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# R&D: ITALY AND POLAND COMPARED

**Abstract**

Innovation and R&D are primary policy factors when governments seek to address major societal challenges through state-level welfare initiatives, and are essential elements in balancing socio-economic development. It is for this reason that the European Union and the governments of its member states have launched a series of initiatives, such as the Lisbon strategy, the Europe 2020 Strategy, the Green Paper on Innovation, and the Action Plan for Innovation in Europe, to stimulate and support innovation and R&D. The article reviews the literature on the theory of innovation in terms of its impact on R&D and compares the development activity undertaken in this area in Poland and Italy. Underpinned by quantitative data and a SWOT analysis, it then presents a comparative analysis of these countries' research systems. The conclusion specifies policy initiatives that could be taken by Poland and Italy to encourage innovation-based R&D.

**Keywords:** research and development (R&D), research system, innovations, EU innovation policy, SWOT analysis.
**JEL Classification:** 030.

## 1. Introduction

As well as being an important process in modern societies, research and innovation is a primary factor for governments wishing to address major societal challenges through state-level welfare initiatives. But how does innovation arise? With a focus on both empirical and theoretical considerations, the paper seeks to understand how R&D policy networks are activated by analysing the Italian and Polish research systems and describing

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the various actors involved. The methodology combines desk research with a comparative analysis of the research systems of the two countries concerned.

The paper undertakes a thorough review of the research structure of Italy and Poland and places special emphasis on the role their governments and institutions play in innovation and economic growth. As it provides information that supports decision-making for strategies of economic development, R&D is one of the central issues of performance evaluation. It is for this reason that the analysis highlights the strengths and weaknesses of the Italian and Polish research systems from the perspective of the results that they achieve.

## 2. The Theoretical Background of R&D in the EU: A Brief Review of Innovation Theory and Important EU Documents

Onak-Szczepanik (2007) states that innovation management involves the constant search for new scientific findings and new ideas for producing new or improved materials, products, equipment, services, processes or methods intended for market or for other use (see also *Rola polskiej…* 2004). It should not be forgotten when we consider innovation in the economy, that a country's technological progress rests on three main actors: science, industry and government (Onak-Szczepanik 2007).

Stryjek (2015) points out that state-level measures to stimulate innovation involve providing businesses with relevant, broadly defined systemic conditions. In other words, innovation policy refers to the actions of central, regional or local state authorities in support of the creation, diffusion and use of innovation.

As Przychodzień (2013) notes, state innovation policy entails the conscious and purposeful action of public authorities in support of innovation in the economy. Its chief goal is to promote innovation and thereby make the economy more competitive. If successful, this will improve the quality and standard of living, signal the transition to a knowledge--based economy and promote cooperation between all market players (Ciok & Dobrowolska-Kaniewska 2009). Insofar as they encourage companies to invest their resources in innovation, the decisions taken by central and local government do much to create a favourable climate for investment. The important issues in this respect include infrastructure, the quality of the wider institutional order, the stability of legal norms, the ease and transparency of establishing and running businesses, the quality of human capital, the efficiency of public administration, and political stability

(North 1990, Witkowska 1996, Benacek et al. 2000, Djankov et al. 2002). The major instruments of innovation policy are legal, financial, institutional, infrastructural, structural and commercial (Dobrowolska-Kaniewska 2008).

The determinants of innovation include internal factors, such as human capital, experience, skills and accumulated knowledge (Klich 2016), and environmental factors, which either stimulate or inhibit innovation at SMEs (Batjargal 2007):

– initiatives and government projects (Hadjimanolis 1999),

– financial resources (Zhu, Sarkis & Lai 2011),

– cooperation between universities and companies (Veugelers & Cassiman 2005),

– changes in the market/dynamics (Martinez-Fernandez, Hinojosa & Miranda 2010).

Economists and scientists in Western Europe began to address state policy for the development of science and technology in the early 1980s, when the first books on the subjects appeared (Braun 1980, *Industrial Policy…* 1981, Rothwell 1986, Rothwell & Zegveld 1981, Stoneman 1987). As Jasiński (2013) observes, even if standardized terminology has yet to be adopted, significant advances have now been made in the worldwide literature on the subject. It should be noted in this connection that many authors use the terms "scientific and technical policy" and "innovation policy", interchangeably.

It will not surprise us to learn that there is no unanimity as to the understanding of the concepts themselves (Jasiński 2013). Edquist (1994), for example, selects separate categories of R&D and technology to write of innovation policy, while the account of Furman, Porter and Stern (2002) defines priority areas for the development of science and technology, determines the level of support for research activities from public sources, and specifies ways to protect intellectual property. Dodgson and Bessant (1996), for their part, distinguish between scientific policy and technology and innovation. The aim of the latter is to improve the ability of companies, industries and the economy to innovate, and to facilitate the transfer of innovations. With admirable brevity, the European Commission (*Creating…* 2006) describes its approach as support for the formation of innovation--friendly markets.

Gibbons (1994) understands innovation policy in terms of a two-phase policy for science, whose development and maturity will lead to a broad range of policies for technical innovation. The current emphasis is on innovation policy in the regions (EC 2006, OECD 2011).

Innovation policy began appearing in the documents of the European Union in the 1990s. The first steps were taken with the publication of the Green Paper on Innovation in 1995 and the issuing of the First Action Plan for Innovation in Europe in the following year (Gust-Bardon 2011). The Lisbon Strategy, which was adopted by the European Council in Lisbon in 2000, represented a milestone in the approach to innovation policy (Rossi 2007).

The Green Paper on Innovation became the platform for European innovation policy in the years that followed. It set out to identify the positive and negative factors influencing innovation in Europe and to formulate measures to increase the EU's innovative capacity. The challenges and issues are diagnosed in chapters II (The Challenges of Innovation), III (The Situation in Europe) and IV (Innovation in a Straight Jacket), while the remedies are set out in Chapter V (Routes of Actions). The remedies include (Gust-Bardon 2011):

– facilitating administrative procedures,
– promoting the benefits of innovation,
– improving the financing of innovation,
– encouraging innovation at SMEs,
– modernizing the innovation efforts of the public sector.

## 3. The Italian R&D System

In the countries of southern Europe, including Italy, Spain, Greece, Malta, Cyprus and Portugal, investment in research does not exceed 1%, universities are struggling, there are few graduates, production is specialized and centred on medium and low technology, welfare provision is uneven and social inequality persists. In short, it is an area that tends to diverge from the rest of Europe (Greco 2011).

Where the socialization of risk is concerned, the conservative/corporatist welfare model is characterized by a greater emphasis on families, intermediate associations and voluntary provision. The provision of services in countries regarded as operating this model is mainly based on the principle of subsidiarity, which means that the state intervenes only where the family's capacity to provide for its members is exhausted. Italy did not produce a social security system on the lines of the Beveridge plan, and thus did not emulate the progress made in the north west of Europe, because of a comparatively low level of industrial development, and owing to the economic difficulties of the post-war period. Furthermore, its political culture meant that there was no social democratic party, and no liberal

party worthy of the name. The ideological base and political focus were both absent. The victory of fascism brought down the curtain on an attempt to build a fair and universal welfare state. Even after 1945, Italy was not witness to the compromise between the working class and middle class that had added impetus to the evolution of the welfare state in the Scandinavian countries and Great Britain[1].

Italy will achieve its R&D target – albeit an unambitious one – if the current trend continues. Italy is a moderate innovator whose performance improved steadily up to 2012 before declining slightly in 2013. It was in the latter year that, nevertheless, the country reached a level of innovation of 80% compared to the EU as a whole. In the context of the Europe 2020 strategy, Italy set an R&D target of 1.53%, which was well below the EU average and insufficient to keep pace with the ever-shifting frontiers of technology in some sectors of its economy. In the aftermath of the 2008–09 financial crisis, austerity measures in countries such as Italy, Greece and Spain had a negative effect on research and may have jeopardised future generations of researchers. In that it reduced the public resources available, curtailed recruitment of new research personnel and introduced a drive to streamline the public sector, the economic crisis that broke out in 2008 had a radical impact on the response to the challenge to innovate. Table 1 presents a SWOT analysis for Italy.

Table 1. SWOT Analysis of Italy

| | Strengths | Weaknesses |
|---|---|---|
| Internal | – universities<br>– scientific co-publications<br>– collaboration between academia and industry<br>– women researchers<br>– mobility and international attractiveness | – low R&D intensity<br>– innovation performance<br>– low business R&D investment<br>– R&D expenditure inequality<br>– foreign investment |
| | Opportunities | Threats |
| External | – state aid<br>– investment incentives<br>– international collaboration<br>– attracting foreign researchers | – economic crisis<br>– very high public debt<br>– "brain drain" |

Source: authors' own elaboration.

[1] Italy had to postpone its democratization process until after the defeat of fascism. Thus it was not until 1948 that a truly democratic constitution appeared and civil and political rights, and social rights underpinned by welfare, were codified.

Let us address the strengths that arise from the SWOT analysis of Italy.

*Universities*. They are responsible for 31.3% of total, national R&D expenditure. This is greater than in the EU 27, where the average national proportion in 2009 was 23.68%. There are 89 universities in Italy, of which 54 are state universities (JOREP 2011a).

*Scientific co-publications*. Italy, which according to the SCImago Institution Rankings (SIR) publishes 3.4% of international scientific publications, always occupies fourth place among European countries. What is more, the country is the world leader in academic publications when the ratio of publications to researchers is taken into account. According to our calculations, which were based on OECD and SCImago data, 726 articles per thousand Italian researchers were published in 2010, compared to 550 per thousand in the UK and approximately 400 per thousand in France and Germany (RIO 2016).

*Collaboration between academia and industry*. Law 240/2010 established a legal framework for this cooperation, which is based on a memorandum of understanding. The vast majority of universities and postgraduate schools offer programmes that receive the joint input of academia and industry. Thanks to their autonomy, Italian universities are free to establish bilateral relations with the business sector.

*Female researchers*. In 2010, 20.1% of grade A academic staff in Italy were women, which compares well with 18.6% for the Innovation Union reference group and the EU average of 19.8% (Deloitte 2013). At the policy level, a memorandum of understanding on gender equality in the research profession is in operation between the Ministry of Education, Universities and Research and the Ministry for Equal Opportunities. The latter ministry has also taken an active role in two EU-funded projects promoting gender equality. The Italian regional authorities have implemented specific measures to support the participation of female students in scientific programmes at universities (mostly at bachelor level) and to support women's careers through scientific training schemes.

*Mobility and international attractiveness*. In Italy in 2010 the percentage of non-EU doctoral candidates as a percentage of all doctoral candidates was 6.2%. This compared with 5.3% among the Innovation Union reference group and an EU average of 20.0% (Deloitte 2013). For reasons including the continued development of programmes taught in English, a number of Italian universities attract a higher number of non-Italian students and/or doctoral candidates. Indeed in some cases the proportion is as great as 30%. The Rita Levi Montalcini Programme, which is a national fellowship

programme managed by the Ministry of Education, Universities and Research, promotes the internationalisation of Italian universities by enabling early-stage researchers working abroad to carry out research projects at an Italian university of their choice. Its purpose is to recruit outstanding post-doctoral researchers working abroad and give them the opportunity to submit a proposal for a temporary position in conjunction with a proposal for a research grant.

Let us now consider the weaknesses revealed by the SWOT analysis.

*Low R&D intensity*. Public funding for R&D has been decreasing as a percentage of GDP over the last eight years. Italy set an R&D intensity target of 1.53% in the context of the Europe 2020 strategy, which is well below the current EU average and thus exposes some sectors of the economy to the risk of falling well behind the ever-shifting frontier of technology. In 2000–11, R&D intensity in Italy increased by an annual average of 1.69%, and rose from 1.04% in 2000 to 1.25% in 2010 (Deloitte 2013). While public sector and private sector expenditure on R&D have both increased during the period, the rate of growth has been modest. The difference between Italy's R&D intensity and the EU average is mainly due to lower industrial R&D. In 2011, business R&D intensity in Italy was 0.68% compared to an EU average of 1.26%. At 0.53%, public sector R&D intensity in Italy is also lower than the EU average, which was 0.74% in 2011 (Deloitte 2013).

*Innovation performance*. Italy remains below the EU average and its relative position has not improved significantly over the past five years: the synthetic innovation index was at 0.314 in 2004 and at 0.354 in 2008 (JOREP 2011a). Italy, which according to the European Innovation Scoreboard (EIS) belongs to the group of "moderate innovators", made slow progress and registered a below-average annual EIS growth rate of 1.8 in 2008 compared to the EU average of 2.3 (JOREP 2011a).

*Low business R&D investment*. Business R&D investment, which in Italy has been traditionally low, is highly concentrated in large firms and has grown weaker due to the recession that followed the economic crisis. Italy's lower level of business R&D intensity is partly due to the structure of the economy, in which the share of high-tech industry in total value added by manufacturing is low, and partly to low R&D investment by Italian firms. Though Italy remains non-specialized in all high-technology sectors except chemicals, there are cases of scientific specialization, such as in pharmaceuticals, or of high concentrations of patents, such as in other machinery and electrical equipment. The difficulty presented by very low business investment in R&D is aggravated by the size of Italian firms,

of which 95% are small or micro enterprises. The proportion of foreign--owned firms is low and remained unchanged over the period 2001–08 (Deloitte 2013).

*R&D expenditure inequality*. Industrial R&D expenditure, of which 73.9% takes place in the north of Italy and only 10% at industrial firms in the Mezzogiorno in the south of Italy, is traditionally concentrated at a geographical level (JOREP 2011a).

*Foreign investment*. The stock of foreign investment in Italy accounts for only 12% of GDP, which is far less than in other EU countries. The main barriers to entry to the Italian market are labour taxes, lack of labour, inflexibility, bureaucracy and high corporate taxes. As domestic venture capital is scarce, the Italian government attempts to encourage foreign investors to invest in Italian companies. With the exclusion of the defence industry, foreign investors are permitted to invest in the privatization of government owned companies.

We now turn to the opportunities. Though it has not outstripped the average of 1.8% for the EU 25, total state aid in Italy has displayed a slight upward trend of 1.1% in recent years. State R&D aid has been boosted by additional funding from large strategic programmes managed by MIUR, and by the Industria 2015 initiative, which was launched by the financial law of 2007. The introduction of these two instruments heralded a switch to a more top-down R&D policy. Italy has adopted a range of measures to train sufficient researchers to meet its R&D targets, to promote attractive employment conditions at public research institutions and to address gender and dual-career issues. With the ultimate aim of attracting researchers, the government has taken initiatives to stimulate the interest of students in the natural sciences and in technology. As the number of enrolments in science and technology disciplines has increased by an average of approximately 20% against the 2008 baseline in recent years, the measures have proved successful (Deloitte 2013).

*Investment incentives*. The incentives the Italian government offers foreign investors are mainly designed to boost the economies of the more depressed areas – especially those in southern Italy. To add impetus to the development of a variety of industries, the Ministry of Education, Universities and Research has established programmes in eleven fields of development. They are meant to ease cooperation between public and private researchers and venture capitalists, support the research and development of key technologies, strengthen industrial research activities, and promote innovative behaviour at SMEs.

*International collaboration*. A number of partnerships, especially with the United States, Great Britain, France and Germany, are close to consolidation. A number of bilateral agreements are being developed by MIUR and other Ministries with EU countries and non-EU countries, but the majority of collaboration agreements are arranged and executed by research institutions and universities, including with the participation of private research organizations. Italy's policy aims to support joint programming and participation in international activities, research infrastructures and agreements. The chief source of funding is MIUR. The Ministries of Health and of Economic Development also make significant contributions to funding. There are no intermediary funding agencies.

*Attracting foreign researchers*. The major programmes open to foreign researchers in Italy concern mobility grants, which are supported by the International Inter-university Cooperation Fund. Under the auspices of the "Return of the Brains" and "Brain Gain" programmes, funds are also available to pay for Italian scientists to return from abroad. The goal of the "Futuro in Ricerca" and "Montalcini Programme" initiatives, which are funded by FIRB, is to attract foreign researchers to work in Italian academic institutions. These have not yet become open programmes. Italian research programmes funded by FIRB and open to the participation of foreign researchers are largely directed at supporting collaboration between Italian and foreign researchers and at attracting the latter to work in Italy.

Finally, let us consider the threats to Italy. The first is the economic crisis, which has paralyzed economic growth and investment in innovation. The government is working to introduce new reforms to escape the crisis and restart growth. Industrial production plunged during the recession while exports soared which, because Italian firms are strongly committed to investments in new EU countries, can be identified as a concern for the productive system. However, because it can stimulate the development of innovative policies, the economic crisis can be regarded as presenting an opportunity.

*Very high public debt*. With a public debt/GDP ratio close to 130% and a particularly heavy amortization of debt, Italy remains exposed to sudden changes of mood in the financial markets. Extensive and long-term policies to reduce public debt are therefore a priority. The results obtained thanks to recent structural reforms need to be consolidated and further measures need to be introduced to promote growth and improve competitiveness. If they succeed, they will lay a foundation for healthy growth.

*Brain drain*. As a result of the economic crisis, many Italian researchers and academics have been forced to leave Italy in search of better job opportunities and higher salaries.

## 4. The Polish R&D System

Poland is part of a region that is not homogeneous. It is a region characterized by research expenditure that rarely exceeds 1%, by lack of investment in universities, and by specialization in goods and services with little value added. Though it is in Europe's poorest area, it is exerting its efforts to prepare the structures that will form the base of a vigorous knowledge economy (Greco 2011).

Since the end of the communist period, Poland has achieved a high rate of development and an improved quality of life. In fact, following the fall of communism in 1990 and the transition from the People's Republic of Poland to the Third Republic, welfare spending has risen. The democratic political system, under which people have expressed the view that the state should meet social needs, has led to the growth of the welfare state. Since its return to democracy, Poland has faithfully pursued a policy of liberalizing the economy, so that today it is an exemplary case of the transition from a centrally-planned economy to a market economy.

There have been two formative periods for innovation policy in Poland. The first, which stretched from the early 1990s until Poland joined the European Union in 2004, began when the country recovered its political and economic freedom. It is characteristic that, due to the state's greater involvement in the transition from a centrally-planned economy to a market economy, innovation policy was then significantly curtailed. This was particularly true of the period until 1995. The marked decreases in the share of new and modernized products in industrial production (from 5.3% in 1989 to 3.4% in 1992), in the share of high-tech products in industrial production (from 10.3% in 1989 to 7.8% in 1992) and in the number of Polish inventions patented abroad (from 190 in 1989 to 43 in 1996), were all evidence of the country's low level of engagement in the modernization process.

According to Jasiński (2013), this period is associated with a lack of proper strategy and coordination between government agencies, insufficient R&D investment, over-centralized economic policies, the absence of a regional approach to shaping innovation policy, too little support – including financial support – for business research, and an emphasis on science in general terms rather than on innovation and the shortcomings

of its transfer and diffusion. Nevertheless, with membership of the European Union drawing near and the need to adapt to the Lisbon strategy, innovation policy began to gather momentum at the turn of the century. Innovation programmes were launched at this time, which formulated goals for innovation policy. However, the specific instruments required to implement them were not yet in place. The period following EU accession was a great deal more important for innovation. Poland was now required to conform with the strategy of making the EU the most rapidly growing economy in the world: an economy that, based on knowledge, would bolster social cohesion by generating more and better jobs.

Jasiński's thesis concerning state innovation policy in a period of transformation of the national economy in Poland (2013) was sharply criticized by a number of authors (see, for instance, Bal-Woźniak 2012, Czerniak 2013, Janasz & Kozioł 2011, Jasiński 2006, Klincewicz 2008, Marciniak 2010, Moszkowicz 2001, Okoń-Horodyńska 1998, Pomykalski 2001 and *Zarządzanie*… 2010). As follows from the results of previous studies (Jasiński 2004), technical progress in the Polish economy in 1990–2004 was sustained by the influence of (a) macroeconomic adjustment, (b) market forces and (c) the influx of foreign technical ideas rather than by the impact of policy formulation and technological research. It should be noted, however, that there has been a significant qualitative change in this policy in recent years due to reforms to scientific research and a significant inflow of EU funds.

In comparing the Polish experience with that of other countries (EC 2003, OECD 1997), Jasiński (2004) proposed the following classification for the policy tools applied to innovation in Poland:

1. Regulations, especially state prohibitions, orders, limits, norms and standards relating to environmental protection, competition, and to consumer and intellectual property, which form a set of boundary conditions for the various actors in the field of innovation.

2. Systemic instruments, or financial incentives enacted in laws, that are intended to encourage companies to innovate.

3. Programmes and government projects, including public procurement, announced for a given period and designed to accomplish specific objectives and policy tasks in that period. This applies especially to the programmes run by the Polish Agency for Enterprise Development (PARP) and the National Centre for Research and Development (NCRD).

4. Bridging instruments that support intermediary bodies in the innovation process. These may be understood as providing "support through

support" for what are known as the institutions of the business environment. These tools are sometimes referred to as organizational or institutional. Table 2 displays a SWOT analysis for Poland.

Table 2. SWOT Analysis of Poland

| | Strengths | Weaknesses |
|---|---|---|
| Internal | – EU structural funds: Poland is the country that benefits most from the structural funds allocated by the European Union every seven years<br>– liberal law<br>– rapid privatization<br>– human resources: employees gain professional skills through a solid level of training using professional techniques and by institutions of higher education and additional courses providing specialized skills<br>– gradual improvement in R&D<br>– new optimistic forecast for R&D expenditure<br>– new strategic research programmes<br>– relatively high rates of economic growth | – welfare<br>– lack of an "open, excellent and attractive research system"<br>– low R&D intensity<br>– low contribution from the business sector |
| | Opportunities | Threats |
| External | – foreign investment<br>– venture capital funds<br>– rapid growth of the global market | – centralization of R&D centres<br>– "brain drain" |

Source: authors' own elaboration.

Let us address the strengths that emerge from the SWOT analysis of Poland.

*EU structural funds*. Poland is the country that has benefited most from the structural funds allocated by the European Union every seven years. In 2007–13, Poland received EUR 102 billion, and the country will receive EUR 106 billion in 2014–20 – despite the crisis that has caused a general reduction in the EU budget (Szymański 2013). These funds have enabled strong growth compared to other EU states, which has been expressed in increased infrastructure, lower unemployment, increased exports (especially of food) and increased employment. By making proper use of EU funds,

keeping rates to a minimum and providing support to SMEs, Poland has managed to avoid the recession that has afflicted the rest of Europe.

*Liberal law and the privatization of firms*. The privatization of small and medium state-owned companies and the presence of a liberal law on establishing new firms have permitted rapid development of an aggressive private sector.

*Human resources*. Employees have acquired professional skills and techniques through solid, general training, including that provided by institutions of higher education and by specialized bodies. Employees in Poland have a high level of motivation when it comes to accepting new challenges. They are willing to improve their qualifications, to acquire new skills and to accept new responsibilities. They accomplish this either by working for modern, international companies in Poland or by working abroad. In this way they have access to the latest technologies and can familiarize themselves with highly-developed organizations, in which high standards of staff training feed into continuous innovation of production processes.

*Gradual improvement in R&D*. Poland has become a moderate innovator. Poland's innovation performance improved only marginally in 2006–13, while its performance relative to the EU, where innovation increased more rapidly, fell from 54% in 2007 to approximately 50% in 2013 (EC 2014). Poland thus sustained its position as a moderate innovator until 2011, before becoming a modest one in 2012.

*New forecast for R&D expenditure*. Following publication of the EU2020 Strategy by the European Commission in March 2010, the Ministry of Science and Higher Education prepared a new R&D expenditure forecast for the period until 2020. It is expected that GERD (Gross Domestic R&D Expenditure) will increase to 1.7% in relation to GDP, with half of that amount coming from private funds.

*New strategic research programmes*. Poland has been distinguished in the past by having the highest share of research expenditure not addressed to specific social and economic objectives in the EU. But this is expected to change in the 2014–20 financial perspective with the adoption by the government in 2014 of Sixteen National Smart Specialisations, which were identified in a high-level policy document as likely to focus R&D efforts.

*Economic growth*. Expressed in Euro, GERD grew by an annual average of almost 12% in 2002–12. Yet Polish GERD, which was at 0.90% of GDP in 2012, remained one of the lowest in the EU when compared with the EU average of 2.06% (RIO 2015).

Welfare is a relative weakness. Following the fall of communism in 1990 and the transition from the People's Republic of Poland to the Third Republic, welfare spending has risen[2]. Transition has therefore not brought a reduction in the welfare state that was built during the communist period. Indeed, the welfare state has grown even bigger, so that social expenditure now accounts for a much larger share of GDP than before the transition. Social expenditure in Poland accounts for approximately 20% of GDP, and has remained roughly stable over the past several decades[3].

*Lack of an "open, excellent and attractive research system".* This is primarily due to the limited number of innovative companies, to unsuccessful linkages and entrepreneurship efforts and to scarce intellectual assets (patents, licenses, trademarks and designs).

*Low R&D intensity.* In terms of R&D employment and the number of research establishments, Poland can be described as a relatively large research system. Yet measured by R&D expenditure as a percentage of GDP, the country has a very low R&D intensity: against the background of the Lisbon GERD target of 3% of GDP, the 2007 average for the EU 27 was 1.85%, and the level in Poland was 0.57% (JOREP 2011b).

*Low contribution from the business sector.* Another feature of the R&D system is the consistently low contribution made by the business sector. In Poland, BERD accounts for only 0.33% of GDP and private enterprise is not especially active in R&D (Erawatch 2014b). Of the 1,000 EU companies ranked, only four Polish companies featured on the 2013 Industrial R&D Investment Scoreboard. The picture is, however, not entirely bleak: business expenditure on R&D has been rising gradually in recent years.

We now turn to opportunities, the first of which is foreign investment. Based on its comparatively low labour costs, Poland offers a strategic entry point to external investors looking to exploit its unfettered access to most EU markets. The Polish economy depends heavily on foreign funding, to the point that about two-thirds of its exports, which together account for 45% of GDP, are generated by companies established with foreign capital. Foreign investment brings innovation and new solutions for growth. Poland is one of the most attractive locations for venture capital funds. Where companies hit by hard economic conditions are undervalued and need restructuring, and new enterprises come to VC funds better prepared, the environment is

[2] The term "welfare spending" is defined as the share of public and private spending devoted to the welfare state.

[3] All of the data presented are available at: http://stats.oecd.org/Index.aspx?DataSetCode=SOCX_AGG. Accessed: 20 May 2015.

favourable for investors. A substantial share of investment will come from VC funds, which will look especially to the technology sector for attractive start-up companies.

*Rapid growth of the global market*. Poland combines low labour costs, including wages, with high-quality production. This makes the country attractive to foreign companies and multinationals, who will be prepared to move their operations and to invest the capital saved on production and logistics costs. Given the rapid growth enjoyed by the companies that invest there, Poland is tightly connected with international economic growth. Poland's export markets are recording steady and consistent growth, which is why the country is sometimes described as the "China" of Europe.

Finally, let us consider the threats to Poland.

*Centralization of R&D centres*. Many international companies active in Poland prefer to keep their R&D activities at headquarters, which limits relationships with other stakeholders.

*Brain drain*. Migration to higher-paid jobs in Western Europe poses a minor, but increasing, threat to the availability of skilled labour in Poland.

## 5. Conclusions

As can be seen from Table 3, the economic crisis that erupted in 2008 radically reduced the availability of public resources and limited the ability to hire new research personnel in Italy. The performance of the public sector was thus less effective and less efficient. With a population of 60 million, GDP per capita is 25,200 (compare and contrast with the target of 3% of GDP for R&D expenditure adopted in the Lisbon Strategy). Poland's R&D expenditure is among the lowest of the EU 28. Despite the respectable share of R&D in the public sector in that country, it is hard to innovate there. As Figure 1 shows, there has nevertheless been an increase over the previous year.

The Italian research system presents a number of difficulties. There would appear to be a poor attitude to implementation of results and cooperation with enterprises, which find it difficult to connect their research with input from the public research centres. Unlike in other countries, there may also be a certain resistance on the part of Italian public research bodies to adopting new organizational models and new incentive mechanisms. The Italian public research system is perhaps over populated. It has a large number of entities that activate relationships with foreign entities, which creates a fragmented R&D system and overlapping functions. There is also

a degree of fragmentation in the sources of research funding. Both vertically at the level of the state, regions and sub-regions, and horizontally at the level of the ministries, regional councils, departments, universities and public research bodies, the Italian public research system is very articulated, each institution having specific responsibilities. The governance of the Italian public research system, understood as the procedures, and organizational and management tools, designed to integrate and coordinate the generation, dissemination and application of knowledge, is unstructured. It is therefore difficult to achieve the overall cohesion that would be conducive to accomplishing the country's strategic goals. The absence of institutional and programmatic unity also hampers relations with the European research system and restricts the ability to argue for the use of public and community resources for research and innovation.

Table 3. Comparison of R&D Policies between Italy and Poland. Year of reference: 2012

| Italy | Poland |
|---|---|
| GDP PPP = 25,200 EUR | GDP PPP = 16,800 EUR |
| R&D INT (GERD/GDP) (%) = 1.27 | R&D INT (GERD/GDP) (%) = 0.9 |
| PR SEC SHARE OF R&D (%) = 55 | PR SEC SHARE OF R&D (%) = 37 |
| PU SEC SHARE OF R&D (%) = 42 | PU SEC SHARE OF R&D (%) = 62 |
| POPULATION (million) = 59.7 | POPULATION (million) = 38.5 |

Note: GDP PPP – GDP per capita, R&D INT – R&D intensity, PR SEC – private sector, PU SEC – public sector.

Source: Erawatch (2014a, 2014b).

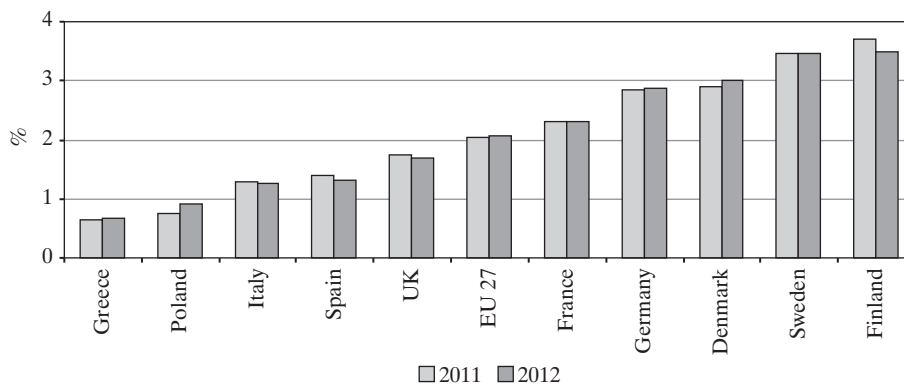


Fig. 1. R&D Intensity

Source: Eurostat Database, http://ec.europa.eu/eurostat/data/database. Accessed: 22 October 2015.

In that it has multiple agencies and research institutions that collaborate with the government, and a high organizational and thematic dispersion that results in a high proportion of research that is not focused on specified social and economic objectives, the Polish research system is different from the Italian one. It is a modern system that is in a transitory phase that will see significant changes in the roles of relevant actors and the introduction of multiple new rules. It continues to be driven by EU structural funds, which have made increases in R&D activities and in the number of R&D actors possible. The challenge now facing the government is to introduce new measures that will sustain the existing momentum and allow Poland to keep up with the major innovating countries in Europe. Poland has all of the assets required to make it an innovative country. It possesses one of the best European markets for foreign investment, it has a stable economy that is growing steadily, and there is a large internal market that affords easy access to neighbouring markets. Table 4 compares the challenges, differences, and similarities between the Italian and Polish research systems.

Table 4. Comparison between the Italian and Polish Research Systems

| Factors | Italy | Poland |
|---|---|---|
| Challenges | Integrate and coordinate the processes of innovation | New innovative measures |
| Differences | Fragmented R&D system | High proportion of research not focused on specified social and economic goals |
| Similarities | Objective to spend 3% of GDP on R&D | Objective to spend 3% of GDP on R&D |

Source: authors' own elaboration.

The research challenge facing Italy is to integrate and coordinate the various processes of innovation so that it can take its place as one of the most innovative countries in Europe. Given that the government's priorities lie elsewhere, and that the recession has made resources scarce, this is not a straightforward task. The problem that Poland must solve, meanwhile, is that of adopting new measures that will enable it to keep pace with other countries. If the government is able to turn the advantages bestowed by a robust economy in its favour, the country is well placed to make a success of introducing new measures. Turning to the differences, Italy presents a fragmented R&D system: there are a number of inefficient agencies that have failed to build the networks that would allow them to work together to

achieve the required objectives. Though Poland has multiple agencies that are well connected to each other, it has a high proportion of research that is not focused on specified social and economic goals. The countries are similar in that they must both strive to bring their R&D expenditure to the level of 3% of GDP required by the European Union. The two countries share the mission of becoming more innovative and more competitive.

In recent years in Europe there has been a move away from traditional policy models, which have been gradually replaced by modern, third--generation innovation policies. Poland's version of this new approach has been to apply strategic planning to designated sectors and research strands, whose promotion, it is hoped, will lead to a knowledge-based economy. This movement has been stimulated by the provision of numerous new tools designed to support innovation and encourage scientific and business cooperation (Staśkiewicz 2013). Based on the analysis of innovation and R&D policy in Poland presented above, the following measures may be taken to shape its future character:

– introduce institutional reforms to implement innovation and R&D strategies,

– ensure adequate funding for the strategy to promote innovation (including tax incentives to stimulate innovative economic development),

– follow good practice for innovative solutions that support R&D activities,

– narrow the gap in meeting the needs of innovative development by improving the quality of scientific information, market information, and training and making them more easily available,

– interact more to increase the efficiency of academic centres and technology transfers, and to boost the public share in financing innovation in industry,

– create and develop infrastructure, organizations, and personnel that can support innovative entrepreneurship,

– promote the emergence of new companies based on high technology, especially in regions with high unemployment,

– increase the R&D efforts of foreign enterprises in Poland (within the framework of foreign direct investment),

– support the establishment and development of organizations that work at the crossroads of science and industry and form an important element in the infrastructure of technology transfer,

– aim to meet the criteria of good governance, especially in public consultation and information policy (openness and coherence),

– lighten the administrative burden, streamline the legislative process and enact economic law that is more consistent,

– create a system favourable to raising funds from internal sources; establish and develop institutions that will operate in the business environment,

– tailor academic education to the requirements of a modern, innovative, and competitive economy,

– devise and implement regional innovation policy while retaining focus at the national level,

– set an example to society in public administration by implementing innovative methods of cooperation and using new technologies and procedures in line with the recommendations of the European Union,

– promote innovative adaptations to export products and services so that they are in demand on world markets,

– increase public funding for research, education, and cooperation and move away from the reliance on grants as a source of capital, which is the dominant model in Poland,

– establish a stable legal framework for innovation policy,

– reduce the number of barriers to innovation,

– create scientific centres capable of gaining a good reputation in Europe and the rest of the world.

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## Abstract

### Porównanie aktywności w sferze badawczo-rozwojowej w Polsce i we Włoszech

Innowacje oraz badania i rozwój (B+R) stanowią istotne sfery działalności w nowoczesnych społeczeństwach oraz zasadniczy element polityki rządów, które chcą sprostać kluczowym wyzwaniom społecznym związanym z implementacją koncepcji państwa dobrobytu do gospodarek narodowych. Ponadto aktywność w tych dziedzinach stanowi

istotny element równoważenia ich rozwoju społeczno-gospodarczego. Z tego powodu Unia Europejska, a także rządy krajów członkowskich ugrupowania starają się stwarzać bodźce stymulujące rozwój tego rodzaju aktywności, przede wszystkim poprzez podejmowanie wielu inicjatyw mających na celu jej wspieranie, takich jak strategia lizbońska, strategia Europa 2020, zielona księga innowacji, plan działań na rzecz wspierania innowacji w Europie. W niniejszym artykule dokonano przeglądu literatury w zakresie teorii innowacji, w aspekcie jej oddziaływania na sferę B+R, a także porównano rozwój aktywności w tym obszarze pomiędzy Polską a Włochami. Podstawę prowadzonych rozważań stanowią: dane ilościowe, analiza SWOT oraz analiza porównawcza sposobu funkcjonowania systemów badawczych w tych krajach. W końcowej części opracowania zostały zamieszczone wnioski i rekomendacje odnośnie do pożądanego kierunku i charakteru polityki tych krajów w ramach wspierania działalności w zakresie B+R opartej na innowacjach.

**Słowa kluczowe:** badania i rozwój (B+R), system badawczy, innowacje, polityka innowacyjna UE, analiza SWOT.