope	SI QIPME aims to: Promote the competitiveness of enterprises through raising the levels of productivity, flexibility and time-to-market reaction; Encourage innovation, modernization and internationalization as key factors for its competitiveness.
Types of projects	This incentive scheme supports individual projects, joint projects, co-operation projects and simplified innovation projects for investments in: Industrial Property; Creation, Fashion & Design; Development and engineering of products, services and processes; Organization and management of information and communication technologies ("ICT"); Quality certification; Environment; Innovation; Diversification and energy efficiency; Digital Economy; Marketing; Internationalization; Social responsibility and safety and health at work; Equal opportunities.

Incentives Scheme for Qualification and Internationalization of SMEs ("SI QIPME") (cont.)

Eligible expenditures	Specific machinery and equipment, hardware and software associated with the investment project; Energy efficiency and renewable energy; Technology transfer; Studies, diagnostics, audits, marketing plans and architectural and engineering plans; Requests for industrial property rights; International promotion; Certification of systems, products and services; Development of systems for quality management; Implementation planning and control systems; Creation and development of brands, own brands and collections; Costs with the hiring of technicians (two, up to 24 months); Vocational training.
Nature of the incentive and applicable standard rates	The incentive to be granted, reimbursable in nature, is calculated by applying to the eligible expenses a standard rate of 40% up to 75%, depending on the type of expenditures, size of firms (small firms are positively discriminated), and type of collaboration underlying the project (positive discrimination to clusters, competitiveness and technology poles, etc.).

The case of Spain

i. Innovation profile

Despite some progress in the recent years, namely at the level of R&D+I expenditure related to Human Resources, Spain continues to lag behind the most advanced EU countries. With the view of reversing this situation, Spain has implemented a set of measures included in the National Reform Programme ("NRP") and the new National Plan for R&D and TI for the 2008-2011 period. The latter's objectives are linked to instrumental programs aimed at (i) generating knowledge and capacities, (ii) fostering co-operation in R&D, (iii) industry-wide technological development and innovation and (iv) promote strategic actions in key-sectors such as energy and climate change.

Recent changes go beyond the launching of new incentive measures, including the reorganization of competences of the Ministry of Science and Innovation and university reforms.

Spain currently ranks 19th in the IUS, remaining for the last years in the group of moderate innovators and still bellow EU average.

Spain's science and innovation profile demonstrates a number of strengths showing improvements over the years that preceded the outbreak of the financial crisis - despite difficult economic circumstances gross expenditure on R&D ("GERD") increased consistently from 0,9% of GDP in 2000 to 1,4% in 2008, with strong average annual real growth of 8,4%.

Considering Graph 2 (see Appendix), R&D+I Inter-firm Co-operation Networks, during 2004-06, only 19,20% of firms and 5,04% of SMEs collaborated on R&D+I activities, against 32,69% and 12,9% of the OECD average, respectively.

In 2008, Business-funded R&D was above OECD average in the higher education and government sectors (7,89% against 5,54%, the OECD average). Furthermore, 31,56% of total co-operation held by national firms was performed with universities or other higher education institutions.

Spain scores poorly in terms of Intellectual Property indicators. In fact, regarding patent applications to the EPO, in 2006 Spain achieved a modest 30,42 applications per million inhabitants significantly below the EU average (115,10). On the other hand, during the period 2004-06, 19,37% patent applications had co-inventors located abroad, stronger international collaboration than the EU average (10,82%).

Considering the qualification of Human Resources, in 2007 Spain had 5,95 researchers per thousand of total employment while OECD average was 7,4. However, Science and Engineering degrees at first-stage university level were 24,01% of all new degrees at first-stage university level, above the OECD average (20,50%).

Internationalization indicators show that, in 2007, high and medium-high-technologies in manufacturing exports represented 55,59% of the total of manufacturing exports, which is a significant proportion but still below OECD average (64,63%). Furthermore, business enterprise R&D funded from abroad represented 6,35% of total business R&D, below the EU-27 average (9,95%).
In this context, the Spanish government has been working on a Science and Technology Act in order to create a new framework for research funding and to improve coordination between state and regional administrations.
Moreover, the State Innovation Strategy was designed to increase the number of innovative businesses and strengthen their commitment to innovation, while the national R&D+I Plan 2008-11 includes specific public funding instruments to support strategic research in key sectors, namely health, biotechnology, energy and climate change, telecommunication and information societies, nanotechnology, new materials and new industrial processes.

ii. Financial and tax incentives for R&D+I

Tax incentives

Corporate Income Tax ("CIT")

Background	The Spanish CIT rate is 30%. Spain applies different tax rates for small companies (25% to 30%), oil companies (35%), savings banks (25%), real estate investment trusts (18%), and investment funds (1%). Spain offers immediate deduction of qualified R&D expenditures, as well as tax credits for research and technological innovation.

Corporate Income Tax ("CIT") (cont.)

Nature of the Incentive	Volume Credit: The volume based credit is equal to 25% of the R&D expenses incurred in the tax year; Incremental Credit: The incremental credit equals 42% of the amount of the current year expenditures exceeding the average of such expenditures incurred in the preceding two tax years. If the taxpayer's current year spend exceeds the average of the prior two years, the taxpayer receives a credit equal to 25% of the current expenses plus 42% of the excess over the base; Personnel Credit: A 17% credit for wages paid to qualified researchers dedicated exclusively to R&D; R&D Equipment Credit: An 8% credit for amounts invested in tangible and intangible fixed assets, excluding real estate, used exclusively in the conduct of qualified R&D; Patent Box: 50% of the income from the assignment of patents is exempt from taxable income.
Credit Limitations	If the amount of qualified R&D expenses for the tax year exceeds 10% of the tax due (considering the reduction related with tax credits), the tax credits may not offset greater than 50% of the gross tax due. In addition, if the amount of expenses does not exceed 10% of the tax due (considering the reduction related with tax credits), the credits may offset up to 35% of the gross tax due. Unused credits may be carried forward for 15 years (no refund).
Eligible industries and qualifying costs	All industries are eligible for R&D tax credits for costs incurred in qualifying activities. R&D activities include original planned investigation aimed at acquiring new knowledge and greater understanding in scientific or technological fields. Development is considered to be the application of the results of research or of any other kind of scientific knowledge for the manufacture of new materials or products or for the design of new production processes or methods, as well as substantial technological improvement of materials, products, processes, or previously existing methods (including software development). Qualifying R&D expenses include: Wages paid to employees engaging in research, as well as the cost of investments in fixed assets that are exclusively dedicated to R&D activities. Supplies and indirect expenses are excluded.
IP and jurisdictional restrictions	In order to qualify for any credit, all qualified R&D must take place in Spain or a member state of the European Union or in the European Economic Area. IP ownership does not affect whether the taxpayer can claim the credit or not.
Other relevant information	Spain also offers an additional incentive in the form of a 40% reduction in social security contributions for certain research personnel.

Financial incentives

R&D Projects - *Proyectos de Investigación y Desarrollo* ("PID")

Scope	This incentive scheme supports business projects directed at developing new or significantly improved production processes, products or services, including both industrial research and experimental development.
Types of projects	Projects of individual firms; National co-operation projects; International technological co-operation projects.
Eligible expenditures	Personnel costs, materials, depreciation of fixed assets, external partnerships and other costs.
Nature of the incentive and applicable standard rates	Multi-year projects are financed if investment exceeds Euro 240.000 per company or Euro 500.000 per project. Maximum rate of incentive equals 75% of the eligible expenses, consisting in both a refundable portion and a non-refundable of 15% to 25%.

Instrumental Line of Action for R&D + TI Projects

Background	ORDER PRE/621/2008, regulating the terms, rules on aid and the management of the Instrumental Line of Action for R&D + TI Projects, under the National Plan for R&D + TI (2008- 2011), was published in the Official State Gazette of March 8, 2008.
Scope	This Instrumental Line of Action includes the following National Programs, (i) Basic Research Projects, (ii) Applied Research Projects, (iii) Experimental Development Projects and (iv) Innovation Projects.
Eligible applicants	Companies (including SMEs); Technological Centres; Private university research and development centres; Public R&D + TI centres; Private non-profit research and development centres; among others.
Types of projects	Individual project or action; Coordinated project or action; Project or action based on co-operation; Project or action carried out by entities located in Scientific and Technological Parks.
Eligible actions	Basic research projects; Applied research projects; Experimental development projects; Technical viability studies; Supplementary actions (e.g., actions targeted at society in general and at academic and business sectors in particular, to disseminate findings of scientific research and technological development activities); Organization of congresses, seminars and conferences.
Nature of the incentive	Repayable subsidies, loans and advances.

Instrumental Line of Action for Human Resources - INNCORPORA Sub-programme

Background	ORDER ECI/266/2008, specifying the regulations for the grant of public subsidies under the Instrumental Line of Action for Human Resources was published in the Official State Gazette of February 9, 2008.
Scope	The purpose of this line was to support the recruitment and mandatory training of high profile technicians as well as indirect costs connected with specific projects of industrial research and experimental development or technical viability studies.
Eligible expenditures	Personnel costs associated with the employment of full-time high profile technicians under the collective agreement; Consulting fees or equivalent services for initial training; Indirect costs.
Nature of the incentive and applicable standard rates	The incentive to be granted, reimbursable in nature, is calculated by applying to the eligible expenses a standard rate of 25% that can be increased up to 80%.

Instrumental Line of Action for Scientific-Technological Infrastructures - INNPACTO, INNPRONTA and INNCONECTA sub-programmes

Background	The Official State Gazette of July 11, 2009 published ORDER CIN/1862/2009, stipulating the terms of reference for the grant of public aid for science and technology under the Instrumental Line of Action for Scientific-Technological Infrastructures under the National Scientific Research, Technological Development and Innovation Plan 2008-2011 and issuing the call for aid applications for 2009 for some of its lines of action.
Scope	Aid to the following subprograms: (i) Subprogram for design, viability, access and improvement of Singular Scientific and Technological Facilities, (ii) subprogram for scientific and technological actions in scientific and technological parks, (iii) subprogram for the creation and consolidation of technological centres, (iv) subprogram for the acquisition of scientific-technical infrastructures in agro-food R&D and TI centres of the National Agriculture and Food Research Institute, (v) subprogram for scientific-technological infrastructure projects financed jointly with the European Regional Development Fund.
Types of projects	Individual project or action; Coordinated project or action; Project or action based on co-operation.
Eligible actions	Actions relating to the improvement of Singular Scientific and Technical Facilities (Instalaciones Científicas y Técnicas Singulares or ICTS); Actions to promote access to ICTS; Preparation of viability studies; Supplementary actions (organization of conferences, seminars or lectures; creation and maintenance of national thematic networks of scientific-technical infrastructures); Actions of scientific-technological policy aimed at attending to strategic initiatives of special interest); Projects to introduce or improve infrastructures able to be used for scientific and technological actions; Projects for the acquisition of equipment for scientific and technological infrastructures; Projects aimed at the creation of centres for entities which, at the time of their application, do not engage in any type of activity; Consolidation projects for existing centres; The acquisition and installation of new scientific, technical or technological equipment as well as the improvement of the performance of existing equipment; Creation and improvement of telematic networks.
Nature of the incentive and applicable standard rates	The incentive can be reimbursable grant, reimbursable advances and loans, with a maximum aid of 75% to 95%, depending on the sub-programme.

Program to support innovation in SMEs (“INNOEMPRESA”)

Scope	This program is organized by each Autonomous Community Government to all SMEs and intermediate organisms.
Types of projects	Advanced management and organizational innovation; Technological innovation and quality; Collaborative innovation projects.

Program to support innovation in SMEs ("INNOEMPRESA") (cont.)

Eligible actions	Tangible or intangible investments; Computer elements; Technical personnel; External collaborations (assistance with travel, consulting fees, tutoring) intercity travel and accommodation; VAT or equivalent; Overhead that does not involve 10% of eligible expenditure.
Nature of the incentive and applicable standard rates	The incentive is a reimbursable grant that can cover up to 100% of eligible costs.

The case of Italy

i. Innovation profile

In terms of innovation performance, Italy is situated below the EU average and its relative position has not significantly improved over the past five years. According to the 2010 Innovation Union Scoreboard 2010, Italy positions itself in the group of "moderate innovators", ranking 17th, having climbed 6 positions since 2008. The main limitations identified by the IUS are at the level of (i) non-EU doctorate students, (ii) licence and patent revenues from abroad, (iii) venture capital and (iv) business R&D expenditure.

In 2008, Italy's GERD increased to 1,2% of GDP, from 1,1% in 2006, remaining, however, below the OECD average. Real GERD grew by almost 6% in both 2006 and 2007, but fell by 0,8% in 2008.

In light of Graph 3 (see Appendix), R&D+I Intra-firm Co-operation Networks, during 2004-06, presents an extremely low 15,67% of firms and 4,28% of SMEs collaborated on R&D+I activities, against 32,69% and 12,9% of the OECD average, respectively.

Scientific and Technological System Co-operation indicators are considerably close to the average. In 2008, 4,40% of total R&D came from Business-funded R&D in the higher education and government sectors, slightly below the 5,54% of the OECD average. Additionally, 32,60% of total co-operation held by national firms was performed with universities or other higher education institutions.

Positioning regarding national and international patents' registration indicators is diverse. Considering patent applications to the EPO, in 2006 Italy had 84,37 applications per million inhabitants, below 115,10 of EU's average. However, during 2004-06, 13,73% patent applications had co-inventors located abroad, which reveals stronger international collaboration than the EU average (10,82%).

Concerning Human Resources Qualification, in 2007 Italy had 3,56 researchers per thousand of total employment considerably lower than OECD average of 7,4. Nevertheless, Italy scored well in science and engineering degrees at first-stage university level which accounted for 21,20% of all new degrees at this level, slightly above OECD average (20,50%).

Internationalization indicators show that, in 2007, high and medium-high-technologies in manufacturing exports represented 50,67% of the total of manufacturing exports, against 64,63% of OECD average, while business enterprise R&D funded from abroad was close to EU-27 average (approximately 10%).

In this context, recent years have shown stronger political willingness to reform the research and innovation policy framework, despite the fact that in the last couple of years policies have been more geared towards the recovery of the national finances. New directions have been given both in terms of governance and policy instruments, including, for instance, the introduction of automatic incentives,

namely tax credit for R&D and the concentration of strategic guidelines on selected strategic priorities and thematic fields.

ii. Financial and tax incentives for R&D+I

Tax incentives

Tax credit for R&D activity (launched in 2011)

Mandatory eligibility requirements	All kinds of R&D projects.
Eligible costs	Cost with personnel; Purchase of machinery and equipments; Consulting costs and other services; Materials; Overhead costs (maximum of 10% of the cost with personnel).
Incentive nature	The contribution consists in a tax credit for the 90% of the amount of the investment that exceed the average investment in R&D made in 2008-2010.
Maximum incentive rate	The tax credit is equal to 10% of the total R&D cost the company has spent in a year for the all R&D projects.
Deadlines	Applications may be submitted during a specific period (call for proposals).

Financial incentives

Technological Innovation Fund or *Fondo Innovazione Tecnologica* ("FIT")

Mandatory eligibility requirements	R&D projects in determinate fields defined by specific calls for proposals.
Eligible costs	Cost with personnel; Purchase of machinery and equipments; Consulting costs and other services; Materials; Overhead costs (maximum of 30% of the cost with the personnel).
Incentive nature	The incentive consists of a mix of non-refundable grants and soft loans. The non-refundable grant is equal to 20% of eligible costs and soft loans up to 50% of eligible costs (interest rate close to 0,5% and maturity equal to 8 years).
Maximum incentive rate	The maximum incentive rate can reach 70% of the total eligible costs.
Deadlines	Applications may be submitted during a specific period (call for proposals currently in standby.

Development Contracts

Scope	Measure aimed to support industrial projects, within the broader effort of simplifying the tools for attracting private investment. This initiative is considered crucial for strengthening the country's productive capacity (as per Article 43 of Legislative Decree 112/2008, ratified by Law 133/2008).
Eligible entities and actions	This mechanism is designed to help attract foreign investment and facilitate the implementation of corporate development plans. Subsidies are available to firms of all sizes, including those with foreign head offices which implement the following types of investment projects combined, when appropriate, with industrial research and experimental development: Set up new productive units; Expand existing productive units; Diversify the production by developing new products; Modify the production process of an existing productive unit.
Nature of the incentive	Capital grants, operating grants (covering operating expenses), subsidized loans, interest rate subsidies or a combination of these.

Industrial Innovation Projects

Scope	Following Italy's new industrial policy, the programme "Industry 2015" establishes strategic guidelines to guarantee development and competitiveness of the economic system, defining new tools aimed at encouraging investment.
Eligible sectors of activity	Such support measures are aimed at promoting investment in high-innovation programmes within strategic sectors for Italy's development, namely: energy efficiency, sustainable mobility, new technologies for living, new technologies for Italian export industries and innovative technologies for cultural heritage.

Research Incentive Fund

Scope	Created by the Legislative Decree 297/99, the Fund supports applied research programmes for the development of new products, production processes and services, as well as the promotion of existing technologies.
Eligible actions	Research and development activities that fall within the following categories: Industrial Research and Experimental Development.
Nature of the incentive	Grants, subsidized loans, interest rate subsidies, tax credit and provision of guarantees.

Comparative analysis

Financial and tax incentive schemes for R&D+I

The following table presents a general overview of the tax and financial measures presented in greater detail in the previous section, matching the available incentive measures with each key area of R&D+I and the rank of each country considering the set of reference indicators previously analysed.

General overview of innovation performance and existing incentive schemes

Key Area		Portugal		Spain		Italy
Collaboration for R&D+I between firms	Rank	**1**	Rank	**2**	Rank	**3**
	TI	N/A	TI	N/A	TI	N/A
	FI	✓	FI	✓	FI	N/A
Scientific and Technological System Co-operation	Rank	**3**	Rank	**1**	Rank	**2**
	TI	✓	TI	N/A	TI	N/A
	FI	✓	FI	✓	FI	N/A
Intellectual property	Rank	**3**	Rank	**2**	Rank	**1**
	TI	✓	TI	✓	TI	N/A
	FI	✓	FI	N/A	FI	N/A
Human Resources Qualification	Rank	**1**	Rank	**2**	Rank	**3**
	TI	✓	TI	✓	TI	✓
	FI	✓	FI	✓	FI	✓
Internationalization	Rank	**3**	Rank	**1**	Rank	**2**
	TI	N/A	TI	N/A	TI	N/A
	FI	✓	FI	✓	FI	✓

Legend: Rank - rank number according to average indicator scores, 1= best rank; TI - Tax incentive; FI - Financial incentive; N/A - not-available.

Since there is more available information regarding the tax incentive schemes for the three countries considered in this report, a more thorough comparative analysis will be presented for these specific incentives on the table below.

Extensive comparison between the three countries' tax incentive schemes

	Portugal	Spain	Italy
Period covered	2006-2015	N/A	2011-2012
Deadlines for applications	Open-ended	N/A	Specific calls for proposals
Incentive nature and rates	Base Rate: 32,5% of R&D expenditure during the tax year. New Small and Medium Enterprises ("SME") may benefit from a special increase of 10% of the base rate; Incremental Rate: 50% of the incremental expenditure of the period, relative to the simple average of the two previous tax years, up to Euro 1,5 million. Expenses of recruiting PhD's are eligible for an additional 20% and the incremental incentive limit, in these cases, is Euro 1,8 million.	Volume Credit: 25% of the R&D expenses incurred in the tax year; Incremental Credit: 42% of the amount of the current year expenditures exceeding the average of such expenditures incurred in the preceding two tax years. Personnel Credit: A 17% credit for wages paid to qualified researchers dedicated exclusively to R&D; R&D Equipment Credit: An 8% credit for amounts invested in tangible and intangible fixed assets, excluding real estate, used exclusively for the development of qualified R&D; Patent Box: 50% of the income from the assignment of patents is exempt from taxable income.	Tax credit equal to 90% of the amount of the investment that exceed the average investment in R&D made in 2008 - 2010. Maximum incentive rate: 10% of the total R&D cost the company has spent in a year for all R&D projects. Overhead costs may not exceed 10% of the costs with personnel.
Credit utilization period	Up to 6 taxable periods.	Up to 15 taxable periods.	N/A
Eligible industries	All industries	All industries	N/A
Eligible expenses	Cost of new fixed assets connected with R&D activities, except buildings and land; Cost with personnel directly involved in R&D activities; Allocated costs of directors and professionals participating in the management of R&D institutions; Operating expenses; Costs of contracting R&D activities from public entities and/or from entities recognized as possessing R&D capabilities; Expenditures incurred to raise capital for institutions that perform R&D and contributions to funds aimed to finance R&D; Costs of registration and maintenance of patents; Costs of R&D audits; Expenses of R&D projects related to the compliance with public contractual obligations.	Cost with personnel directly involved in R&D activities; Cost of investments in fixed assets that are exclusively dedicated to R&D activities.	Cost with personnel directly involved in R&D activities; Purchase of machinery and equipments; Consulting costs and other services; Materials; Overhead costs (maximum of 10% of the cost with personnel).

Finally, Portugal can be used as an interesting case study to better understand how specific incentive schemes are addressing the current challenges and helping to reduce R&D+I gaps. Considering the set of performance indicators illustrated in Graph 1 (see Appendix), the following table analyses the degree in which tax and financial incentives match R&D+I weaknesses.

Matching between incentive schemes and R&D+I gaps (Portugal)

Major gaps	Incentive scheme	Comments
High technology exports	SII/SI I&DT/ SI QIPME	Positive discrimination of innovative projects with high export potential; No discrimination between different levels of technology incorporated in the production of goods/services.
Intellectual property (Patents)	SI I&DT/SI QIPME/SII/ SIFIDE II	Expenses with patents and other industrial property registrations are eligible costs.
	Other	Portugal introduced in 2008 simplified procedures for the protection of industrial property. The progress achieved by these measures was recognized in the World Bank's "Doing Business Report 2011" which placed Portugal among the top countries with the most improvement in registering property. These measures include streamlined procedures for patents that reduce time, cost and the number of procedures, and the possibility of a provisional patent application.
Co-operation between firms and with R&D entities	SII	Higher incentive rates are attributed to projects that involve co-operation between firms, and with entities belonging to the national scientific and technology system; Higher incentive rates for projects involving promoters from recognized clusters and technology and competitiveness poles.
	SI QIPME	Higher incentive rates for projects involving promoters from recognized clusters and technology and competitiveness poles.
	SI I&DT	Higher merit scores for projects that involve international R&DT partnerships and collaboration with national scientific and technology entities and networks.
	Other	Projects associated with clusters and technology and competitiveness poles, as well as other forms of recognized collective efficiency strategies, have specific calls and fund allocations.
Researchers in total employment	SII/SI QIPME	Higher scores for projects that involve the creation of high-skilled jobs.
	SI I&DT	Expenses with the hiring of research fellows are considered eligible.
	SIFIDE II	In 2010 a new positive discrimination was introduced to favor the hiring of PhD's: Higher incentive rate applied to these expenses.

Attractiveness, differences and elements of convergence

Despite some difficulties accessing detailed information concerning all available R&D+I incentive schemes of the countries under analysis, some interesting considerations can be made regarding the differences between the various schemes and their attractiveness.

Financial incentives are quite diverse between countries. Portugal and Spain present a very significant assortment of instruments which are generally oriented towards reducing the major R&D+I gaps, such as increasing collaboration between firms and increasing qualification levels of Human Resources. While Portuguese and Italian incentive schemes have in general a more broader scope, Spanish financial incentives are more oriented towards specific sectors or key areas. Most of the finance incentive schemes are partly financed by European structural funds.

Regarding the tax incentives, generosity of the tax incentive seems to be stronger in the Portuguese case as a consequence of higher incentive rates and continuously open applications. The Spanish R&D tax credit can be viewed as particularly attractive considering the period allowed for credit use (up to 15 taxable periods). Tax incentives differ considerably between countries in terms of incentive rates and

eligible costs but all three schemes have in common the link between incentive levels and the growth of R&D expenditure relative to the two previous years. Thus, all three tax credits promote increases in R&D levels by firms. Common eligible costs include expenditures with personnel and fixed assets.
However, these analyses of tax and financial incentives do not take into account the way incentive schemes actually operate in practice. The Portuguese R&D tax credit "SIFIDE" is a good example since it presents several problems at the execution level which are relevant for the efficacy and generosity of this instrument. These issues include long delays in the evaluation of applications, vague evaluation criteria which leads to arbitrariness in the analysis of R&D projects, frequent changes in legislation attaches unpredictability to the instrument affecting decision-making at the firm level.
The more thorough analysis of the Portuguese case reveals that the major R&D+I gaps are being addressed both through specific targeted incentives and measures connected with the streamlining of administrative procedures. Some measures, like the ones related to patents and the positive discrimination of the hiring of PhD's included in the "SIFIDE II" tax credit, are recent and thus require time to produce effects.

Conclusions

OECD and Eurostat indicators show that Portugal, Spain and Italy lag behind most OECD and European members in critical areas of R&D+I. Promoting stronger performance is key to strengthening competitiveness and achieving higher levels of sustainable long-term growth, especially at a time when new and strong global players are emerging and increasing competitiveness and participation in non-traditional markets.
All three European countries currently offer a mixed set of incentive measures, which include tax and financial policy instruments, revealing the commitment of governments to enhance innovation performance and promote greater private investment in R&D+I.
However, the comparative analysis presented in this report was based on the formal analysis of legislation and reference material. Understanding how these incentive schemes are designed and implemented, the way they operate in practice can add further differentiation and allow for a more complete analysis.
In this sense, the efficacy of the available incentive schemes depends also on the way information is organized, accessible, and understandable to potential national and foreign beneficiaries of these schemes. This is particularly important regarding the attractiveness of each country to foreign direct investment.
OECD (2002) underlines the importance of "clarity, consistency and predictability" for the efficacy of tax incentives in influencing R&D investment decisions. This points to another interesting line of research worth exploring in future comparative analyses.

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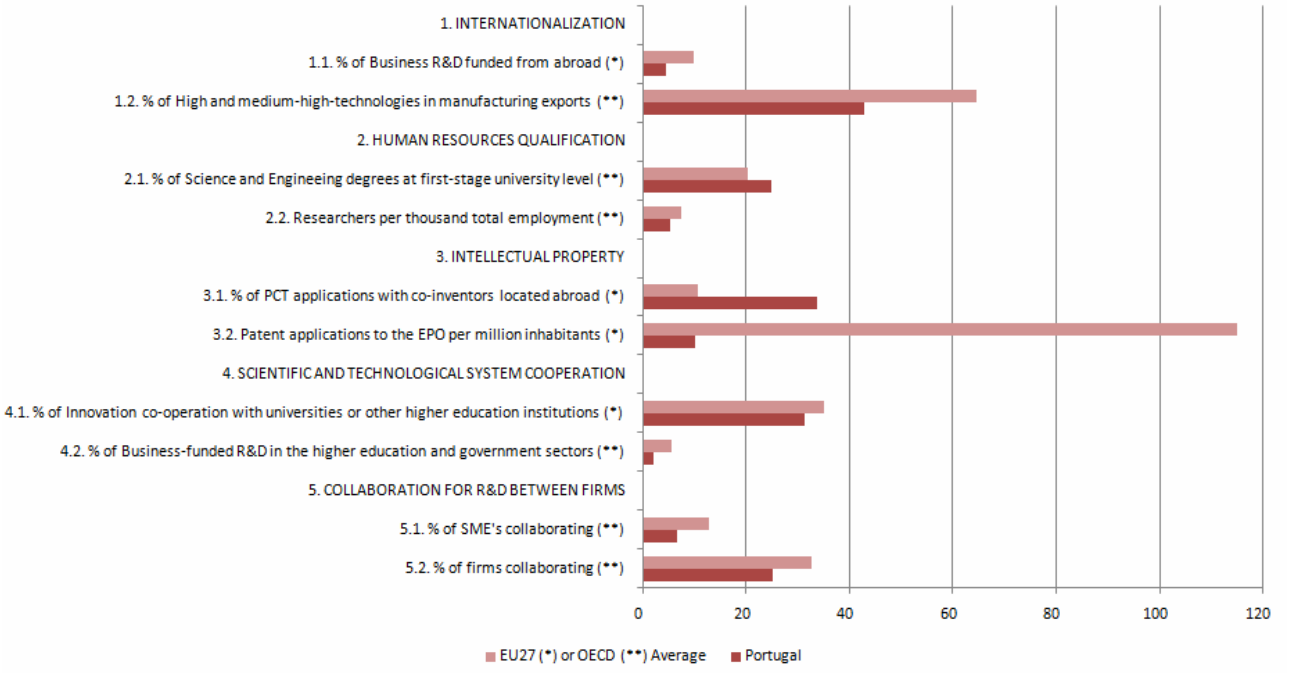
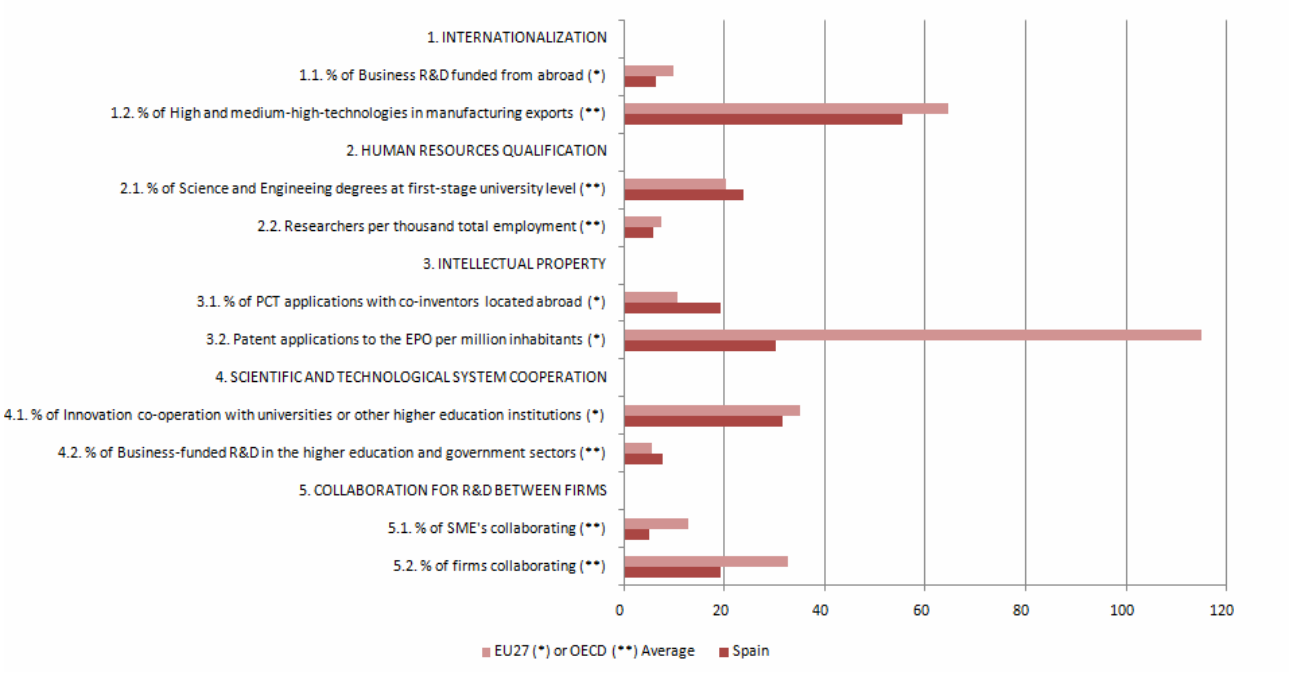
Appendix

Graph 1: Innovation indicators - PORTUGAL



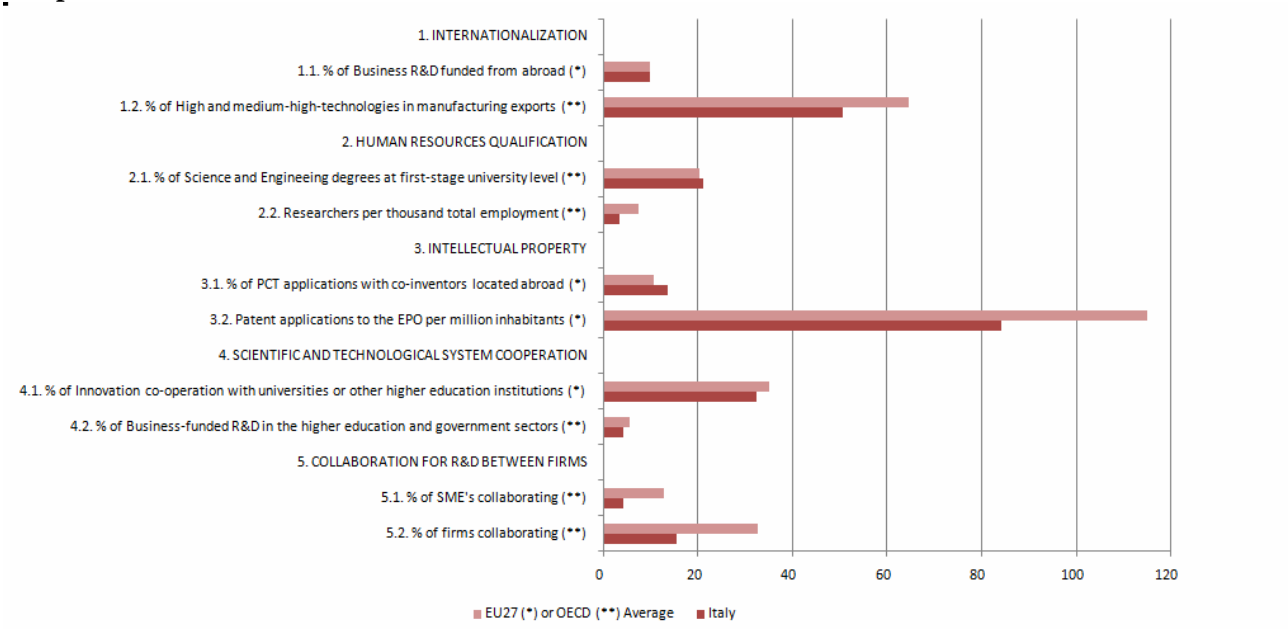
Source: Indicators 3.2, 4.1 and 5.1. - Eurostat database. Indicators 1.1, 1.2, 2.1, 2.2, 3.1, 4.2 and 5.2 - OECD Main Science and Technology Indicators database.

Graph 2: Innovation indicators - SPAIN



Source: Indicators 3.2, 4.1 and 5.1. - Eurostat database. Indicators 1.1, 1.2, 2.1, 2.2, 3.1, 4.2 and 5.2 - OECD Main Science and Technology Indicators database.

Graph 3: Innovation indicators - ITALY



Source: Indicators 3.2, 4.1 and 5.1. - Eurostat database. Indicators 1.1, 1.2, 2.1, 2.2, 3.1, 4.2 and 5.2 - OECD Main Science and Technology Indicators database.

Human Capital for Innovation[2]

[2] *The present report was prepared through an analysis led by the Cotec Spain Working Group, in cooperation with Cotec Portugal and Cotec Italy.*

Introduction

Human capital and innovation are always included among the factors defining the productivity of an economy and in today's knowledge-based society their importance is greater than ever. Also, there is overwhelming evidence of the effect that these two factors have on the competitiveness of countries and there is also evidence showing that competitiveness is contingent upon the makeup of its human capital and the type of innovation on which an economy's competitive advantages are based.

In today's global market the sustainability of any economy, especially the most developed ones, requires taking advantage of knowledge in the form of innovation capable of generating value which, in turn, makes it possible to maintain the level of well-being achieved. Naturally, knowledge and the capacity to apply it is in the hands of people who are able to detect the economic opportunities of their know-how and possess the skill sets to make products, services and their processes a reality. These skills include those needed to open new in-roads and lead change as well as those other numerous skills required for implementation. Much has been written about the relationship between innovation and employment but there can be no doubt that the greater the level of innovation the more qualified the employment. And more important still is that this employment must be able to adapt to the change characterising innovative economies.

Given the existing empirical evidence, it is safe to say that a virtuous circle is formed by people's expertise giving rise to more innovations which, in turn, require greater and better expertise. In any case, preparing people is the starting point in stimulating this virtuous circle and that is what this document is all about.

The concept of human capital

According to the OECD, human capital is the set of people's knowledge, skills, competences and qualities conducive to the creation of personal, social and economic well-being.

In trying to explain the relationship between growth and classic production factors in the 1950s, economists such as Solow pointed out the economic importance of people's knowledge and competences. As is well known, Solow's major contribution was the formalisation, in economic terms, of the role played by technical progress in growth. According to his initial findings, 80% of the growth in the United States during the first half of the 20th century was attributable to technical progress.

However it quickly became apparent that technical progress could only be harnessed when the educational level of workers had reached a certain threshold, i.e. when the necessary level of human capital was reached to handle the new technologies becoming available at any given time. Technical progress undergoes two stages when it comes to human capital requirements. During the first, new technologies are created which, to be generated and then used, require skilled labour and therefore higher quality human capital. During the second stage the technology becomes more commonplace so that it can be made available to less skilled personnel.

In 1964 Gary Becker laid the groundwork for today's theory on human capital which, making an analogy with physical capital, concedes that individuals, enterprise and governments can invest in

education, training and even in health in order to achieve greater and better human capital. Given that this capital is essentially a part of individuals, they can take decisions to increase their capacity to contribute to the generation of wealth and therefore improve their personal income.

Human capital is essential to the creation of value based on the use of knowledge which is the ultimate objective of innovation. That is why the most developed economies, which are also the most innovative, are the ones which have taken the time to generate a sufficient base of human capital with a view to building and sustaining a competitive productive fabric in the global economy. And they have achieved this, first of all, by providing educational systems which not only convey knowledge but also skills, competences and qualities which are the components of human capital, and secondly by ensuring that their productive systems are the source of continuous learning. However, the human capital theory has drawn attention to the existence of disputes with regard to the financing of the process of creating human capital. The lack of information among current and potential workers and the fear on the part of companies of losing the workers they have trained, are causes of a permanently deficient allocation of resources which should be the focus of governmental attention.

Human capital assessment in Spain, Portugal and Italy

It is a recognised fact that there are important differences in the quality and quantity of human capital available in the different countries. An important attribute of a country's human capital is the breakdown of its adult population (age 25 to 64) according to level of education attained. In the United States, only 11% of the population has only attained a primary or compulsory secondary education diploma. The rest is divided more or less equally between those who have completed secondary school and those with higher studies. These figures contrast with those of EU-19 where slightly more than a quarter of the population has only primary or compulsory secondary studies and approximately half of the population in the age brackets considered have taken part in post-compulsory secondary school studies. The other 25% have enrolled in higher studies.

The educational profile of the population of our three countries differs significantly from the European and US patterns. In Spain and Italy, approximately half of the population considered has only completed primary or lower secondary studies while in Portugal this is the case for 75% of the population. The breakdown at higher levels is quite different in the three countries. Italy, at 40%, is very close to the European average with regard to upper secondary education, while Portugal and Spain are clearly below that level. As regards tertiary education, Italy and Portugal are in the middle of the European average while Spain is three points above that average.

Percentage of the population according to level of education, 2009

	Primary to upper secondary	Upper secondary to tertiary	Tertiary
Spain	48	22	30
Portugal	70	16	14
Italy	47	40	14
USA	11	47	41
OECD Average	27	44	30
EU-21 Average	25	48	27

Source: OECD, 2011

Other characteristics of human capital include the qualification of workers and occupation by economic activity. In our countries, skilled non-manual workers account for between one and 14 percentage points less than the European average. Also, in our countries the proportion of workers in elementary occupations is between one and four points higher than the European average. The trend over the last several years has been towards the European average except for Spain where the number of workers in elementary occupations has continued to grow slowly.

Employed persons 15 years and older: composition by occupation (%, main job), 2010

	EU	ES	IT	PT
Skilled non manual workers	39.9	35.2	38.3	25.6
Low skilled non manual workers	24.9	26.7	24.2	25.1
Skilled manual workers	25.5	23.9	26.8	36.8
Elementary occupations	9.8	14.1	10.7	12.5

Source: Eurostat Statistics in focus 30/2011

Regarding occupation by economic activity, in 2010 services accounted for nearly 70% of total employment in the EU. 39% of that was employment in market-oriented services (trade, transport, hotels and restaurants, IT and communications services, finance and real estate) while the remaining 30% was in the public administrations, education, health, the arts, entertainment, etc. Industry and construction employed 25% and agriculture 5%. The percentage breakdown of employment by activity is very similar for all EU countries although Spain does stand out with 43% of the workforce engaged in market services and it is also the country with the lowest employment in industry, 22%. Italy stands out for employment in industry (29%) and a lower employment rate (4%) in agriculture. Portugal stands out in agriculture with 11% and has the lowest rate of employment in market and non-market oriented services.

Employed persons aged 15 years and older: composition by economic activity (%, main job), 2010

	EU-27	Spain	Italy	Portugal
Agriculture	5.2	4.3	3.8	10.9
Industry	25.4	23.1	28.8	27.7
Market services	39.2	43.3	40.4	34.9
Non market services	30.3	29.3	27.1	26.5

Source: Eurostat, Statistics in focus 30/2011

In 2006 in EU-27, 9 400 000 people worked in high-technology sectors; in Italy that number was 1 000 000, in Spain 670 000 and in Portugal 116 000. On average in Europe, 26% were

professionals, 22% technicians and the remaining 52% had other qualifications. These percentages were very similar in our countries except for Italy where the percentage of technicians was twice the European average and the number of professionals was proportionately lower. In Spain, the number of university graduates in these sectors is 20% higher than the European average and than that of Italy and Portugal. This Spanish difference is a constant in all business sectors.

Employment in high technology sectors. Number and percentages by type of occupation, 2006

	Tot. *(thousands)*	Professionals (%)	Technicians (%)	Other (%)	University grads in HT (%)	University grads all sectors (%)
EU-27	9 372	25.7	22.1	52.1	39.50%	25.68%
ES	676	21.9	27.9	50.2	58.80%	33.73%
IT	996	12.4	40.3	47.3	21.90%	15.29%
PT	116	19.6	24.4	56	29.30%	14.04%

Source: Statistics in focus 51/2008 (Eurostat)

The need for a European Occupational Qualifications Framework

The figures used for the international comparison of human capital must be handled carefully because they are the product of the different perception that countries have of the same level of professional qualification. The importance of harmonising this issue was highlighted back in 2000 by the Lisbon European Council and has been since then the object of different resolutions, being the concept of a European Qualifications Framework defined at the 2005 and 2006 Brussels Councils. In 2008, the European Parliament and the Council urged Member States to use the European Qualifications Framework as a reference instrument against which to compare their respective national qualification systems. The European Qualifications Framework defines eight levels, each one of which includes different knowledge, skills and competences (Table in Annex I).

In the meantime, most European countries have implemented mechanisms to develop national qualification systems with different objectives. In some cases the main objective is to clarify the relationships between the already existing qualifications while in others the intention is to reform the educational structure to make it more permeable. The national systems in place in each country have achieved very different degrees of development. Portugal has already established theirs, Spain is at an advanced state of definition and Italy has yet to pass the conceptual stage and is still working on harmonising regional qualifications. The situation is similar in many other countries such as Germany or Finland which have embarked upon the consultation phase or France and the United Kingdom which, after having devoted more than ten years to this process, have finally arrived at the initial stages of implementation.

The Communication from the Commission of November 2010 regarding the new qualifications and employment agenda, whose title incorporates these two concepts, represents another step forward. One of the actions proposed in this Communication is the drafting, starting in 2012, of an overview of qualifications to be included in the updated list of training courses and labour market demand through 2020, the completion by 2012 of the list of European qualifications, competences and occupations (ESCO) in all European languages and to move forward on a European qualifications passport. (Annex II)

Naturally, this will require a concerted effort but will have very positive consequences for job seekers, workers, companies and public institutions and will undoubtedly contribute to a substantial reduction in the waste of talent throughout the European Union.

The training of human capital

We will now turn our attention to expectations for the enhancement of human capital in our countries and in the European Union. It is common knowledge that, in addition to family and social environment, the training of human capital depends on at least two other specific areas: academics and entrepreneurship. The proper engagement of these two areas contributes to achieving the best quality of this capital.

In our countries the educational system is frequently criticised, especially in business circles, for being out of date and distant from the real needs of the productive sector. It is therefore advisable to review the data characterising our systems and compare them with those of reference countries and to that end we have data which allow for a reasonable comparison.

Although experts draw attention to the fact that, once certain thresholds are exceeded, there is no strict correlation between the cost of an educational system and its effectiveness, it is always interesting to compare the percentage of GDP that each country allocates to education.

The EU-19 average in 2007 was 5.3% of GDP compared with 7.0% in the case of Korea and 7.6% in the United States. Focusing on Cotec Europe countries, Portugal with 5.6% of its GDP devoted to education is the only one which exceeds the European average, Spain and Italy allocating 4.8% and 4.5% of GDP respectively to education. These figures are not far from Japan's 4.9% or Germany's 4.7%.

Total expenditure in education /GDP (%), 2006

Finland	5.643
France	5.972
Germany	4.703
Italy	4.466
Japan	4.932
Korea	7.005
Portugal	5.595
Spain	4.820
United Kingdom	5.795
United States	7.573
OECD Average	5.660
EU-19 Average	5.339

Source: OECD, Education at a glance 2010

In 2007, the average expenditure per student in EU-19 at all levels of education considered jointly was $US 8 013 PPP while in the US that figure was $US 14 269. In comparison with this benchmark, Spain was the Cotec Europe country with the highest expenditure with 107% of the

European average, Italy came in at 99% and Portugal at 83%. However, an analysis of average expenditure at each level of education shows significant differences between our three countries.

Expenditure per student at all levels (PPPs, 2007)

	Expenditure/ student	Expenditure with respect to EU-19 (%)
Finland	8 440	105.3
France	8 932	111.5
Germany	8 270	103.2
Italy	7 948	99.2
Japan	9 312	116.2
Korea	7 325	91.4
Portugal	6 677	83.3
Spain	8 618	107.6
United Kingdom	9 600	119.8
United States	14 269	178.1
OECD Average	8 216	102.5
EU-19 Average	8 013	100.0

Source: OECD Education at a glance 2010

In the field of academics there is a long-standing concern about standardising educational levels and that is why at the beginning of the 1960s UNESCO proposed a definition of training levels which could be compared internationally and which was finally approved in 1978 and was called the International Standard Classification of Education (ISCED). Its most recent adaptation took place in 1997. According to this ISCED classification, six levels of training are defined ranging from ISCED 0, pre-school education with no pre-determined duration, to ISCED 6, the second cycle of post-graduate higher education whose duration is typically two years.

All of these levels are important for our purposes because they have a specific impact on the different types of innovation. However, compulsory secondary education which lasts for four years, normally from age 12 to 16 and corresponding to ISCED 2, is especially important and should provide general training allowing future citizens to prepare themselves for working life. Some countries already have a branch of training focused on employability but the number of students enrolling in these courses is typically low.

ISCED 3, requiring a minimum of two years of study, prepares students for higher education (ISCED 3a) or for incorporation into the labour market (ISCED 3b) through the intermediate vocational training levels. This level is particularly suited to incremental innovation and to helping future workers achieve long-term employability.

ISCED 4 is post-secondary (non-tertiary) education and includes programmes such as basic pre-university courses or short vocational programmes that are not considered as higher training. These programmes should include specialised material or more complex application than the ISCED 3 programmes and the successful completion of ISCED 3 is a pre-requisite. Duration tends to be in the six-month to two year range. Naturally, its purpose is to enhance the employability of students but its presence has diminished in the EU today.

ISCED 5, with a minimum duration of three years of higher education, also has two different branches: 5a which concludes with an Undergraduate and Masters degree giving students access

to level 6 PhD studies, and 5b high-level vocational training. These levels, together with level 6, prepare students for all sorts of innovation and should guarantee that they are able to meet all of the demands of today's frenetic technological change.

This standard allows for a more detailed comparison of the standing of our countries in comparison with the rest of Europe. Italy spends the most on primary education (ISCED 1) with expenditure at 109% of the European average while Spain checks in at 97% and Portugal at 74%. As for compulsory secondary education, Italy and Spain are at the Community average while Portugal is at 80%. In terms of non-compulsory secondary education, Spain is at 114% of the European average, Italy at 91% and Portugal at 84%. Having regard to tertiary education (without counting funds received by universities for R&D activities), Spain stands at 113% of the European average, Portugal at 94% and Italy 69%. It is always useful to compare these data with those of the United States which spends an average of 78% more per student than EU-19 and trebles per-student expenditure at university level.

Annual expenditure by educational institutions per student (EU-27 = 100), 2008

	Pre-primary education (for children 3 years and older)	Primary education	Lower secondary education	Upper secondary education	All secondary education	All tertiary education excluding R&D activities	All tertiary education including R&D activities
Spain	112.3	96.8	99.9	114.5	104.6	113.4	107.6
Portugal	91.5	74.2	79.6	84.1	81.9	94.0	83.3
Italy	100.0	109.4	100.7	91.3	95.9	69.0	99.2
USA	171.8	151.5	133.0	136.8	135.4	306.8	178.1

Source: OECD, Education at a glance 2010

In 2007, 2.5% of the total number of EU-27 students enrolled in compulsory secondary education (ISCED 2) opted for the employability branch. In Spain this percentage was 0.4% and in Portugal 7.0%. Italy does not offer this sort of programme at this level.

Vocational training students in lower secondary education as a percentage of the student body at that level

	2000	2007	2008
Spain	0.4	0.4	0.5
Italy	0.0	0.0	0.0
Portugal	0.2	7.0	12.1
EU - 27	:	2.5	:

Source: World Bank

At upper secondary education where vocational training studies (ISCED 3b) form part of the curriculum in practically all countries, the figures are much higher and are more comparable. In EU-27, half of the students at that level 3 opted for Vocational Training; in Spain 43%, Italy 60% and Portugal 34%. In the year 2000 the proportions were 33% in Spain and 24% in Italy and Portugal. The growing interest in these studies on the part of young people in our three countries is indisputable.

Vocational training students in upper secondary education as a percentage of the student body at that level

	2000	2007	2008
Spain	33.5	43.4	43.8
Italy	24.6	59.8	59.4
Portugal	24.1	33.2	35.1
EU – 2 7	:	51.5	:

Source: World Bank

The comparison between different countries at the upper levels of Vocational Training (ISCED 4 and 5b) is more difficult because in many, vocational training is not part of the curriculum at some levels. In 2007 in Europe, 19% of the total number of students at these levels were enrolled in vocational training courses. A similar calculation was made for our three countries with 2002 data showing 3.4% for Italy, 1.4% for Portugal and 13.5% for Spain.

Vocational Training students at ISCED level 4 and 5 out of the total student body at those levels (%)

		Year and source
Spain	13.8	2007, World Bank
Italy	3.4	2002, Unesco
Portugal	1.4	2002, Unesco
EU - 27	19.2	2007, World Bank

Sources: World Bank, Unesco

With regard to ISCED level 6 (PhD), only Finland stands out in terms of the percentage of students enrolled in these studies. Its 1.5% is clearly higher than the 0.5% of other countries, including the United States. This is also very similar to the percentage of university students who choose to earn a PhD, approximately 3%. In absolute terms, in 2008 in EU-27 there were half a million PhD students while in the US there were 461,000. In Spain there were 67.000, In Italy 39.000 and in Portugal 16.000.

PhD students in thousands and as a percentage of the total number of students in 2008

	Total *(thousands)*	%
Spain	67.0	0.7
Italy	39.3	0.4
Portugal	16.0	0.7
EU - 27	499.3	0.5

Source: Eurostat, education statistics.

One third of all European university students (EU-27) in 2008 enrolled in social sciences, a fifth in exact and natural sciences while the rest were distributed evenly among engineering, health and humanities. Our three countries exhibit percentages very similar to the average with the exception of Portugal where the percentage is higher in engineering and lower in health. A comparison of this breakdown with that of graduates in the year 2000 shows a significant increase in health. Among our three countries, the rise in health in Portugal is noteworthy, up from 8% in the year 2000, and in engineering which was at 18% in the year 2000. This upward trend in the percentage of engineers can also be observed in Spain while the European average has fallen. Also worthy of

mention is the decline in exact and natural sciences of between two and three points in Spain and Portugal.

Percentage of university students by field of study

	2008				2000			
	EU-27	**Spain**	**Italy**	**Portugal**	**EU-27**	**Spain**	**Italy**	**Portugal**
Humanities	13	10	13	9	13	11	16	8
Social sciences	34	32	35	32	34	37	40	36
Exact and natural sciences	10	10	8	8	10	13	8	9
Engineering	14	18	15	22	15	16	17	18
Health	13	12	13	17	11	9	11	8

Source: Eurostat

In-company training

The training received by workers during their work life varies greatly from one country to the next, even among the most developed, despite its recognised importance to innovative capacity and therefore in terms of competitiveness. At least theoretically, two extreme models can be distinguished which obviously are not strictly followed in any country. One model responds to a labour market based on a formally recognised vocational qualification which is obtained simultaneously through school-based and in-company learning. The second model leaves this sort of training in the hands of companies meaning that there is no formal recognition of the expertise acquired. The main difference between the two models is the ultimate objective of the training. The first model provides mobility to workers who earn formal recognition of their skills while the second seeks greater effectiveness in the worker's current job post. Naturally, the desirability of one model over the other depends quite a bit on the training received at the academic stage and on the volatility of the workers. Note that neither of the two models is strictly followed in any country.

In general terms, the model recognising vocational training favours innovation because it adapts better to change insofar as training is not conditioned by the way things are done in a particular company. Some empirical studies show that training based strictly on business interests tends to reject capital goods which are not completely certified and this lowers the likelihood of future innovation. Workers with general vocational training take advantage of capital goods still under development in order to be the first in possible innovations. On the other hand, dependence on pre-determined qualifications imposes a degree of inflexibility on the labour market which diminishes the freedom of companies.

Germany is closer to a vocational market based on wide-ranging social consensus and recognised academic education also received during the initial stages of in-company training. On the other end of the spectrum we have Japan which places trust in its academic system and companies keep the training received by their employees up to date. In this case, the fidelity of Japanese workers to their company plays a supporting role.

In any case, the continuous changes taking place in productive systems and the speed at which this is occurring raises new demands with regard to the labour qualifications required by

companies meaning that workers must possess specific and permanently updated training. This is referred to as continuous training which has become a fundamental element providing new knowledge and the permanent retraining of workers contributing to the enhanced competitiveness of companies.

The following are considered to be the objectives of continuous training:

- promote personal development, self-confidence, identification and self-realisation;
- increase economic efficiency, productivity and profitability in terms of individual and national income;
- prevent competences from becoming out of date;
- reduce the specific problems of high-risk groups;
- satisfy the demands made by the social and democratic development of societies;
- increase cultural participation and social competences.

While continuous training does prioritise the objectives most closely linked with the labour market, it goes beyond these boundaries in aspiring to be an instrument to form the new knowledge-based society.

In 2005, 33% of workers in companies throughout EU-27 participated in some course of this sort, but this percentage has been on the decline since 1999. In our three countries the level of participation in 2005 was similar to the European average and in all cases higher than the 1999 percentages. Also, the number of courses per employee and their duration were similar to the European average.

Participants in continuous vocational training courses (% of the total employees at all companies)

	1999	2005
Spain	25	33
Italy	26	29
Portugal	17	28
EU - 27	40	33

Source: Commission staff working document PROGRESS TOWARDS THE LISBON OBJECTIVES IN EDUCATION AND TRAINING Indicators and benchmarks 2008

Average number of hours devoted by employee and by participant

	Employee	Participant
Spain	9	26
Italy	7	26
Portugal	7	26
EU - 27	9	27

Source: Commission staff working document PROGRESS TOWARDS THE LISBON OBJECTIVES IN EDUCATION AND TRAINING Indicators and benchmarks 2008

Human resources in science and technology

In order to develop, an innovative society must invest in all types of human capital. Naturally, however, there are certain qualifications that are more related with innovative potential such as human resources in science and technology.

The EUROSTAT statistics drawn up in accordance with the recommendations of the Canberra Manual, with the exception of some minor adaptations to the EU context, can be used as the basis to analyse human resources in the field of science and technology. These statistics make use of the ISCED educational profiles described earlier, as well as the ISCO occupational profiles (International Standard Classification of Occupations), whose levels are defined in Annex III.

According to EUROSTAT, human resources in science and technology (HRST) are individuals who fulfil at least one of the following conditions:

- have successfully completed tertiary-level education (ISCED ’97 version, levels 5a, 5b or 6); and/or
- are working in an S&T occupation as professionals or technicians (ISCO ‘88, COM codes 2 or 3).

According to Eurostat, HRST with tertiary training (ISCED ´97 version, levels 5a, 5b or 6) make up the HRSTE group.

HRST with tertiary education are divided in EUROSTAT statistics into three sub-groups depending on the areas in which they work: a) Science, mathematics and computing, b) Engineering, manufacturing and construction and c) Other.

EUROSTAT also distinguishes what it calls “core HRST” (HRSTC), comprised of people with third-level education who are employed such as professionals or technicians in the field of science and technology. Outside of this core group are the people who discharge administrative or other types of duties.

The HRSTO category refers to individuals who have both successfully completed tertiary-level education (ISCED ’97 version, levels 5a, 5b or 6) and are employed in an S&T occupation as professionals and technicians (ISCO ‘88, COM codes 2 or 3). (See Annex III). Scientists and engineers employed in science and technology activities (SE) belong to this category.

The following table shows HRST categories and sub-categories and the requirements defining them:

HRST categories and sub-categories

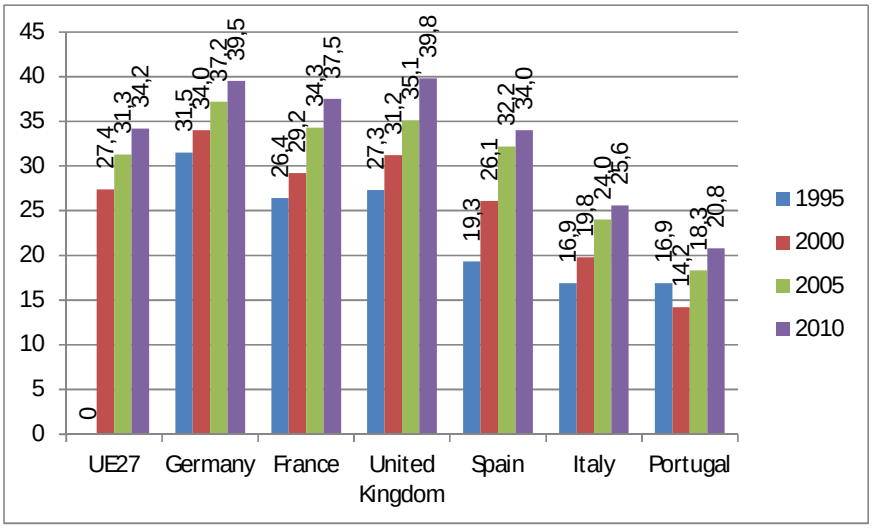
			HRSTE (in terms of education)			
			Tertiary education			Lower than tertiary education
			ISCED 6	ISCED 5A	ISCED 5B	ISCED < 5B
HRSTO (in terms of occupation)	ISCO 2	Professionals	HRST Core HRSTC			HRST without tertiary education
	ISCO 3	Technicians				
	ISCO 1	Managers	HRST non-core			Non-HRST
	ISCO 4-9	All other occupations				
		Unemployed	HRST unemployed HRSTU			
		Inactive	HRST inactive			

Source: "Science and technology. Human Resources in Science & Technology statistics". EUROSTAT (2008).

Annex IV includes four tables with figures on science and technology human resources organised according to this model for EU-27 and the three Cotec-Europe countries.

The following graph shows the evolution of HRST percentages of the entire population age 25 to 64 from 1995 to 2010 in our countries and in other European countries.

Human Resources in Science and Technology (HRST) in different countries. Source: "Science and technology. Human Resources in Science & Technology statistics". EUROSTAT (2011).



Breakdown of HRST by category

In 2009 in the EU there were 91 695 000 people certified as HRST, 33.8% of its population between the ages of 25 and 64 of which 8 627 000 were Italian, nearly 26% of the Italian population in that age bracket, 8 944 000 were Spanish, a percentage on par with that of the European Union and 1 201 000 were Portuguese, just over 20%.

	EU-27	DE	UK	FR	ES	IT	PT
HRST	91 695	17 450	12 698	11 948	8 944	8 627	1 201
HRSTE	68 032	11 670	10 615	9 126	8 069	4 836	873
HRSTO	61 783	12 855	7 227	7 767	4 695	6 743	900
HRSTC	38 119	7 075	5 144	4 945	3 819	2 952	572
HRST NC	19 211	3 075	3 883	2 662	2 727	880	185
HRST with out higher education	23 664	5 780	2 083	2 822	875	3 791	328
HRST unemployed	3 301	384	444	502	751	242	55
HRST inactive	7 401	1 136	1 144	1 017	772	762	61

(Data in thousands)

The occupational breakdown of HRST in Science and Technology activities varied from one country to the next. On average in Europe, 67% worked directly in science and technology activities as professionals or technicians, (HRSTO), while 21% did so indirectly as managers or support staff or worked in other occupations (HRST non-core). 4% of HRST in EU-27 were unemployed and 8% were inactive. Regarding Cotec-Europe countries, Italy had the highest percentage of direct employment in technological activities with 78% and Spain the lowest with 52%.

63% of HRST were directly or indirectly employed in science and technology activities in the EU and had university training, a percentage reflected in Portugal. In Spain these workers accounted for 73% of the total number of HRST and in Italy this figure was 44%.

The following table shows the percentage of the total population in 2009 of the different HRST categories in our three countries and the EU benchmark countries.

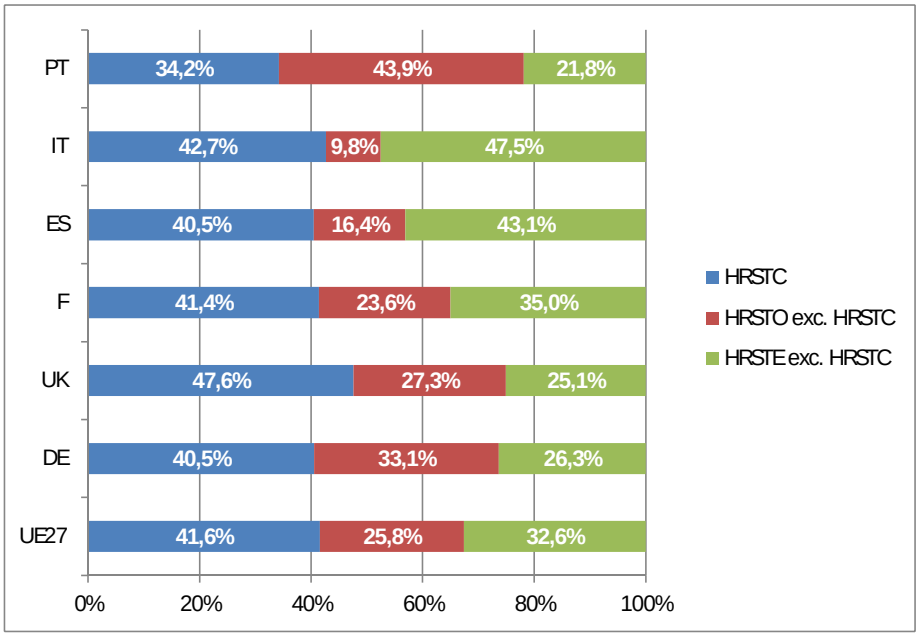
	EU-27	DE	UK	FR	ES	IT	PT
HRST	33.8	39.2	39.1	36.9	33.8	25.9	20.2
HRSTE	25.1	26.2	32.7	28.2	30.5	14.5	14.7
HRSTO	22.8	28.9	22.3	24.0	17.7	20.2	15.1
HRSTC	14.0	15.9	15.8	15.3	14.4	8.9	9.6
Scientists and Engineers	4.1	5.1	4.5	4.3	3.9	2.5	2.7

In 2009 in EU-27 there were 38 119 000 advanced degree holders working directly in science and technology activities as professionals or technicians (HRSTC) and 23 664 000 who were not advanced degree holders but who also worked in these activities. There were 29 913 000 advanced degree holders in Science and Technology who did not work directly in these activities or who were unemployed or inactive.

	EU-27	DE	UK	FR	ES	IT	PT
HRST	91 695	17 450	12 698	11 948	8 944	8 627	1 201
HRSTC	38 119	7 075	5 144	4 945	3 819	2 952	572
HRSTO exc. HRSTC	23 664	5 780	2 083	2 822	875	3 791	328
HRSTE exc. HRSTC	29 913	4 595	5 471	4 181	4 250	1 884	301

(Data in thousands)

The following graph shows the percentage weighting of these categories out of the total number of science and technology human resources for the three Cotec-Europe countries, for EU-27 and for other benchmark countries.



Breakdown of HRSTO by occupation

In EU-25 in 2009 there were nearly 62 million people working in science and technology activities distributed nearly evenly amongst professionals and technicians and just over 62% had university training.

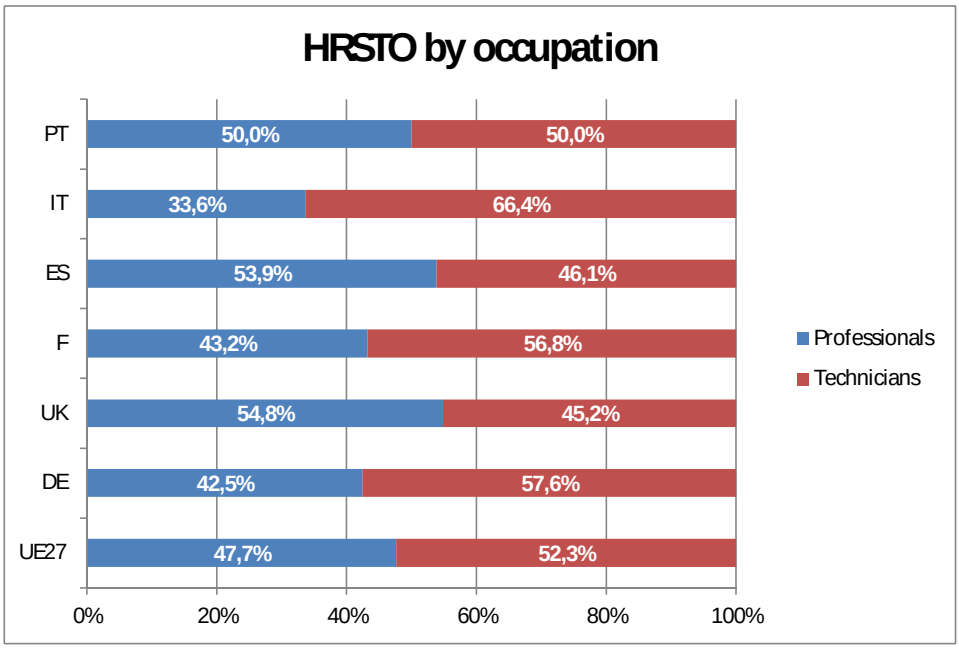
In Spain, 4 695 000 people worked in science and technology, in Italy 6 743 000 and in Portugal 900 000. The percentage of these workers with an advanced degree in Portugal was practically the same as the EU average while in Spain it was higher (81%) and in Italy lower (44%). These differences, albeit in lesser proportions, were also reflected in terms of the occupational levels for professionals and technicians.

Human Resources in Science and Technology - Occupation

	Total	*Professionals*	*Technicians*
EU-27	61 783	29 441	32 342
DE	12 855	5 457	7 399
UK	7 227	3 963	3 264
F	7 767	3 356	4 411
ES	4 695	2 529	2 165
IT	6 743	2 269	4 474
PT	900	450	450

(Data in thousands)

The following graph shows the breakdown of professionals and technicians from among the total number of human resources in science and technology who worked directly in these activities in 2009.



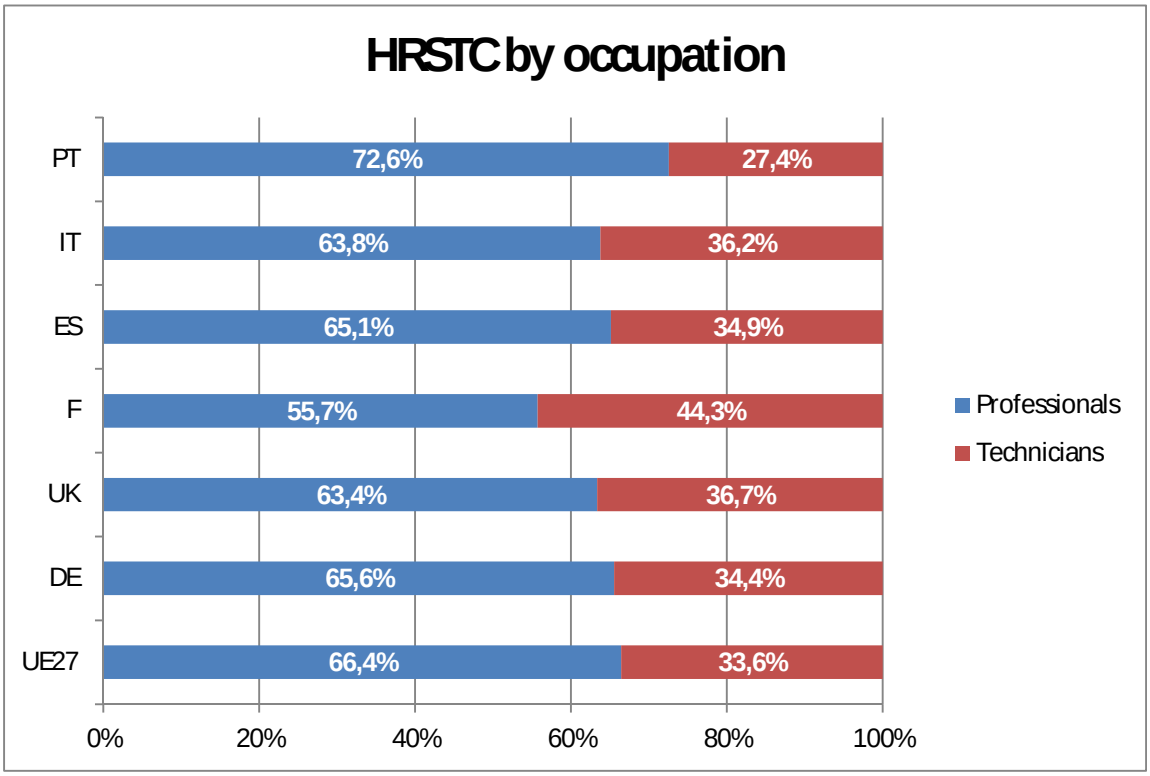
The following table shows advanced degree holders employed directly in science and technology activities as professionals or technicians.

Human Resources in Science and Technology - Core

	Total	Professionals	Technicians
EU-27	38 119	25 330	12 790
DE	7 075	4 639	2 437
ES	3 819	2 488	1 331
FR	4 945	2 756	2 189
IT	2 952	1 882	1 070
PT	572	415	157
UK	5 144	3 259	1 886

(Data in thousands)

The percentages pertaining to occupation in Italy and Spain are nearly identical to the European average, i.e. 66% are professionals and 34% technicians. Of the professionals, 44% are engineers or scientists. In Portugal, the percentages of professionals and technicians are somewhat different; 73% are professionals while 27% are technicians.



Engineering Graduates

According to data from the German Association of Engineering (VDI) regarding graduates in 2010, the percentage of them who were employed but were not working in their profession varied considerably between countries. France had no such cases, there was a 4% incidence in Germany, in Portugal and Spain this percentage reached 36% and was over 50% in Italy. These figures show that our productive fabrics are not able to employ a large proportion of the engineers emerging from our educational systems.

Minimum of engineering graduates who do not work as engineers (%), 2007	
Italy	52.9
Portugal	36.7
Spain	35.9
Country average	28
France	24.8
Germany	4.2
Source: VDI	

A study performed in 2011 by Cotec Italy in cooperation with the Fondazione Ugo Bordoni confirms this low absorption capacity of the productive tissue in Italy, where the yearly supply of

engineers is around 36 000, and the demand by business services and industry is only around 20 000 in full-time equivalents.

Researchers and R&D + Innovation personnel

Approximately 11 out of every 1 000 active people in 2009 were employed in R&D activities in EU-27 and in our three countries. Of these, 61% were researchers in EU-27 and in Spain while that percentage in Portugal was 84% and in Italy 40%.

People engaged in R&D activity per 1 000 employees, 2009	
Spain	11.55
Italy	9.63
Portugal	10.42
EU - 27	11.11
Source: OECD, "Main Science and Technology Indicators, 2011/1"	

Eurostat 2009 figures indicate that 11 out of every 1 000 employees in EU-27 are engaged in innovation activities and the figure is quite similar in our three countries. France and Germany exceeded this figure by two or three points.

There were 3.05 company researchers per 1 000 employees in EU-27 while that figure was 2.26 in Spain, 2.00 in Portugal and 1.45 in Italy. This is compared to the more than 7 in the United States.

Number of company researchers per 1000 employees, 2008	
Spain	2.26
Italy	1.45
Portugal	2.00
EU - 27	3.05
Source: OECD, "Main Science and Technology Indicators, 2011/1"	

Of the total number of people employed in R&D in EU-27, 61% were researchers: Spain's percentage matched the European average while Portugal had 84% and Italy 40%.

Percentage of researchers out of the total of R&D workers, 2008	
Spain	60.73%
Italy	40.45%
Portugal	84.39%
EU - 27	61.34%
Source: OECD, "Main Science and Technology Indicators, 2011/1"	

Of the total number of researchers, company researchers accounted for 47% in EU-27, 42% in Italy and 35% in Portugal and Spain, compared to 80% in the US.

Percentage of company researchers with respect to the total number of researchers, 2008	
Spain	35.63%
Italy	41.79%
Portugal	34.81%
EU - 27	47.23%

Source: "Main Science and Technology Indicators. OECD

Conclusions

The data previously presented show significant human capital weaknesses in our three countries which undoubtedly have a negative effect on our innovative capacity. It has also been shown that when it comes to the training of human capital, the engagement of the educational system and the assumption of this responsibility by the business fabric is likewise important. From both a theoretical and empirical point of view, there is evidence of a sub-optimal allocation of resources to the training of human capital which would justify the sort of public intervention assumed by any government. The need is even more crucial in our countries given the gap with the most advanced ones.

It has also become clear that employability is what confirms the suitability of the human capital a country needs and hence the importance of businesses taking part in training processes. Although it is also true that long-term employability can only be guaranteed with solid training provided by an efficient educational system.

Also, in light of economic fluctuations, workers mobility needs to be facilitated and the significant effort being made in Europe to achieve a European Occupational Qualifications Framework represents a step in this connection. There is objective reason to hope that this effort will serve not only to make more optimal use of Europe's human resources but also to adapt and enhance the flexibility of the educational systems of each country and to harmonise the formal academic training offered through the educational system with that offered by companies.

Regarding the human capital needed for innovation, data show that in our countries people trained as engineers have an easier time finding employment in other fields. Also, there are fewer company researchers counted as a percentage of the total number of researchers in comparison with other countries. This shows that in our countries the bottleneck is not in the training capacity of our educational system but rather in the absorption capacity of the productive fabric.

Annexes

ANNEX I

Descriptors defining levels in the European Qualifications Framework (EQF)

Each of the 8 levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications.			
	Knowledge	**Skills**	**Competence**
	In the context of EQF, knowledge is described as theoretical and/or factual.	In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	In the context of EQF, competence is described in terms of responsibility and autonomy.
Level 1 The learning outcomes relevant to Level 1 are	Basic general knowledge.	Basic skills required to carry out simple tasks.	Work or study under direct supervision in a structured context.

Level 2 The learning outcomes relevant to Level 2 are	Basic factual knowledge of a field of work or study.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools.	Work or study under supervision with some autonomy.
Level 3 The learning outcomes relevant to Level 3 are	Knowledge of facts, principles, processes and general concepts, in a field of work or study.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.	Take responsibility for completion of tasks in work or study adapt own behaviour to circumstances in solving problems.
Level 4 The learning outcomes relevant to Level 4 are	Factual and theoretical knowledge in broad contexts within a field of work or study.	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change. Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.

Level 5* The learning outcomes relevant to Level 5 are	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge.	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems.	Exercise management and supervision in contexts of work or study activities where there is unpredictable change review and develop performance of self and others.
Level 6** The learning outcomes relevant to Level 6 are	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles.	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study.	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts. Take responsibility for managing professional development of individuals and groups.

Level 7*** The learning outcomes relevant to Level 7 are	Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research critical awareness of knowledge issues in a field and at the interface between different fields.	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields.	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams.
Level 8**** The learning outcomes relevant to Level 8 are	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields.	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice.	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research.

ANNEX II

Skills upgrading and matching - Key Actions 4 to 8:
The Commission will:

- 4. As of 2012, produce **an EU skills Panorama** to improve transparency for jobseekers, workers, companies and/or public institutions. The Panorama will be available online and contain updated forecasting of skills supply and labour market needs up to 2020. It will provide: i) up-to-date information on the top 25 growth occupations in the EU, and on the top five 'in demand' occupations per Member State; ii) an analysis of skills requirements based on the European Vacancy Monitor; iii) an analysis of skills mismatches and use of skills in the workplace, through surveys of employers, learners and graduates; iv) foresight analysis at sector level, based on the work of the European Sector Councils' on Skills and Employment; and v) CEDEFOP[3] and Member States' projections. Where relevant the Panorama will report on skills needs in particularly important areas such as science, technology, engineering and mathematics.
- 5. By 2012, complete in all European languages the **European Skills, Competences and Occupations classification (ESCO)**, as a shared interface between the worlds of employment, education and training.
- 6. In 2012, consider the possibility of presenting proposals to help **reform the systems for the recognition of professional qualifications,** on the basis of the evaluation of the Professional Qualification Directive.
- 7. In 2011, launch a **New Agenda for Integration** of third country nationals, to provide improved structures and tools to facilitate the exchange of knowledge, and the mainstreaming of integration priorities of the Member States in all relevant policy areas.
- 8. In 2012, consider the possibility of presenting proposals to help improve **the enforcement of rights of EU migrant workers** in relation to the principle of free movement of workers.

Accompanying and preparatory measures:
The Commission, in cooperation with Member States, will also:

- By 2011, propose a **new benchmark on education for employability** to stimulate a new focus on preparing young people for the transition to the labour market, propose a Council Recommendation on **reducing early school leaving**, and set up a **High Level Expert Group on improving literacy** among young people and adults.
- By the end of 2010, launch an **awareness campaign on how citizens can benefit from EU social security coordination rules to move within Europe,** without losing their rights.
- In the framework of the **SME Performance Review,** assess future skills needs in micro and craft (-type) enterprises for a representative sample of EU Member States, to better mainstream the needs of these enterprises in existing EU policy initiatives.
- As of 2011, support competences for sustainable development, and promote skills development, in sectors covered by **the Roadmap towards a resource-efficient Europe and by the new Eco-Innovation Action Plan**.
- As of 2011, support '**knowledge alliances'**, i.e. ventures bringing together business and education/training institutions to develop new curricula addressing innovation skills gaps and

[3] *European Centre for the Development of Vocational Training*

matching labour market needs. The EU Industrial PhDs in the framework of Marie Curie actions and the Erasmus placement in companies will also be developed.

- In 2011, propose a Council Recommendation on the identification, recording and **validation of competences** gained outside of formal education and training, including in particular a **European Skills Passport** to help individuals record and present the skills acquired throughout their life.
- In 2011, present **an analysis of the contribution of migration policies to labour market and skills matching** in line with the Stockholm programme. A **policy network to improve the education of migrants** will be established to address the educational achievement gap between migrant students and the indigenous population at school.
- By 2012, **reform the European Employment Services EURES and its legal basis**, to develop its matching and placement capacity at the service of the European Employment Strategy and to expand it to support Your First EURES Job.
- By 2012, propose an EU-wide approach and instruments to support Member States in the **integration of** ICT competences and digital literacy (e-skills) **into core lifelong learning** policies.
- By 2012, present a **Communication on the European policy for multilingualism**, proposing priorities in the education and training systems, and a European language benchmark based on results of the European Survey on Language Competence so as to achieve the "mother tongue +2" Barcelona objective.
- By 2012, develop in cooperation with Member States an **action plan to address the gap in the supply of health workers**. The action plan will be accompanied by a Joint Action under the Health Programme on forecasting health workforce needs and workforce planning.
- By 2012, map out and promote European **centres of excellence within new academic specialisations** for tomorrow's job. The Commission will analyse the best way to support mobility of students (European and international) towards these centres of excellence.

ANNEX III

ISCO-08 Draft definitions

0 Armed forces occupations

Armed forces occupations include all jobs held by members of the armed forces. Members of the armed forces are those personnel who are currently serving in the armed forces, including auxiliary services, whether on a voluntary or compulsory basis, and who are not free to accept civilian employment and are subject to military discipline. Included are regular members of the army, navy, air force and other military services, as well as conscripts enrolled for military training or other service for a specified period.

Occupations in this major group are classified into the following sub-major groups:

01 Commissioned armed forces officers
02 Non-commissioned armed forces officers
03 Armed forces occupations, other ranks

1 Managers

Managers plan, direct, coordinate and evaluate the overall activities of enterprises, governments and other organizations, or of organizational units within them, and formulate and review their policies, laws, rules and regulations.

Tasks performed by managers usually include: formulating and advising on the policy, budgets, laws and regulations of enterprises, governments and other organizational units; establishing objectives and standards and formulating and evaluating programs and policies and procedures for their implementation; ensuring appropriate systems and procedures are developed and implemented to provide budgetary control; authorising material, human and financial resources to implement policies and programs; monitoring and evaluating performance of the organization or enterprise and of its staff; selecting, or approving the selection of staff; ensuring compliance with health and safety requirements; planning and directing daily operations; representing and negotiating on behalf of the government, enterprise or organizational unit managed in meetings and other forums.

Occupations in this major group are classified into the following sub-major groups:

1.1 Chief executives, senior officials and legislators
1.2 Administrative and commercial managers
1.3 Production and specialized services managers
1.4 Hospitality, retail and other services managers

2 Professionals

Professionals increase the existing stock of knowledge, apply scientific or artistic concepts and theories, teach about the foregoing in a systematic manner, or engage in any combination of these activities. Competent performance in most occupations in this major group requires skills at the fourth ISCO skill level.
Tasks performed by professionals usually include: conducting analysis and research, and developing concepts, theories and operational methods, and advising on or applying existing knowledge related to physical sciences including mathematics, engineering and technology, and to life sciences including the medical and health services, as well as to social sciences and humanities; teaching the theory and practice of one or more disciplines at different educational levels; teaching and educating handicapped persons; providing various business, legal and social services; creating and performing works of art; providing spiritual guidance; preparing scientific papers and reports. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

2.1 Science and engineering professionals
2.2 Health professionals
2.3 Teaching professionals
2.4 Business and administration professionals
2.5 Information and communications technology professionals
2.6 Legal, social and cultural professionals

3 Technicians and associate professionals

Technicians and associate professionals perform mostly technical and related tasks connected with research and the application of scientific or artistic concepts and operational methods, and government or business regulations. Most occupations in this major group require skills at the third ISCO skill level.
Tasks performed by technicians and associate professionals usually include: undertaking and carrying out technical work connected with research and the application of concepts and operational methods in the fields of physical sciences including engineering and technology, life sciences including the medical profession, and social sciences and humanities; initiating and carrying out various technical services related to trade, finance, administration, including administration of government laws and regulations, and to social work; providing technical support for the arts and entertainment; participating in sportiing activities; executing some religious tasks. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

3.1 Science and engineering associate professionals
3.2 Health associate professionals
3.3 Business and administration associate professionals
3.4 Legal, social, cultural and related associate professionals
3.5 Information and communications technician

4 Clerical support workers

Clerical support workers record, organize, store, compute and retrieve information related, and perform a number of clerical duties in connection with money-handling operations, travel arrangements, requests for information, and appointments. Most occupations in this major group require skills at the second ISCO skill level.

Tasks performed by clerical support workers usually include: stenography, typing, and operating word processors and other office machines; entering data into computers; carrying out secretarial duties; recording and computing numerical data; keeping records relating to stocks, production and transport; keeping records relating to passenger and freight transport; carrying out clerical duties in libraries; filing documents; carrying out duties in connection with mail services; preparing and checking material for printing; writing on behalf of illiterate persons; performing money-handling operations; dealing with travel arrangements; supplying information requested by clients and making appointments; operating a telephone switchboard. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

4.1 General and keyboard clerks
4.2 Customer services clerks
4.3 Numerical and material recording clerks
4.4 Other clerical support workers

5 Service and sales workers

Service and sales workers provide personal and protective services related to travel, housekeeping, catering, personal care, or protection against fire and unlawful acts, or demonstrate and sell goods in wholesale or retail shops and similar establishments, as well as at stalls and on markets. Most occupations in this major group require skills at the second ISCO skill level.

Tasks performed by service and sales workers usually include: organizating and providing services during travel; housekeeping; preparing and serving of food and beverages; caring for children; providing personal and basic health care at homes or in institutions, as well as hairdressing, beauty treatment and companionship; telling fortunes; embalming and arranging funerals; providing security services and protecting individuals and property against fire and unlawful acts; enforcing of law and order; posing as models for advertising, artistic creation and display of goods; selling goods in wholesale or retail establishments, as well as at stalls and on markets; demonstrating goods to potential customers. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

5.1 Personal service workers
5.2 Sales workers
5.3 Personal care workers

5.4 Protective services worker

6 Skilled agricultural, forestry and fishery workers

Skilled agricultural, forestry and fishery workers grow and harvest field or tree and shrub crops, gather wild fruits and plants, breed, tend or hunt animals, produce a variety of animal husbandry products, cultivate, conserve and exploit forests, breed or catch fish and cultivate or gather other forms of aquatic life in order to provide food, shelter and income for themselves and their households. Most occupations in this major group require skills at the second ISCO skill level. Tasks performed by skilled agricultural, forestry and fishery workers usually include: preparing the soil; sowing, planting, spraying, fertilising and harvesting field crops; growing fruit and other tree and shrub crops; growing garden vegetables and horticultural products; gathering wild fruits and plants; breeding, raising, tending or hunting animals mainly to obtain meat, milk, hair, fur, skin, sericultural, apiarian or other products; cultivating, conserving and exploiting forests; breeding or catching fish; cultivating or gathering other forms of aquatic life; storing and carrying out some basic processing of their produce; selling their products to purchasers, marketing organisations or at markets. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

6.1 Market-oriented skilled agricultural workers
6.2 Market-oriented skilled forestry, fishery and hunting workers
6.3 Subsistence farmers, fishers, hunters and gatherers

7 Craft and related trades workers

Craft and related trades workers apply specific knowledge and skills in the fields to construct and maintain buildings, form metal, erect metal structures, set machine tools, or make, fit, maintain and repair machinery, equipment or tools, carry out printing work produce or process foodstuffs, textiles, or wooden, metal and other articles, including handicraft goods. The work is carried out by hand and by hand-powered and other tools which are used to reduce the amount of physical effort and time required for specific tasks, as well as to improve the quality of the products. The tasks call for an understanding of all stages of the production process, the materials and tools used, and the nature and purpose of the final product. Most occupations in this major group require skills at the second ISCO skill level.

Tasks performed by craft and related trades workers usually include: constructing, maintaining and repairing buildings and other structures; casting, welding and shaping metal; installing and erecting heavy metal structures, tackle and related equipment; making machinery, tools, equipment, and other metal articles; setting for operators, or setting and operating various machine tools; fitting, maintaining and repairing industrial machinery, including engines and vehicles, as well as electrical and electronic instruments and other equipment; making precision instruments, jewellery, household and other precious-metal articles, pottery, glass and related products; producing

handicrafts; executing printing work; producing and processing foodstuffs and various articles made of wood, textiles, leather and related materials. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

7.1 Building and related trades workers, excluding electricians
7.2 Metal, machinery and related trades workers
7.3 Handicraft and printing workers
7.4 Electrical and electronic trades workers
7.5 Food processing, wood working, garment and other craft and related trades worker

8 Plant and machine operators, and assemblers

Plant and machine operators, and assemblers operate and monitor industrial and agricultural machinery and equipment on the spot or by remote control, drive and operate trains, motor vehicles and mobile machinery and equipment, or assemble products from component parts according to strict specifications and procedures. The work mainly calls for experience with and an understanding of industrial and agricultural machinery and equipment as well as an ability to cope with machine-paced operations and to adapt to technological innovations. Most occupations in this major group require skills at the second ISCO skill level.

Task performed by plant and machine operators and assemblers usually include: operating and monitoring mining or other industrial machinery and equipment for processing metal, minerals, glass, ceramics, wood, paper, or chemicals, operating and monitoring machinery and equipment used to produce articles made of metal, minerals, chemicals, rubber, plastics, wood, paper, textiles, fur, or leather, and which process foodstuffs and related products; driving and operating trains and motor vehicles; driving, operating and monitoring mobile industrial and agricultural machinery and equipment; assembling products from component parts according to strict specifications and procedures. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

8.1 Stationary plant and machine operators
8.2 Assemblers
8.3 Drivers and mobile plant operators

9 Elementary occupations

Elementary occupations involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort. Most occupations in this major group require skills at the first ISCO skill level.

Tasks performed by workers in elementary occupations usually include: cleaning, restocking supplies and performing basic maintenance in apartments, houses, kitchens, hotels, offices and other buildings; washing cars and windows; helping in kitchens and performing simple tasks in food preapartation; delivering messages or goods; carrying luggage and handling baggage and freight; stocking vending machines or reading and emptying meters; collecting and sorting refuse; sweeping streets and similar places; performing various simple farming, fishing, hunting or trapping tasks performing simple tasks connected with mining, construction and manufacturing including product-sorting; packing and unpacking produce by hand and filling shelves; providing various street services; pedalling or hand-guiding vehicles to transport passengers and goods; driving animal-drawn vehicles or machinery. Supervision of other workers may be included.

Occupations in this major group are classified into the following sub-major groups:

9.1 Cleaners and helpers
9.2 Agricultural, forestry and fishery labourers
9.3 Labourers in mining, construction, manufacturing and transport
9.4 Food preparation assistants
9.5 Street and related sales and service workers
9.6 Refuse workers and other elementary workers

ANNEX IV

EU27

<table>
<tr><td colspan="6">HRST (HRSTE + HRST without terciary education) = 91,695</td></tr>
<tr><td colspan="3"></td><td colspan="3">HRSTE
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(in terms of education)</td><td></td></tr>
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<tr><td colspan="3"></td><td>ISCED 6</td><td>ISCED 5A</td><td>ISCED 5B</td><td>ISCED < 5B</td></tr>
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61,783
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ITALY

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SPAIN

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<tr><td rowspan="3">HRSTO -
4,695
(in terms of occupation)</td><td>ISCO 2</td><td>Professionals</td><td colspan="3" rowspan="2">HRST Core - HRSTC</td><td rowspan="2">HRST without terciary education -
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751</td></tr>
<tr><td colspan="3">Inactive</td><td colspan="3">HRST inactive
772</td></tr>
</table>

ANNEX V

Human Capital in the ICT domain in Italy: current trends

During 2011, Cotec Italia and Fondazione Ugo Bordoni – one of the major Italian research centres in the ICT sector (www.fub.it) – jointly carried out an analysis of the current role played by the Human Capital in the ICT related fields in Italy. The aim of the analysis was to explore the dimensions of the skill shortage in the ICT sector, focusing on the Italian population of graduates in engineering (electronics, computer science, management, telecommunications).

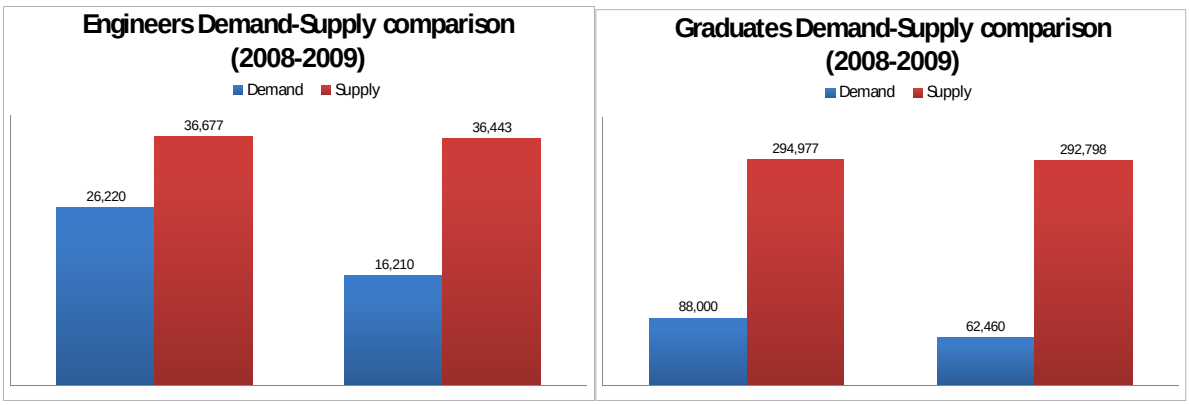
The analysis combined both quantitative and qualitative factors grounded on the most recent data available on graduates trends (the Italian Ministry of Education, University and Research database and the AlmaLaurea Consortium database) and demand of highly-skilled personnel (the Italian Chambers of Commerce system database) in some key sectors. Moreover, 15 stakeholders representing the most relevant players in the ICT domain and some of the most important Universities in Italy were interviewed.

Some significant results emerged, hereafter summarized.

1) The skill shortage perception related to the engineering and ICT field needs to be sharply reviewed. In fact, some difficulties in absorbing graduates in scientific and engineering disciplines by the Italian industrial systems emerge. Considering the last five years, some key figures are worth to be mentioned:

- the Italian university system "produces" as average about 300,000 graduates a year, 28% of which (about 80,000) in scientific disciplines. Amongst them, about 36,000 are engineers (12% of total graduates) (source: Italian Ministry of Education);

- a (even rough) estimate of the size of the demand by business services and industry reaches about 550,000 new workers a year, of which about 12% are graduates (around 65,000), while about 3,6% (around 20,000 full-time equivalents) are engineers (source: Unioncamere, union of italian chambers of commerce);

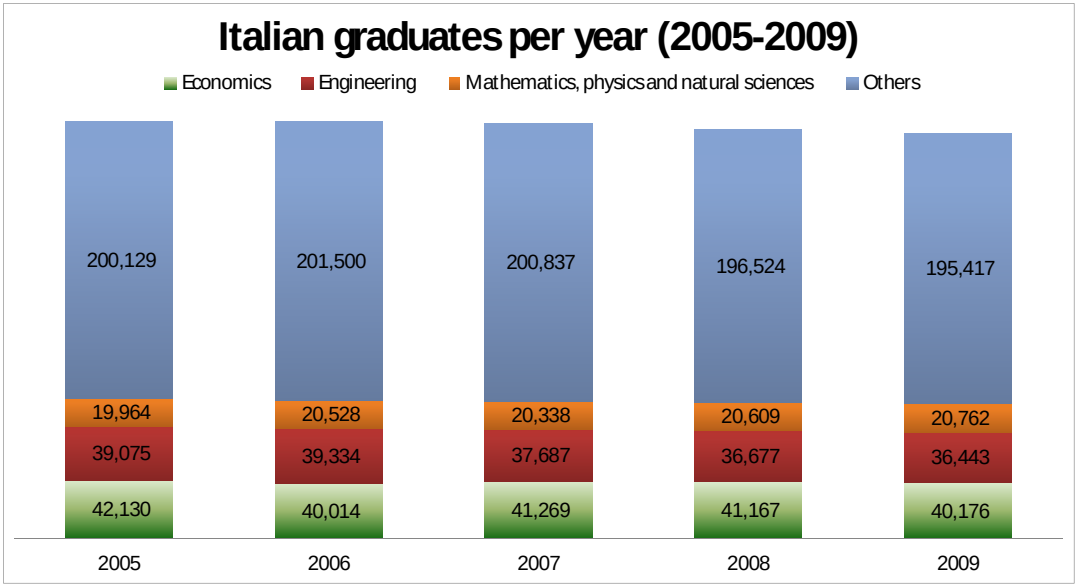


Source: Fondazione Cotec / Fondazione Ugo Bordoni (2011), elaboration on MIUR and AlmaLaurea data.

- once recruited, only half of the Science & Engineering graduates work in positions that deeply require the use of the skills acquired during their studies (this is even lower for the other degrees) (source: AlmaLaurea);

- net earnings three years after the degree in Science & Engineering disciplines reaches around 1,300 euros per month (and up to 1,500 if we consider only the Engineering branches), overcoming the average of all fields (source: AlmaLaurea);

- in general terms, the ratio of Engineering graduates over the entire population of graduates is rather stable, even in the long term (around 12%, see the chart below).



Source: Fondazione Cotec / Fondazione Ugo Bordoni (2011), elaboration on MIUR and AlmaLaurea data.

Considering the figures reported above, the actual size of the skill shortage issue seems lower than expected.

The interviews conducted with several leading ICT players in Italy confirmed such trend: on the one hand all consulted firms stated that they have no particular difficulty in finding newly graduated engineers to be hired by their organization; besides, they declare themselves satisfied with the skills and the proficiency of the newly graduates, which reflects the good performance of the education processes in Italian Universities, at least in the Science & Engineering domains.

2) The second step of the analysis allowed to identify a linkage between the supply vs. demand assessment and the Italian industrial model. Although mostly focused on traditional products (the so-called "Made in Italy"), the latter still seems to keep up with the increase of competition due to globalization and shows to be able to play a key role in the international markets. Success companies use ICT as enablers for new processes and new business models. This is true both for mature sectors traditionally representing a high share of the Italian exports (such as footwear, textiles, food, and so forth) and for technology-based sectors like mechatronics, metallurgy and chemistry, just to mention a few.

The analysis furthermore showed that an Italian model of doing business (strongly characterized by creativity and customization, regardless the dimension of the firm) can be identified. Such a model can indeed benefit of a smart use of ICT in all its stages, bringing a significant competitive advantage. Indeed, knowledge spillover between traditional sectors and technologically advanced sectors is a key process to be fostered in order to increase the overall competitiveness level of the Italian industrial system.

3) Following the output of the analysis, some policy guidelines were drafted.
With respect to the supply side, the obstacles experienced by newly graduates (even in the Science & Engineering fields) when attempting to enter the work market need to be take into account by the education system in its broader extent. In particular, the integration between the ICT skills provided by the Italian education system have to be integrated with the specialization models adopted by firms. Moreover, and this is a further issue to be tackled, the research paths undertaken by the Italian universities in the ICT domain rarely match with the innovation needs of the firms.
Secondly, on the demand side, new emerging markets (such as China, India, Brazil just to mention a few) have to be quickly tackled in order to increase opportunities. Institutional support in that direction, especially addressed to SMEs, is therefore crucial.
Thirdly, large-scale ICT projects, involving both private and public players, should be promoted in Italy in key frontier domains – such as high-definition ditigital TV integration with web services and on-demand services – in order to catalyse a critical mass of resources and to improve the overall competitiveness of the country.

Public Procurement as a driver for Innovation[4]

[4] *The present report was prepared through an analysis led by the Cotec Italy Working Group, in cooperation with Cotec Spain and Cotec Portugal.*
Cotec Italy would like to thank CONSIP S.p.A., represented by Gian Luigi Albano (Head of R&D), together with Francesco Licci and Marco Sparro, for the important suggestions and comments.

Executive Summary

In the framework of a new generation of Innovation policies focused on demand-side support, Public Procurement of technology-based products and services appears to encompass the most relevant opportunities. Indeed, procurement strategies, approaches and procedures adopted by Public Administrations have several effects, both in the short and mid run, on competition, market structure and market efficiency, of course depending on some key features of the downstream markets.

The implications of Public Procurement of technology with respect to innovation are at least threefold: (i) it fosters the birth and/or the growth of innovative markets; (ii) it enhances the efficiency of the public sector; (iii) it contributes to tackle some key societal challenges.

At European level, the Directives in force promote the use of innovation-oriented approaches for Public Procurement, such as Competitive Dialogue, the introduction of performance-based requirements and Framework Agreements. Moreover, key markets and societal challenges are identified within high-level initiatives.

The current legislative and policy frameworks and trends in Italy, Spain and Portugal are described. While several measures have been issued in order to boost the use of public purchases as a driver for innovation – mainly adopting the European Directives on the subject – some improvements are still needed in order to exhaustively exploit Public Procurement for such purposes.

In order to define useful prescriptions, some key pre-conditions are considered. First of all, a mid- and long-term Innovation agenda certainly represents an essential guideline for more specific Innovation policies complementary with each other. Besides, some specific Public Procurement schemes – such as for instance the Competitive Dialogue – are still to be fully fine-tuned in order to reach their full potential. Thirdly, even small buyers can pursue less challenging innovation objectives, but still important, with a smart use of performance-based contracts.

Following the main points emerged within the analysis carried out, COTEC promotes four policy recommendations:

- Improving the role of public-private partnerships.
- Public Administrations acting as “intelligent purchasers”.
- Shifting from a functional-based assignment to a performance-based awarding.
- Supporting enabling technologies.

Conceptual framework

Definitions

Historically, innovation policies designed and promoted by governments relied on two different sets of tools: supply-side measures (e.g. sustaining the Research & Innovation process through direct funding and the promotion of key framework conditions) and demand-side support, mainly by the means of monetary and fiscal policies in order to tackle market failures. The increasing awareness of the importance to balance the former and the latter grounds itself on at least three key aspects: (i) the traditional linear model of innovation (focussed on R&D in the first place) no longer seems able to describe the innovation cycle in its broader extent; (ii) market demand is becoming the most relevant factor influencing the level of R&D investment (as showed in the EU 2005 Survey of R&D Trends); (iii) the current pressure on fiscal budget in many OECD countries generate strong incentives in fostering innovation while increasing the productivity of public spending.

Regulation and standardization activities indeed play a key role in supporting directly and indirectly the demand-side of the innovation framework. However, Public Procurement (hereafter further defined) of technology-based products and services appears to encompass the most important set of instruments within the new generation of demand-side innovation policies. In fact, not only governments are characterized by large purchasing power – at least with respect to some key issues – but they usually represent (early) lead users able to sustain the diffusion of innovation by mobilising common needs to create common demand.

As suggested by OECD, two different levels of Public Procurement can be identified: (i) regular Public Procurement of ready-made products and services which do not incorporate any R&D result; (ii) request of specific technologies or knowledge-intensive services in order to deliver public services (innovation-oriented procurement). Our analysis mainly focuses on the latter. As reported in Figure 1, technological procurement is supposed to promote innovation at architectural level, making the public sector as the largest (and more sophisticated) consumer, while experimental procurement searches for the most innovative solution and leads, in the best cases, to radical innovation.

Figure 1 - Procurement types and possible effects of Public sector interventions on innovation

	Role of the public sector	Main motivation of procurement or award	Potential innovation type	Innovation-related risks on the supply side	Geography of procurement
Efficient procurement	Large efficiency-driven user	Best value for money	Incremental	Overdependence on public markets, risk of obsolescence	Centralised specifications (standard)
Adapted procurement	Niche user	The best adapted solution	Market niche	Market uncertainty	Regional specifications, regional procurement
Technological procurement	Large (sophisticated) customer	The best available solution	Architectural	Insufficiently reliable demand to justify investment	Centralised specifications, national procurement
Experimental procurement	Experimental (lead) user	The most innovative solution	Radical	Market uncertainty, difficult user-producer communication, insufficient incentives (*e.g.* IP protection)	Regional specifications, national procurement

Source: OECD, adapted from Uyarra and Flanagan (2010).

From a more technical point of view, two main categories of public procurement aimed at fostering innovation exist:

- Public Procurement of innovative products and services;
- Public Procurement of R&D services (also labelled Pre-Commercial Procurement, PCP).

Public procurement of innovation occurs when a public agency approves an order for a product or system that does not already existing but that can be designed and produced in a reasonable time. This requires the development of new or improved technology to meet the requirements specified by the purchaser (Edquist and Homma, 1999).

Pre-Commercial Procurement (PCP) is besides described as "an approach to procuring R&D services other than those where the benefits accrue exclusively to the contracting authority for its use in the conduct of its own affairs, on condition that the service provided is wholly remunerated by the contracting authority". Moreover, in PCP the scope is R&D services only, it applies a risk-benefit sharing between authorities and industry and excludes State aid (European Commission COM (2007) 799 final).

As suggested by Edler (2011), several differences under key dimensions can be identified between general innovation procurement and PCP schemes (Figure 2).

Figure 2 – Innovation Procurement vs Pre-Commercial Procurement : a comparison

Dimension	General innovation procurement	Pre-Commercial Procurement
Budget	Regular budget of public body	Dedicated budget for PCP
Buyer function	Buyer normally is user (sometimes mediated through framework contracts, centralised providers)	PCP in Europe: dedicated agencies on behalf of potential users (principal) US: dedicated budgets within mission oriented departments
What is bought	Works, good or service	New knowledge, principles, solution, prototype
Innovation effect	Innovation is bought, benefit of buyer and potentially spill over effect of markets	Innovation may not be bought (but knowledge still produced, potentially spill over effects)
Innovation scope	Both incremental and more radical	Tends to be more radical innovation
Expertise (market / technology, process)	With buyer, but often functionally separated from actual purchase internally	PCP in Europe: Market / technology expertise with principal which is potentially de-linked from PCP agency US: Market / technology expertise with buyer and process organiser
Procedure	Normal procurement cycle, some negotiated procedures/technical dialogue	Multi-step procedure, complex

Source: Edler (2011)

A relevant trade-off

Indeed, procurement strategies, approaches and procedures adopted by Public Administrations have several effects, both in the short and mid run, on competition, market structure and market efficiency, of course depending on some key features of the downstream markets.

As suggested by Albano and Sparro (2010), one of the most relevant choices relates with the degree of centralization of the public purchases. While aggregating demand may not only contribute to rationalize both direct and transaction costs, also by exploiting economies of scale, but also to increase the bargaining power of the Public Administration, therefore leading, ceteris paribus, to increased quality of the offer and lower prices, further factors have to be considered.

With respect to the impact on the market structure, a centralized strategy, implying sizeable contracts and therefore more stringent economic requirements, may widen entry barriers for SMEs. More than this, the risk of buyer's lock in may increase. Splitting contracts into lots and/or reducing constraints for

joint bidding could however represent an interesting solution allowing to mitigate the potential risks of demand aggregation.

Implementation level

According to the European Commission ("Public procurement indicators", 2010) the amount of public purchases accounted for 17,23% of GDP in the EU in 2008 (the same indicator reached 14,9% in Spain, 141% in Italy and 17,4% in Portugal). Assuming as one of the main purposes of Public procurement the one to provide solutions to public administrations that allows better services to citizens, this short-term objective may well coexist with additional strategic purposes such as increased productivity, employment growth, environmental sustainability and energy efficiency. To provide an example, according to the Gartner Group, 65% of spending on eGovernment in the EU was focused on maintaining the infrastructure installed, and an additional 30% was spent on improvements of existing standards, corresponding 5% remaining technologically innovative projects in 2003.

Some further interesting figures are highlighted in the most recent Innobarometer "Innovation in Public Administration" (European Commission, 2010), within a survey conducted amongst 3963 Public Administrations in Europe. Innobarometer singled out a few procurement areas that typically or at least potentially involve an aspect of innovation, and asked managers whether or not their organisation has published a public tender for private contractors in any of these areas since January 2008. The list of the tested services were:

- ICT equipment or systems;
- Technologies or services to improve environmental or energy performance;
- Other types of technology;
- Consulting to recommend, design or pilot test new or improved services;
- R&D for new technologies and services;
- Provide one or more services to your users

As reported in Figure 3, 72,2% of the organisations have published tenders focussed on potentially innovative solutions in 2008. The higher rates concern some key sectors such as Housing (76,7%), Environment (76,2%), Health (73,4%) and Social Services (73,4%).

Figure 3 - Publishing tenders to support potentially innovative solutions, % by organisational background (2008)

	Total N	% Have published a tender	% Have not published a tender
EU27	3963	72.2	27.8
SIZE			
10-49 employees	2121	62.9	37.1
50-249 employees	961	77.2	22.8
250+ employees	864	89.4	10.6
TYPE OF ORGANISATION			
Government organisation	3581	72.2	27.8
Independent organisation	225	69.6	30.4
Private company	56	68.2	31.8
GEOGRAPHIC AREA			
Local	3132	71.5	28.5
Regional	584	74.7	25.3
National	243	75.8	24.2

Source: Innobarometer 2010, European Commission

Critical issues

According to OECD ("Demand-side innovation policies", 2011) several key critical points have to be addressed in order to enhance Public Procurement of innovation and its role with respect to technological competitiveness and response to societal issues, among which:

- the need for balance and coherence between the generic goal of Public Procurement (purchasing quality products and services for the public sector) and its potential secondary goal, i.e. support for research and innovation in the public and private sectors;
- the aim to overcome the fragmentation of public demand (often between different levels of government), which can limit potential scale effects for innovative procurement;
- the definition of the markets and technological fields to be tackled;
- the potential distortion of competition raised by excluding foreign technology providers from domestic markets.

Public Procurement in the EU

Legislation

As a general rule, public contracts in the European Union are subject to the agreements undersigned within the World Trade Organization (WTO), to the Treaties of the European Community and to the European Directives on the subject.

The *Agreement on Government Procurement* (GPA), in force since 1st January 1996, binding for all WTO State members, is a multilateral agreement aimed at assuring fair competition between suppliers by promoting key conditions such as transparency, non-discrimination and openness. In particular, with respect to national treatment and non-discrimination principles, the GPA (Article III, paragraph 2) states, among other provisions, as follows: "*With respect to all laws, regulations, procedures and practices regarding government procurement covered by this Agreement, each Party shall ensure: (a) that its entities shall not treat a locally-established supplier less favourably than another locally-established supplier on the basis of degree of foreign affiliation or ownership; and (b) that its entities shall not discriminate against locally-established suppliers on the basis of the country of production of the good or service being supplied, provided that the country of production is a Party to the Agreement in accordance with the provisions of Article IV*".

At European level, the legislation in force concerning Public Procurement consists of two Directives, namely:

- the *Directive 2004/17/EC* of European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors- L 134/1;
- the *Directive 2004/18/EC* of European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts.

Both the Directives introduce new policy tools aimed at promoting new models in the Public Procurement domains, leaving to the State members the task to implement them, also setting important conditions for a pan-European Public Procurement framework grounded on ICT platforms (electronic bids, dynamic purchasing systems). Among the innovation-oriented Public Procurement measures contained in the Directives, it is worth to mention:

- the *Competitive Dialogue* procedures, to be used in case of "*particularly complex contracts (…) where contracting authorities consider that the use of the open or restricted procedure will not allow the award of the contract*", (Directive 2004/18/EC, Article 29, paragraph 1). The competitive dialogue is furthermore described as a "*dialogue the aim of which shall be to identify and define the means best suited to satisfying their needs. They may discuss all aspects of the contract with the chosen candidates during this dialogue. During the dialogue, contracting authorities shall ensure equality of treatment among all tenderers. In particular, they shall not provide information in a discriminatory manner which may give some tenderers an advantage over others. Contracting authorities may not reveal to the other participants solutions proposed or other confidential information communicated by a candidate participating in the dialogue without his/her agreement*" (Directive 2004/18/EC, Article 29, paragraph 3);

- the updated definition of *technical specifications*, which not only encompass quality standards, but also *performance-based requirements*, in order to better meet the purposes of the tender, leaving to suppliers a reasonable degree of autonomy in designing the most appropriate solution: "*Without prejudice to legally binding national technical rules, to the extent that they are compatible with Community law, the technical specifications shall be formulated (a) either by reference to technical specifications (…); (b) or in terms of performance or functional requirements; the latter may include environmental characteristics. (…); (c) or in terms of performance or functional requirements (…)as a means of presuming conformity with such performance or functional requirements (…);(d) or by referring to the specifications mentioned in subparagraph (a) for certain characteristics, and by referring to the performance or functional requirements mentioned in subparagraph (b) for other characteristics*" (Directive 2004/17/EC, Article 34, paragraph 3). The manner in which the technical specifications are drawn up determine the variety and quality of the offers. Therefore, it appears crucial for contracting authorities to concentrate on performance-based requirements (instead of pure technical requirements), in order to leave open means by which suppliers can prove they have achieved desired results.

- the possibility to set *framework agreements* allowing contracting authorities to require technological modifications without calling a new tender. "*Contracts based on framework agreements concluded with several economic operators may be awarded either: – by application of the terms laid down in the framework agreement without reopening competition, or – where not all the terms are laid down in the framework agreement, when the parties are again in competition on the basis of the same and, if necessary, more precisely formulated terms, and, where appropriate, other terms referred to in the specifications of the framework agreement*" Directive 2004/18/EC, Article 32, paragraph 4);

As summarized in the *Wilkinson Report* (European Commission, 2005), the main opportunities brought by the European directives for Public Procurement comprise:

- facilitation of critical elements of dialogue between contracting authorities and suppliers by the means of negotiated procedures;
- references to standards and broadest definition of technical specifications, encompassing also performance-based requirements;
- the option for the suppliers to submit variants;
- improved conditions to allow IPRs management and their transfer to the supplier.

More recently, the *Directive 2009/33/EC* of European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles seems to have relevant implications on Green Public Procurement, by binding authorities purchasing vehicles for public transport to include among its criteria and requirements the costs related with energetic consumption and CO2 and other polluting emissions within their entire life-cycle.

Recent policy trends

Currently, public procurement is part of the set of policy tools promoted within the *Lead Market Initiative* (LMI), a European policy for 6 important sectors (e-Health, sustainable construction, protective textiles, bio-based products, recycling and renewable energies) that are supported by actions to lower barriers to bring new products or services onto the market. LMI grounds its deployment on a

mix of supply-side measures, such as e.g. R&D financing and equity support, and demand-side measures, such as regulation, standardisation processes and public procurement.

With respect to the latter, the EC is committed into fostering sector specific networks of contracting authorities to foster demand for innovation. This includes financial support to procurers to collaborate on (i) building networks and exchanges of information and practice; (ii) improving their knowledge about innovative solutions available in the market, "the intelligent customer"; (iii) interacting with suppliers and markets about future needs, "more investments, better suppliers; (iv) developing procurement strategies, "economies of scale, scope, risk sharing and possible joint actions.

The existing procurement networks, operational since 2009, are described in the following table:

Figure 4 - European Procurement Networks

Name	Participants	Main objective	First achievements
SCI-Network *Sustainable Construction & Innovation through Procurement*	European Secretariat ICLEI (DE), Transport for London TFL (UK), City of Torino (IT), Department for Environment, Food and Rural Affairs (UK), Dutch National Procurer Association PIANOo (NL), Culminatum, Helsinki Region Centre of Expertise (FI), University of Klagenfurt (AT), Motiva, National Agency for Energy Efficiency and Renewable Energy (FI)	To help public authorities exploit and drive sustainable innovations in public construction and regeneration projects across Europe by bringing a large group of public authorities together with other key stakeholders in the construction sector with the aim to help combat the cross-border fragmentation of the sector.	120 organisations participating in the pilot phase; Online Forum of 5 Working Groups: application of environmental standards in renovation; new technical solutions; procuring innovation; whole-life costing; financing & contracting
ENPROTEX	Firebuy (UK), Belgian Ministry of the Interior IBZ (BE), Dutch national Disaster Response Agency LFR (NL)	To spark innovation through public procurement to meet future needs of fire services using a number of methodologies including; establishing and sustaining a specialised platform of European Network of Public Procurement Organisations; developing cooperation among public procurers; providing an interface with both end-users and manufacturers.	A web-portal for public procurers and SMEs; Innovation mapping in textile research on protective clothing; Providing industry with forward commitments to meet future needs of procurers; A Personal Protective Equipment public procurers network (under development).
LCB-HealthCare	Department for Business, Innovation and Skills BIS (UK), Netherlands Organisation for Applied Scientific Research TNO (NL), Norwegian Directorate for Health Affaires(NO), Cracow Rydygier Hospital (PL), Department of Health DH (UK), European Health Property Network EuHPN (NL)	To stimulate innovative low-carbon building solutions for the healthcare sector. A platform for a network of public procurement stakeholders that wish to be proactive in stimulating innovative low-carbon building solutions for the healthcare sector will be created.	Stakeholders' consultations; Survey on barriers to investment in low carbon solutions; European state-of-the-art report.

Beyond LMI, the policy environment is indeed further developing at EU level, with the aim to strengthen the role public procurement as a driver for innovation.

The recently adopted EC Communication COM (2010) 546 final on the "Europe 2020 Flagship: Innovation Union" to strengthen Public Procurement as a driver for innovation in Europe, notably through action number 17: "*Member States and regions should set aside dedicated budgets for pre-commercial procurement and public procurement of innovative products and services. (…) The Commission will provide guidance and set up a (financial) support mechanism to help contracting*

authorities to implement these procurements in a non-discriminatory and open manner, to pool demand, to draw up common specifications, and to promote SME access. (…)In addition, the Commission will offer guidance on implementing joint procurements between contracting entities (…)."

Moreover, quoting the European Council conclusions of February 4th, 2011, "*the Commission is invited to: provide guidance on the application of the Directives on public procurement; more generally public procurement should be better geared to creating greater demand for innovative goods and services" (nr. 20) and "the Commission is invited to present proposals by the end of 2011: (…) and for assessing how best to meet the needs of fast growing innovative companies through a market-based approach. In this connection the Commission is also invited to explore the feasibility of a Small Business Innovation Research Scheme*" (nr. 22).

Besides Pre-Commercial Procurement (PCP), the implementation of effective First Commercial Procurement (FCP) procedures is currently perceived as crucial. The former encompasses the phases of exploratory research, solution design, prototype development and pre-commercial small scale product/service development (including field test), while the latter focuses on the first wave of commercialisation and diffusion of products, services or processes.

The most appropriate financial schemes to support PCP and FCP are therefore under study. A call for proposals within the Competitiveness and Innovation framework Programme for networking and procurement preparation, granting also a portion of the procurement expenditure has been released (closing September 2011). Eligible public bodies encompass public purchasers, i.e. contracting authorities in the meaning of the public procurement directives at all levels (local, regional, national and supra-national) including utilities and public authorities (e.g. innovation agencies, specialized platforms and/or cluster organisations). The included domains are related with European societal challenges, such as smart cities and mobility, sustainable construction, raw materials and sustainable agriculture.

Interesting to mention, the STEPPIN project (acronym for Standards in European Public Procurement lead to INnovation) has led to release a Handbook of policy guidelines on the subject. The publication covers crucial points such as the role of standards when purchasing innovative goods in all procurement stages (before, during and after),

The *Green Paper* on the modernisation of EU public procurement policy released by the European Commission in 2011 in order to discuss the directives in force also underlines the key role of demand-side policies within the Europe 2020 strategy, the latter stressing that public procurement policy must ensure the most efficient use of public funds and that procurement markets must be kept open EU wide. The *Green Paper* envisages improvements in the following domains:

- new tools for contracting authorities in order to further modernise procedures (taking also into account the different size levels of those authorities), horizontal cooperation (public vs public) and aggregation of demand (joint procurement);

- the creation of a true pan-European public procurement market through a better access for SMEs and enhancement of downstream competition;

- the strategic use of public procurement in response to emerging societal and economic challenges and the role of public procurement as a driver for innovation, also by requesting the development of products or services that are not yet available on the market (PCP).

National frameworks

Italy

In Italy, Public procurement activities encompass the purchases of the central Government and the ones by local administrations (Regions and other local authorities), the former accounting for around 23% of the overall expenditure (source: Istat, 2006).

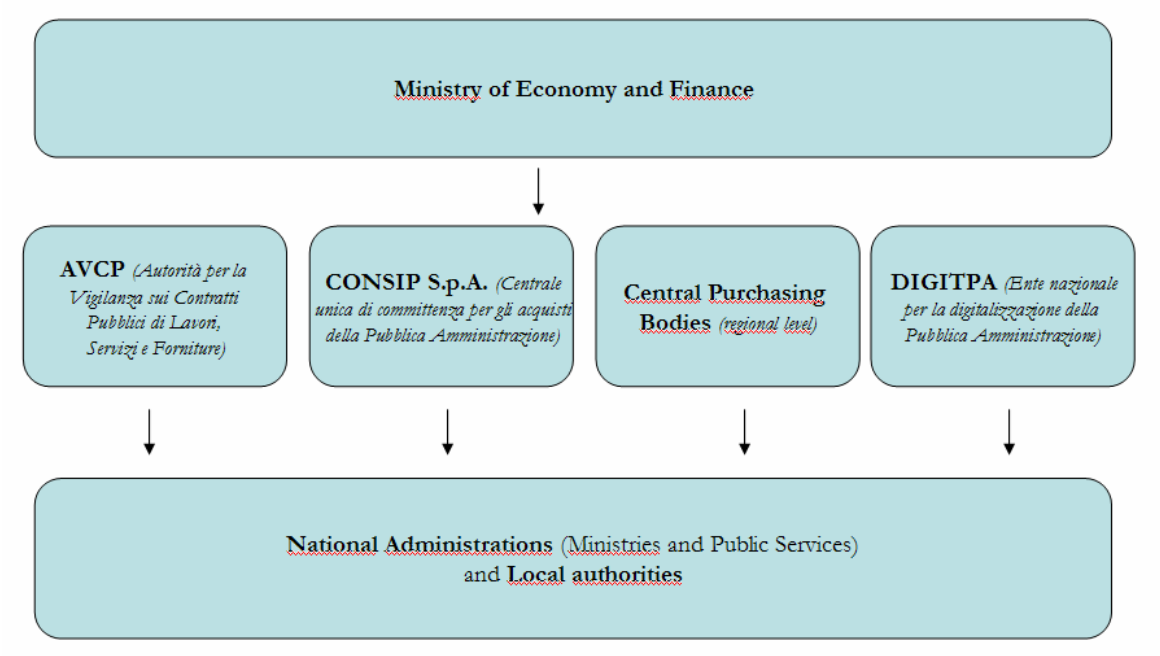
A key actor of the Public Procurement process is **Consip**, a stock company entirely owned by the Ministry of the Economy and Finance (MEF). Consip's activity is deployed along two principal business lines: (i) management and development of information technology systems on behalf of the Ministry of the Economy and Finance (MEF), providing project, technical and organizational know-how; (ii) implementation of the Program for the Rationalization of Public Expenditure in Goods and Services through the use of information technology and innovative purchasing tools. CONSIP therefore directly manages public purchases (around 9% of the public expenditure for goods and services in 2010) CONSIP furthermore awards frameworks contracts (labelled as "convenzioni" in the 2000 Italian Budget Law) and establishes agreements with Regions and other local authorities in order to implement the so-called "network system" aiming at undertaking joint projects and/or common procurement strategies. Besides, prices, terms and conditions set by law CONSIP's framework contracts and agreements provide benchmark price/quality parameters for purchases made outside of those framework contracts.

The **Authority for the Supervision of Public Contracts** (AVCP in the Italian acronym) has been established by law n. 109/1994 with the aim of supervising public contracts in order to grant compliance with principles of transparency, rightfulness and competition among operators in the public procurement market. The Authority supervises the entire public procurement system, both at a State and at a Regional level, in order to grant compliance with the principles of rightfulness and transparency in awarding procedures and with effective and convenient execution of contracts, as well as compliance with competitions rules within each single tender. In particular it supervises the correct application of laws and regulations, while verifying the regularity of awarding procedures and the economic efficiency in contracts execution, also through sample surveys; it also ensures that any injury does not occur for the exchequer. Through its Public procurement Observatory, the Authority ensures the collection and processing of data on public procurement, in order to provide indications for the supervising departments and to address the regulating activity towards rules of transparency, simplification and competition.

DigitPA, the Italian authority for the digitization of Public Administration, is as well worth to be mentioned with respect to Public procurement, since it defines technological standards, specific regulations and deploys monitoring activities concerning the use of ICT within the Public Administration.

The general configuration of the Italian Public procurement system is reported in Figure 5.

Figure 5 – Italian Public Procurement framework



Source: Istituto nazionale per il Commercio Estero (2010), our elaboration

According to the 2007 Budget Law (Legge Finanziaria), all public purchases of goods and services under a given threshold (corresponding to the one definend by the EC, i.e. 125'000 € for the central Government and 193'000 € for the other authorities) have to be achieved through the **electronic marketplace**. The Public Administration Electronic Market (MePA) is a digital marketplace in which registered authorities can make purchases for values below the European threshold of the goods and services offered by suppliers that have been vetted and authorized to post their catalogues on the system. CONSIP identifies through its calls for tender the goods and services categories and the general delivery conditions of the products, manages the authorization of suppliers and the publication and updating of their catalogues. Navigating through the product catalogue, the registered authorities may verify the offer of goods and/or services and purchase online, comparing the offers submitted by various suppliers and choosing the one that best suits their needs. MePA allows time savings and transparency and enables Public Administrations to meet specific requirements through a broad a varied offer. On the supplier's side, the Electronic Marketplace represents an opportunity to spread the offer in the whole national territory and to increase competitiveness.

In more general terms, the e-**procurement** procedure implementation plays a crucial role in increasing the efficiency of the public purchases, by shifting the main phases of the buying cycle, such the expression of interest and needs, the submission of bids, the competition between providers, the final award and the execution of payments, into ICT tools. This provides benefits in terms of reduction of the overall needed time, streamlining of the procedures, increased interoperability between databases and facilitation of the expenditure monitoring. Moreover, the electronic purchasing systems foster downstream competition by lowering entry barriers for potential providers, especially SMEs (typically underprivileged due to scale factors and the lack dedicated resources) and enhance innovation by encouraging the development of new technologies in the ICT domain.

E-procurement policy support started in Italy in 2000 (Budget Law), namely with the Program for the rationalization of public spending for purchases of goods and services, implemented by CONSIP. In 2001, the Ministry of Economy and Finance acquired the right to promote aggregations between authorities in order to carry out joint purchases. In 2002, the right was extended to local authorities (with the obligation to adhere to the same pricing regimes in case of autonomous purchases). Since 2007 (Budget Law) national and peripheral government authorities have to carry out purchases not overcoming the aforementioned threshold via the Electronic Marketplace. The 2007 Budget Law has besides defined a network system within which regional authorities have to operate jointly by coordinating their rationalising procedures and sharing the same e-procurement models (a national portal www.acquistinretepa.it was released with this purpose, together with some regional portals).

Italian Public administration can rely on complementary tools for electronic procurement. In fact, all procedures can rely on such complementary tools(including the Framework Agreements):

- the *Electronic Marketplace of the Public Administration* (**MePA** in the Italian acronym), mandatory (only for central Governement) for all purchases below the aforementioned thresholds. Around 230 million Euros of public purchases have been carried out through this system in 2009;
- the *Dynamic Purchasing System* (**Sistema Dinamico di Acquisizione** – SDA in Italian), that can be used for all purchases that overcome the aforementioned thresholds for standardised and widely used goods;
- *e-Shops* (**Negozi elettronici** in Italian), that are on-line purchases directly from Framework Agreements with fixed terms concluded by Consip SpA with one single economic operator (so called Convenzioni in Italian);
- *e-Tenders* run by Consip on behalf of other public authorities (**Gare su delega** in Italian) for specific needs.

With respect to innovation-oriented Public procurement, two models may be used (both defined within the *Codice degli Appalti Pubblici*, D.Lgs 163/2006, consistently with the European directives):

- the *Competitive Dialogue* (**DC** in the Italian acronym);
- the *Public-Private Partnership* (**PPP**).

The former consists in a proper negotiation between the public purchaser and the potential providers concerning economic, financial and technical features of the goods and services purchased. The biggest critical point of the competitive dialogue procedure may be the lack of real incentives for companies to participate in the process and invest to make an offer technologically viable for the PA contractor. In fact, the economic risk to participate without guarantees for the award can be a deterrent for businesses.

By the means of PPP, Government is able to select private partners that can contribute to the financing of a highly-innovative project, whose economic and financial features are already known by the Public administration. In that sense, PPP falls under the broader category of Project Financing initiatives, including contracts for at least one of the following activities: design, construction, operation or maintenance of public works or public utilities, provision of services, each including an efficient risk allocation between public and private operators.

The underlying idea of PPP is that encouraging the bundling of all tasks of a complex project encompassing sequential stages to one single operator can lead to optimal results, both in terms of overall efficiency and incorporated innovation. More than this, avoiding the Public administration to describe in detail ex-ante all technical features of the project leads to fewer constrains for the private

operators in terms of design of the best possible solution. Finally, in a PPP framework, private operators have to ensure increased accountability.

At local level, outcomes of innovation-oriented Public procurement are still heterogeneous and not comparable, mainly because of a lack of coordination between actors. Generally speaking, the most frequent model is to replicate di national approach by centralizing purchases at regional level. This is the main reason why trends of Public purchases of innovative goods and services – e.g. procurement of green technologies – mainly depend on specific orientations by local administrators.

Green Public Procurement (GPP) is indeed one of the most promising domains of action, as identified e.g. by the Green Public Procurement Communication of the European Commission (2008). Again, the implication is at least twofold: GPP promotes the adoption of more sustainable processes, therefore addressing a key societal challenge as the environment preservation; at the same time, it enhances the growth of emerging technological sectors such as the so-called green technologies. Evidence shows that its implementation suffered from a lack of coordination in Italy, with no dedicated institutional framework. However, local administrations are putting in practice interesting initiatives in the GPP field. The "Piano d'azione nazionale per la sostenibilità ambientale dei consumi nel settore della pubblica amministrazione" (Action plan for the environmental sustainability of consumptions of the Public Administration), approved in 2008, provides for taking into account environmental issues within the purchasing system of the public sector, with the objective to reach 50% of "green" purchases in 2010. In 2009, the Ministry of the Environment has adopted the "Minimum environmental criteria" with respect to the purchases of specifici goods (e.g. paper, textiles) by the public sector. The Ministry of Economic Development is supporting too the adoption of GPP-related initiatives in the local administrations. A call was promoted in 2010 within the Inter-regional Operative Programme (POI), aimed at funding installation of facilities for energy production based on renewables in the public buildings of the Italian "convergence" regions.

With respect to policy tools, the **Industria 2015** programme, launched in 2006 by the Ministry of Economic Development, frames out some key competitiveness objectives for the future of the Italian productive system. Among the main initiatives carried out within Industria 2015, the Industrial Innovation Projects (PII in the Italian acronym) are aimed at fostering the innovative growth (i.e. new technology-based products and services) of strategic fields such as energy efficiency, sustainable mobility, life sciences, Made in Italy and cultural heritage. The PII framework not only encompasses supply-side tools (though in large majority), but also demand-side support such as contracts and the involvement of public authorities as end-users of new technologies.

Spain

During the recent years, important pieces of legislation have been issued in order to promote Public Procurement for innovation. In particular, it seems worth to mention the following.

- The **Law 30/2007**, regulating Public Sector Contracts, which concretely sustained Public Administration in overcoming some key obstacles with respect to the purchase of innovative products and services. such as:
    - the focus on functional aspects of the good / service purchase (Article 101.3) based on performance requirements, with a reduced importance of the purely technical prescriptions;

- the acknowledgement of technical variations proposed by the supplier in order to better comply with the tender specifications (Article 131);
- award of the contract via negotiated procedures (Articles 153 to 162 included) and introduction of the Competitive Dialogue scheme (Articles 163 to 167 included);
- multi-criteria evaluation of the offers (Article 134), especially with respect to complex and technologically advanced products or services;

This Act not only adopts the contents of the aforementioned European Directives on the subject, but also provides public bodies with new contracting instruments supporting purchase of innovative goods and services:

- the new form of agreements between the Public Sectors and private players focused on the supply of technologically advanced products and services overcoming the current solutions available in the marketplace (Article 11c); amongst the other provisions, the clauses of such contracts allow (i) a more detailed risk allocation between the tenderer and the supplier(s); (ii) the conditions under which the Public Administration can unilaterally amend the contract in case of emerging / unforeseen requirements;

- The **Sustainable Economy Act** (2011), which include some interesting provisions promoting public purchases of innovation, namely specific measures aimed at fostering the efficiency of Public Procurement and financing public-private partnerships for key technological applications (also by dedicating a specific budget), with special attention to the needs of Small and Medium Enterprises.

Moreover, the Spanish Parliament approved in May 12th a Bill on Science, Technology and Innovation, Law 14/2011, of June 1st on Science, Technology and Innovation, which also includes some prescriptions on public purchases, inviting Regions and Local Administrations to elaborate a plan detailing its Pre-Commercial Public Procurement strategy.

The Spanish **Innovation Strategy** (E2I), adopted in July 2010, provides the framework actions in support of Innovation, mainly, through the promotion and creation of structures that enhance the use of scientific knowledge and emerging technologies. The Innovation Strategy encompasses five axes, namely: (i) the use of Public Procurement as a driver for innovation; (ii) the promotion of an innovation-friendly ecosystem; (iii) the support to the international dimension of innovation; (iv) the strengthening of regional cooperation; (v) the role of human capital in the innovation processes.

Besides, four key domains have been identified as crucial: Healthcare and social services; Green technologies and clean energy; Scientific facilities (both tangible and intangible); Modernization of the Public Administration (including E-gov). Interesting to notice, all the previously mentioned fields of action encompass the Information and Communication Technologies as strategic enablers.

More directly related with Public Procurement of technology, the Spanish Government charged the Ministry to Science and Innovation to:

- determine the goods and services to be purchased within the formula of innovative Public Procurement;
- design the more adequate mechanisms for its effective deployment;
- define a road map of the foreseen initiatives in the different Ministries in order to advertise it them to potential suppliers;

- determine the annual budget devoted to Public Procurement of innovation;
- support pilot projects for Public Procurement of innovation in the framework of a Science - Industry cooperation, involving public research institutions, universities and technology clusters.

Finally, four key set of instruments are being conceived by the Spanish Public Administration in order to enhance the role of Public Procurement as a driver for innovation:

1) A **fast track** aimed at to identify the best PP / PCP opportunities, provide technical support to contracting authorities and encourage the purchase of technological goods or services;

2) Budget allocation to **Pre-Commercial Procurement**;

3) Funding to the **R&D stage** embodied in technological advanced goods or services purchased by Public Administrations.

4) A new program named "Innocompra", directed to support Public Procurement of innovation in the different Spanish Regions or Autonomous Communities, based on ERDF technological funds. Of these funds, there are still approximately 300 million euros to be instrumentalized in regions such as Galicia, Andalucía, Castilla-La Mancha and Extremadura

Portugal

According to the most recent published statistics relating to the government budget (Central Government, Regional and Local Governments and Social Security), in 2010 public sector purchases of goods and services in Portugal have reached 14.515 billion Euros including 8.858 billion Euros in consumption of goods and services and 5.657 billion Euros in capital goods. These sums respectively represent 5,1% and 3,3% of GDP.

If the purchases of goods and services on the part of public sector companies are added, even though consolidated information is lacking, the total will be close to the EU average, calculated as 17% of GDP (2009 figures).

Mostly concerned with matters of efficiency (reduction of expenditure by the large-scale purchase of goods and services), in 2007 the Portuguese government created a National Public Sector Purchasing System (SNCP) which all Central Government services were obliged to join. The adhesion of Regional and Local Government, State Companies (including those of Local governments) and other public bodies is not obligatory but may be made voluntarily.

A fundamental aspect of the system is that it only covers the so-called "cross-department public expenditure in goods and services" - goods and services purchased by practically all Ministries, not including services specific to the activities of each Ministry. For example defence equipment and other armed forces purchases, goods and services specifically for the health and education departments and transport material continue to be the exclusive responsibility of the respective Ministries and outside the scope of the SNCP.

The total annual purchase of goods and services covered by the SNCP is estimated at 1.250 million Euros or just under 10% of total government purchasing (excluding the company sector).

The creation of the SNCP covered three main objectives:

- Contributing towards the balancing of the public accounts, rationalising and reducing public expenditure;
- Contributing towards the modernisation and the efficiency of government departments;
- Promoting competition between suppliers in conditions of transparency, equality and competitiveness.

The central and most innovative aspect of the SNCP implemented by the Portuguese Government is the National Public Purchasing Agency (ANCP), a Public sector company created in February 2007. It has responsibility for implementing some of the main guiding principles of the SNCP, mostly:

- Entering into framework agreements or other public contracts, gradually and by stages, for groups of categories of goods and services;
- Adopting electronic purchasing tools with electronic catalogue and automatic ordering functionalities;
- Adopting electronic purchasing practises based on the action of buyers and specialists in order to reduce costs for the government;
- Adopting practices and preference for the purchase of goods and services which promote environmental protection;

At the end of its fourth year, in December 2010, the ANCP had entered into 15 framework agreements by which suppliers are vetted prior to the sale of goods and services to the government. The framework agreements establish the requirements and conditions which vetted suppliers are required to fulfill in terms of pricing, delivery dates, levels and quality of service in a public supply contract.

Subsequent purchasing procedures (organised by the decentralised services, the ministries and, in a more centralised way, by the ANCP itself) are directed towards these vetted suppliers which once again puts them in competition with one another.

The 15 existing framework agreements cover purchases of 1 billion euros equal to 80% of total cross-department public expenditure in goods and services. 70% of the 385 bidders have been qualified; 183 (68%) of the 269 qualified suppliers are SME. At the moment, almost 2.000 public bodies are involved in the system, 400 of them on a voluntary basis.

Portuguese Government saved 16% in the total cost of goods and services bought through this system.

Fulfilling the objective of “adopting electronic tools”, one of the first competitions launched by the ANCP for a framework agreement with selected contractors was that relating to electronic contracting platforms. The competition ended in June 2009 having selected 5 platforms from different bidders, each of which incorporated the electronic catalogue and automated ordering functionalities.

This is possibly the most important result of the SNCP’s operations in Portugal along with the activities of the ANCP, having created an area of activity distinguished:

- by its contribution towards improving the efficiency of the entire public sector purchasing system by obliging public bodies using the platform not only to be informed about the suppliers’ catalogues but, what is most important, to execute the purchasing procedure using the electronic platform;

- by contributing to the improvement in the operations of all suppliers including a large number of SME;
- by the potential for leverage deriving from the possibility for suppliers to sell to other bodies outside of those linked to the SNCP or those voluntarily connected to it. This means having access to the many large, private purchasers in addition to the thousands of public bodies (regional and local government bodies, public companies etc.);
- by the potential for going international of the supplier companies using electronic business platforms.

Following a rapid expansion the five suppliers of electronic business platforms selected by the ANCP now deal with an annual turnover of the order of 12 billion euros (twelve times the annual volume of purchases of goods and services by central government covered by the 15 framework agreements negotiated by the ANCP).

The turnover of these five companies approaches 24 million euros (two thousandths of the turnover undertaken over their platforms which demonstrates their high level of operational efficiency from which are derived the low costs for users).

Much more important, today there are 50,000 companies using these platforms, an overwhelming majority being SME. This is more than 170 times the 269 selected companies under the framework agreements with the ANCP and more than 250 times the number of SME selected under the same framework agreements.

At least three of the five companies selected as suppliers of electronic business platforms now have an international presence having taken the first steps towards entering the globalised market.

In those cases where this is the business model adopted (a single electronic business platform which all customers use and to which all of their suppliers are subscribers), the volume of business opportunities for supplier companies has grown exponentially. The same can be said of the number of potential suppliers able to respond to customer orders when the platform becomes international.

As it may appear simple to conclude, the success of the system referred to above resides much more in the modernisation which purchasers (both public and private) and supplier companies are obliged to undertake, and in the improvement in processes of all of these bodies than in the capacity for promoting the appearance on the market of new, innovative goods and services. Electronic business platforms themselves are the main exception.

Concerning Ecological Purchasing, priority has been given to combating climate change with the objective of turning the Portuguese government's activities more neutral in relation to the emission of greenhouse gases. A Counsel of Minister´s Resolution in the year 2007 decided that at least 15%, 30% and 50% of the contracting procedures and the value of the subsequent purchases through SNCP should fulfill environmental criteria in 2008, 2009 and 2010 respectively.

In 2010, 79% of the purchasing procedures effected under the framework agreements entered into by the ANCP included some kind of environmental requirement. Goods and services such as the licensing of software, computer equipment, paper, stores and printing services were the categories most frequently covered by this kind of requirement. Electrical vehicles (cars and motorcycles) must be included in the small group of goods that these environmental requirements have developed in Portugal.

Innovation-oriented Public Procurement: the way forward

The main challenges

The analysis of the European, Italian, Spanish and Portuguese frameworks with respect to Public Procurement allowed us to highlight some important points:

- The increasing attention devoted to demand-side Innovation policy and to the use of Public Procurement as a driver for Innovation in particular. The current European legislation – adopted, even with different features in Italy, Spain and Portugal – strongly promotes such approach. Still, some improvements (mostly at a technical level) need to be implemented.

- The portion of GDP related with public purchases is close to the EU average both in Italy and Spain. This means that the Mediterranean area of Europe can benefit from the use of a (even low) share of this amount to purchase innovative goods or services with a positive impact comparable with the other European zones.

- The need to balance the contribution by relevant players that hold a strong technological leadership with the participation of SMEs to public tenders. From this point of view, as already mentioned, the approach to demand aggregation has to be carefully pursued so that entry barriers to SMEs do not become too wide. Splitting contracts in several lots, as applied in some cases in Italy, may represent an adequate line of action.

The implications of Public Procurement of technology with respect to innovation are therefore at least threefold: (i) it fosters the birth and/or the growth of **innovative markets**; (ii) it enhances the **efficiency** of the public sector; (iii) it contributes to tackle some key **societal challenges**.

With respect to (i), the role of the contracting authority acts as a lead purchaser and/or temporary monopsonist of a new set of innovative solutions produced by technology providers. Some peculiar challenges therefore emerge, such as the need to effectively specify the content of the public demand (with functional and/or performance-based metrics), to identify the best proposal among the applications and to carry out the monitoring of the process. Here, designing efficient risk-sharing models between contracting authority and suppliers is a key issue. Moreover, considering the features of the Mediterranean industrial environment (encompassing a very high share of SMEs), a trade-off between the aggregation of the demand – which has a close relationship with the decrease of the unit cost – and the opportunity for small and medium firms to apply for large contracts.

Concerning (ii), strong opportunities of improvements in the organisational efficiency of the public sector, both at central and peripheral level, come from the adoption of *e-government* procedures. Not only contracting authorities can manage all the stages of the purchase through ICT platforms, therefore reducing direct and transaction costs, but the set of tools falling under the *e-procurement* label is supposed to foster e.g. interoperability between datasets, in the framework of an increase in the openness of the public sector both within itself and towards firms and citizens. Indeed, the relationship between enhancement of public sector efficiency, procurement and innovation also involves how procurement of innovation, beyond the adoption of innovative procurement tool, may aim at modernizing most of the public sector activity.

As for (iii), technological innovation is traditionally a key driver to improve welfare and address emerging issues. In a broad set of cases, investments in technology are however characterized by high

fixed costs (mostly capital) and relatively low marginal costs (e.g. reproduction and/or management of an infrastructure). This framework may generate market failures, e.g. inefficient allocation (or even underprovision) of resources, which the public sector has the role to overcome. To this end, lead markets related with emerging challenges (such as e-Health and renewable energy), can be supported through public demand. The public effort furthermore has to be produced towards the identification of short-, mid- and long-term priorities within the emerging issues.

Policy recommendations

Following the main points emerged within the analysis carried out in the previous paragraphs, COTEC recognizes the importance of some key prescriptions in order to enhance the potential of Public Procurement as a driver for Innovation.

Some pre-conditions are indeed worth to be mentioned.

First of all, assuming that – together with its original role – Public Procurement belongs to the set of tools to be deployed by Governments in order to sustain Innovation and Technological change implies a tight relationship with the high-level Innovation strategy carried out at National and European level. A mid- and long-term Innovation agenda – taking into account the structure and composition of the economic systems, the most relevant societal challenges to be tackled and, more in general, the current and future economic and technological trends – certainly represents an essential guideline for more specific Innovation policies complementary with each other. It therefore seems vital, at national level, to define: (i) a hierarchy of market and societal priorities to be faced; (ii) a taxonomy of technological fields to be sustained as enablers of such developments; (iii) a roadmap that clearly identifies short-, mid- and long-term measurable objectives; (iv) the set of tools and resources to be committed.

Besides, some specific Public Procurement schemes – such as for instance the Competitive Dialogue – are still to be fully fine-tuned in order to reach their full potential, also with respect to the purchase of technologically advanced goods and services. This may involve further tests in selected fields, even at local level.

More in general, it seems important to remind that Public Administrations encompass several levels, characterized by a variable size, purchasing power and even contracting power of the authorities. Even if demand aggregation is at the centre of a key trade-off (shortly described in Section 1), small buyers can pursue less challenging innovation objectives, but still important, with a smart use of performance-based contracts.

With respect to the role of Public Procurement as a driver for innovation, COTEC promotes four policy recommendations.

I	**Improving the role of public-private partnerships** Considering both the information asymmetry between the Public Administrations and the private technology suppliers and the scarcity of financial resourced devoted to technological innovation of the former, the role of public-private partnership within the innovation-oriented Public Procurement framework needs to be strengthened. This approach, currently rather under-exploited, indeed allows: • to reach a **critical mass** of resources in order to carry out large-scale projects; • to exploit the **added-value** generated by public investments, which usually goes beyond the indirect positive externalities on the competitiveness of the private sector; • to efficiently keep the role of **technological leadership** of private stakeholders in key domains; • to trigger a **virtuous circle** within the public spending on innovation, the profits of which can be reinvested in new projects. In this framework, a new set of tools grounded on the **project financing** conceptual model needs to be envisaged, also by broadening the pool of involved stakeholders within the Public Procurement process (e.g. private equity operators). This also implies new models in the risk sharing between the contracting authority and the private suppliers, in particular involving **up-side leverage schemes** that allows the public sector to multiply the positive effects deriving from the success of the projects instead of having to cover eventual losses.
II	**Public Administrations acting as "intelligent purchasers"** The current frame of reference generates the need for the contracting authorities to provide themselves with reliable instruments in order to effectively address all stages of complex purchases, not limited to the general **planning** but also including a deep analysis of the product or service **life-cycle** with respect to the key framework conditions. At a high-level, the public sector should identify key innovation challenges to be addressed, mostly related with the emerging societal needs. In this respect, Public Procurement guidelines should be closely linked with the overall **innovation strategy** of our countries. At an operational level (authorities and public purchasers) the cost-benefits analysis should encompass new conceptual inputs such as (but not limited to) the most advanced **technology foresight** and technology scouting.
III	**Shifting from a functional-based assignment to a performance-based awarding** Traditional Public Procurement processes ground their decisions on functional-based analysis of the product or service to be purchased. Moreover, bids are designed to purchase the best solution at the minor possible cost. are However, especially in the case of complex technological goods, the most efficient process may be **non-linear** and iterative. **Competitive dialogue** is indeed an important tool in order to comply with such a feature. As pointed out also by the European directives on the subject, a performance-based evaluation allows not only to **overcome the information asymmetry** between purchaser and potential suppliers (the former may not be able to envisage all possible technological applications to a given issue), but also to **avoid technological bias** related with ready-for-use solutions.

IV	**Supporting enabling technologies** The "long tail" paradigm shows how the asymmetric distribution of information between supply and demand leads to a sub-optimal degree of differentiation of the former. The structural features of the Web significantly helped to tackle such market distortion. However, some basic enabling infrastructures, such as, for instance, broadband networks, are still not equally distributed within our countries, therefore highlighting a deep **digital divide** between different geographical areas. More generally, **ICT** is indeed an example of enabling technology, the availability of which is supposed to foster organizational improvements and creation of new innovative multi-sectoral applications. Public Procurement initiatives aimed at promoting a national "backbone", which enables connectivity at all levels, therefore appear as a priority.

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