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1 Executive summary

Background:

Puglia Region is one of the Convergence regions under the Structural and Cohesion funding 2007-13, in the so called Mezzogiorno¹ area. It is a NUTS 2 region located at the south-eastern tip of the Italian peninsula (“the heel of the boot”) and consists of the following NUTS 3 provinces: Foggia, Bari, Barletta-Andria-Trani², Taranto, Brindisi and Lecce. The capital of the Region is Bari, which is also one of the nine metropolitan areas set at national level and a relevant harbour of Italy.

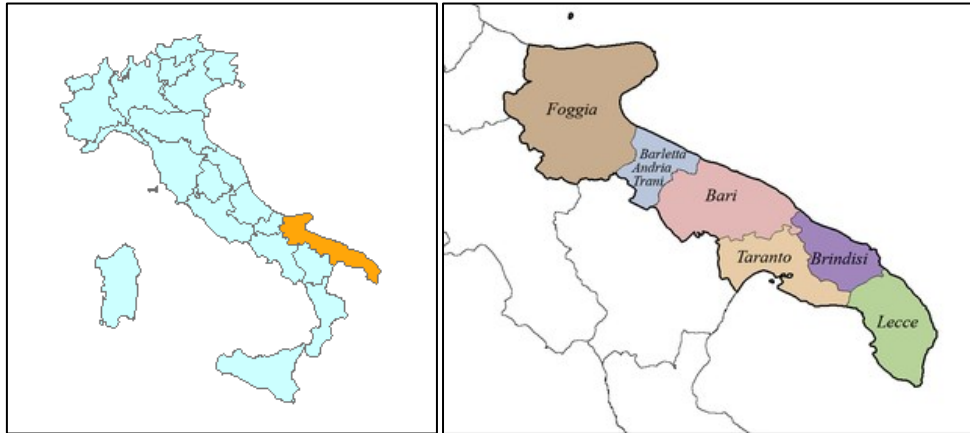


Figure 1 Puglia's location (ITF4) and administrative structure.

Due to its location, Puglia has access to the Ionian Sea and has a long coastline on the Adriatic Sea. In addition to the four bodies of water that touch Puglia's coasts (Adriatic and Ionian Seas, Strait of Otranto and Gulf of Taranto), the region also borders the Italian regions of Molise, Campania, and Basilicata. Being at the south of Italy, Puglia is a very dry region. Besides, it has few rivers, most of which are located at the foot of the Gargano promontory and are torrential. In addition, in Puglia, rainwater permeates the limestone bedrock and feeds underground watercourses, which resurface near the coast, where there are many caves and sinkholes. These features define the chronic regional scarcity of water resources. Although Puglia lacks its own superficial water resources, after importing water from bordering regions it provides drinking water to its inhabitants by its aqueduct (AQP) that has a water distribution-net of 20.000 km.

With regard to population, the population density in Puglia is 211.3 inhabitants per km², which slightly above the national average. While Bari is the most densely populated province, Foggia, in the north, is the less densely populated area, with a population density of around 92, well below the average for Puglia. It should be noted that the population of Puglia is younger than the Italian average. However, the birth rate has fallen constantly over the last 30 years.

Finally, in Italy, regional administrations are now responsible for policy making in the area of scientific and technological research and support to innovation for industrial sectors (while observing some fundamental principles set by national law). In the case of Puglia, regional authorities develop policy initiatives with the support of the recently created Regional Agency for Technology and Innovation (ARTI). All these changes offer new opportunities to the regional administrations, as well as challenges. E.g. community roles of new stakeholders need to be promoted, partnerships and interaction among stakeholders needs to be increased, the evaluation and monitoring of policy initiatives needs to be reinforced, etc.

¹ The Mezzogiorno area comprises the following Italian NUTS 2 regions: Abruzzo, Puglia, Basilicata, Campania, Calabria, Molise, Sicily and Sardegna.

² It should be noted that Barletta-Andria-Trani was created in 2004 out of ten municipalities which formerly belonged to Bari and Foggia. Its first elections for the provincial council were held in 2009. Barletta-Andria-Trani is excluded from ESPON typologies

Regional economy and the performance of key sectors

There areas comprising the Mezzogiorno are all characterized by lagging behind the Northern regions in terms of socio-economic development. Even if they have registered a catch up trend along the years, the differences continue to be relevant. With regard to Puglia, its per capita GDP is one of the three lowest in Italy and represents about 69% of the EU average. In addition, there is great disparity of economic development within the region. Some areas are economically developed (province of Bari), some are starting to take off economically (Lecce), and others are in economic decline (Taranto) or suffering severe economic crisis (Foggia and Brindisi).

However, from an economic point of view, Puglia is considered the most dynamic region in Southern Italy (Vecchi et al. 2011). Over the last years, there has been a transition from an economy based predominantly on Agriculture, to an economy which comprises large-scale industrial plants, a relevant number of SMEs and a raising tertiary sector.

Since the early 1990s, Puglia has been a net exporter of electricity to the rest of the country and its regional labour market is well endowed with specific skills in energy production. In this regard, Puglia's universities and national research centres are specialised in energy and the region has specific demonstration processes launched by the national government in the field of concentrated solar power (CSP).

Besides, Puglia is the leading region in Italy in renewable energy (RE) production³. In 2011 its total installed capacity was 1.3 GW for wind, almost 1 GW for photovoltaic energy (PV) and 0.14 GW for biomass and waste energy, which respectively represent 21%, 17% and 9% of the national totals (OECD 2012).

Even if the employment in high tech and knowledge-intensive industries is below the Italian average, Puglia is increasingly strengthening its innovation system. It is fostering clusters, alliances for innovation and research and development centres (e.g. Tecnopolis-CSATA and the software development centres near Bari, the Cittadella della ricerca -Centre for research and new materials- near Brindisi, etc.), all of which contribute to the competitiveness of Puglia's economy. From the green economy perspective, Puglia ranks high in Italian classifications of green entrepreneurship.

Against this backdrop, and from GRECO's perspective the most relevant sectors are:

- (Renewable) Energy production
- Green Research and Eco-innovation

(Renewable) Energy production:

As aforementioned, Puglia is specialized in electricity (energy) production; first only from traditional sources, then both from traditional and renewable sources. With a total production of 34 786 GWh and regional demand of only 17 394 GWh (2010), Puglia is a net exporter of electricity to the rest of the country (OECD 2012). Around 11% of this energy production comes from renewable sources, namely wind and solar (GSE 2010). The increase in PV generation between 2010 and 2011 was remarkable not only for Puglia, but for Italy as a whole.

Nonetheless, it is worth noticing that Puglia due to its above average sun irradiance (around 1700 KWh/m²) and the simplification of the authorisation process for the installation of PVs, it outperforms other Italian regions in PV energy generation. In this regard, the greatest capacity of PV has been installed in Puglia, with 1.68 GW in 17,800 plants.

In 2012 the Puglian city of Lecce completed the largest PV rooftop plant in Southern Italy, with 3 MW of installed power at the parking area of the University campus. When it comes to

³ <http://www.solarserver.com/solar-magazine/solar-news/current/2011/kw37/italy-becomes-the-worlds-largest-pv-market-gse-announces-installation-of-65-gw-in-2011-expects-12-gw-by-the-end-of-the-year.html>

wind power, the wind resources are spatially sensitive. Therefore, wind power farms are located in the north of Puglia, in the mountains of Foggia, where the wind speed average is 6-7 m/s. Wind power installations have remained quite stable between 2010 and 2011 but they almost doubled between 2008 and 2009 (OECD 2012).

Since 2007 the Puglia region has its own independent Regional Environmental Energy Plan (PEAR), which is currently under revision. In addition to making a survey of the energy needs of the territory, this plan shall formulate guidelines for 2016. In particular:

- reduction of CO₂ emissions into the atmosphere;
- energy efficiency;
- development of energy production from renewable sources (solar, wind, biomass, geothermal, etc.).
- clear opposition to the development of energy from nuclear sources

After the adoption of this plan, Puglia has developed a broad legislative and regulatory framework that has fostered the rapid development of renewable energy sources.

According to ARTI (2013), for the next decade, the main challenges will be to (i) manage wisely the diffusion of green technologies and to (ii) grasp the opportunity to combine the progress in renewable energy generation and local economic development.

Green Research and Eco-innovation:

Over the last years, Puglia's innovation performance has increased by almost 27 %⁴, it is one position higher in the ranking of Italian innovative regions and has evolved from a modest-high innovator in 2009 (RIS 2012) to a moderate-medium innovator in 2011 (Ibid.).

Puglia has a good public research infrastructure and thus, research activities are primarily concentrated in research institutions and focused on basic research. Over the years, technological districts have bloomed and are aimed at boosting innovation in the region. In this context, technological districts are territorial aggregations included to network and linked to the international environment, able to support local industrial growth based on innovation and research. Generally the creation of a technological district tends to accelerate scientific and technological cooperation between leading companies and public actors in positions of excellence in a particular technology area.

Furthermore, in Puglia Productive districts are also relevant. Productive districts are characterized by a high concentration of enterprises (SMEs in especial) each of which is integrated into a production system with relevant expertise and active support to local economy and by the presence of social and institutional stakeholders with capacities for supporting the local economy. The policy objectives of such productive districts are mainly three: (1) increase the competitiveness and innovative capacity in order to expand their presence in foreign markets; (2) enhance the creation and development of new enterprises particularly in activities with high technological content; (3) intensify the processes of size growth.

Even if Puglia is still lagging behind in terms of innovation performance and it has barriers to overcome if it is to become a smart and specialized region, the progress made over the last two decades in terms of (i) setting up the policy and legislative documents, (ii) setting up the institutions, such as ARTI, (iii) raising awareness, (iv) facilitating stakeholder interaction (clusters, technology and productive districts), etc. all of which is needed to a functioning and efficient regional innovation system, has been remarkable. Still, some challenges remain, namely:

- Increasing demand for innovation and university-industry linkages
- Improving productivity
- Promotion of research-based initiatives.

However, Puglia is well prepared to face these challenges due to the relatively high number of young researchers, SME involvement and emerging new business. In addition the

⁴ Cluster Observatory data of the Regional Innovation Scoreboard (RIS) for 2007 and 2011.

forthcoming Smart Puglia strategy, framed in the RIS³, will also contribute to definitely overcome these barriers.

Key findings from Puglia

From the green economy perspective, Puglia ranks high in Italian classifications of green entrepreneurship. According to GreenItaly report 2012 (Fondazione Symbola – Unioncamere, 2012), Over the period 2009 to 2012 Puglia sheltered more than 21,000 companies with active investments in environmental goods and services sectors. Bari province ranked on sixth position in Italy, with almost 9,000 companies actively involved in green sectors. Such figures imply that one out of four Puglian companies hold active investments in the green economy, making Puglia is placed slightly below the Italian average in terms of share of total companies with active investments in green sectors.

In recent years, a model of networking has taken shape in which universities, public and private research centres and other institutions collaborate in trying out new products and processes and promote the transfer of technologies. Nanotechnology, laser microprocessing, magnetic resonance and advance research techniques applied to energy, health, agriculture and food, aerospace, mechatronics – these are the main sectors at the centre of the new “Made in Apulia” research landscape. In this context, the four technological clusters based in Apulia also have a leading role: Dhitech for high-tech, D.A.Re, for agriculture and food, Medis for Mechatronics and Di.T.Ne for renewable energy.

Building on this networking structure, a relevant policy instrument that have been mentioned by some Italian reports as a ‘powerful accelerator’ (Fondazione Symbola – Unioncamere, 2012) for green transformation are the Network Contracts adopted in 2009 under the auspices of the Small Business Act (SBA). The Network Contracts were introduced in 2009 as a new tool that aims at enhancing collaboration among firms to increase their potential for innovation, research, and development. One of their main goals of Network Contracts is to overcome the typical lack of scale economies that characterise Small and Medium Enterprises (SMEs).

Moreover, despite the slowdown in economic growth in the context of the Europe wide economic crisis, Puglia continues to develop its potential by fostering research and innovation. This investment in innovation is taking place not only in leading sectors, but also in traditional ones. However, even if the initiatives fostered by Puglia related to innovation and green economy, are promising and have been well received by local actors, it is too early to evaluate the success of the measures. For instance, Productive Districts were launched in 2008, but the majority were not established until 2009-2011. Nonetheless, this measure is recommended as an example of regional good practice by the Regional Innovation Monitor of the European Commission⁵.

Besides, the Puglian pioneering experience in renewable energy (PV in especial) is often mentioned as a best practice and according to ARTI (2013) could be easily transferable to other regions with similar characteristics (e.g. sun irradiance). The key milestone of this process was Regional Law 31 of 21 October 2008, which limited the establishment of plants fuelled by renewable sources in areas of particular value and introduced the single DIA (Declaration of Home Activity) for the installation of the equipment renewable up to 1 MW, while the national law provided lower thresholds: 60 kW for wind power, 20 kW for PV, 200 kW for biomass. This resulted in a simplification of the bureaucracy for authorization of PV plants and spurred their deployment.

All in all, Puglia is well positioned to achieve the green economy transition. Over the last years it has promoted policy measures to enhance the regional innovation system and promote partnerships and networking. On top of that it already has a leading position in some green economy sectors, such as renewable energy.

⁵ <http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/index.cfm?q=p.home>

2 General description of Puglia

2.1 Geography

Puglia Region is one of the Convergence regions under the Structural and Cohesion funding 2007-13, in the so called Mezzogiorno⁶ area. It is a NUTS 2 region located at the south-eastern tip of the Italian peninsula ("the heel of the boot") and consists of the following NUTS 3 provinces: Foggia, Bari, Barletta-Andria-Trani, Taranto, Brindisi and Lecce. The capital of the Region is Bari, which is also one of the nine metropolitan areas set at national level and a relevant harbour of Italy.

It should be noted that Barletta-Andria-Trani was created in 2004 out of ten municipalities which formerly belonged to Bari and Foggia. Its first elections for the provincial council were held in 2009. Barletta-Andria-Trani is excluded from ESPON typologies.



Figure 2 Puglia's location (ITF4).

Due to its location, Puglia has access to the Ionian Sea and has a long coastline on the Adriatic Sea. In addition to the four bodies of water that touch Puglia's coasts (Adriatic and Ionian Seas, Strait of Otranto and Gulf of Taranto), the region also borders the Italian regions of Molise, Campania, and Basilicata.

Puglia covers over 19 355 km² of broad plains and low-lying hills, which make it the least mountainous region in Italy. The only mountainous areas are located in northern Puglia and comprise the Gargano promontory and the Dauno sub-Apennines, which do not exceed 1150 m. The central area of the region is occupied by the Murge, a vast karst plateau, and Itria Valley.

With regard to climate, Puglia has Mediterranean climate. Therefore, climate is hot and dry in the summer, and what rain there is falls in the winter months and averages no more than 500 mm per year.

Along these lines, Puglia is a very dry region. It has few rivers, most of which are located at the foot of the Gargano promontory and are torrential. In addition, in Puglia, rainwater permeates the limestone bedrock and feeds underground watercourses, which resurface near the coast, where there are many caves and sinkholes. These features define the chronic regional scarcity of water resources. Although Puglia lacks its own superficial water resources, after importing water from bordering regions it provides drinking water to its inhabitants by its aqueduct (AQP) that has a water distribution-net of 20.000 km.

⁶ The Mezzogiorno area comprises the following Italian NUTS 2 regions: Abruzzo, Puglia, Basilicata, Campania, Calabria, Molise, Sicily and Sardegna.

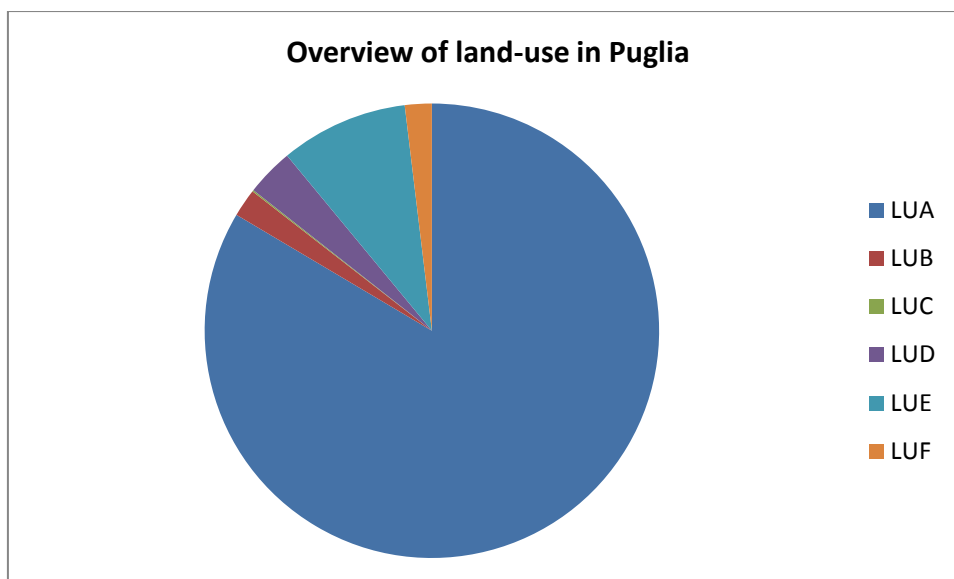


Figure 3 Overview of land-use in Puglia in 2009. Source: Eurostat (*lan_lu_oww*).

In addition, there are a number of protected natural areas in Puglia, such as the **(a)** Gargano and Alta Murgia National Parks, **(b)** the State Reserves of Torre Guaceto, Le Cesine, Falascone, and San Cataldo, **(c)** the Regional Natural Parks of Porto Selvaggio e Palude del Capitano, Litorale di Punta Pizzo e Isola di Sant'Andrea, Costa Otranto - S. Maria Leuca - Bosco Tricase and Salina di Punta Contessa, and **(d)** the Protected Marine Areas of Porto Cesareo and Torre Guaceto.

Moreover, there are two UNESCO World Heritage Sites in Puglia, both man-made. One is the 13th century Castel del Monte near Bari, and the other is a remarkable type of mortarless construction, the limestone dwellings called "trulli". Trulli are found in several towns in southern Puglia, but the UNESCO Site is the town of Alberobello.



Figure 4 Puglia's UNESCO World Heritage Sites: The Trulli of Alberobello (left) and Castel del Monte (right). Source: <http://whc.unesco.org/en/list/398>

In addition, there are Roman and Greek ruins in Puglia, castles and other buildings from many different centuries, picturesque medieval town centers, and artifacts archaeologists have found from several historic periods.

2.2 State of infrastructure

Puglia is Italy's gateway to the Eastern Mediterranean, with the port of Taranto playing an important role. The region also has a good network of roads but the railway network is somewhat inadequate, particularly in the south. In such a context, The Program for the development of strategic infrastructure and regional logistics platform⁷, aims at enhancing infrastructures to allow real intermodality in Puglia. The below summarize the most remarkable interventions identified by the plan:

- High speed/capacity railways connection Bari-Napoli
- Adriatic railways connection (extend corridor 5 to Bari)
- Taranto Interport
- Taranto Logistic platform
- Bari interport

Besides, Puglia has a good research infrastructure. It hosts 5 Universities, more than 25 Public Research Centers, 6 interregional Centres of Competence, 3 Enterprise Incubators, 7 Industrial Liaison Offices, 4 Technological Districts (ICT, Energy, Mechatronics, Agro-food), 15 Production Districts (ICT, Aerospace, Mechanics, etc.) and 3 PPP (Ambient assisted living, Materials, Environment).

Finally, with regard to the Information Technology (IT) infrastructure, 38% of the population are regular Internet users, while 50% of the households have access to the Internet. These shares have been increasing since 2006, with a slight stagnation between 2010 and 2011.

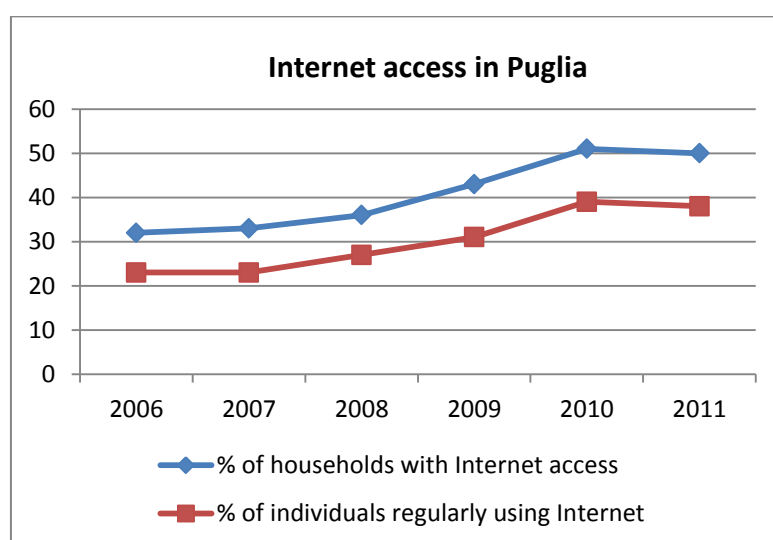


Figure 5 Overview of Internet access in Puglia. Source: Eurostat (tgs00047 and tgs00050).

This share, however, is still below the EU average, where two-thirds of households have Internet access (64%) (EC 2012).

⁷ Puglia corsara Programma per lo sviluppo delle infrastrutture strategiche e della piattaforma logistica della Puglia

http://mobilita.regione.puglia.it/index.php?option=com_zoo&task=category&category_id=59&Itemid=55

2.3 Demographics

The population density in Puglia is 211.3 inhabitants per km², which is slightly above the national average. While Bari is the most densely populated province, Foggia, in the north, is the less densely populated area, with a population density of around 92, well below the average for Puglia.

Table 1 Population density of Pugliese provinces in 2011 (Source Eurostat: *demo_r_d3dens* and *demo_r_d3avg*)

Province	Area (km ²)	Population (thousands)	Density (inh./km ²)
Province of Bari	3821	1259.1	329.2
Province of Barletta-Andria-Trani	1543	393.1	255.5
Province of Brindisi	1839	403	219.1
Province of Foggia	6960	639.9	91.9
Province of Lecce	2759	815.4	295.5
Province of Taranto	2437	579.5	238.6

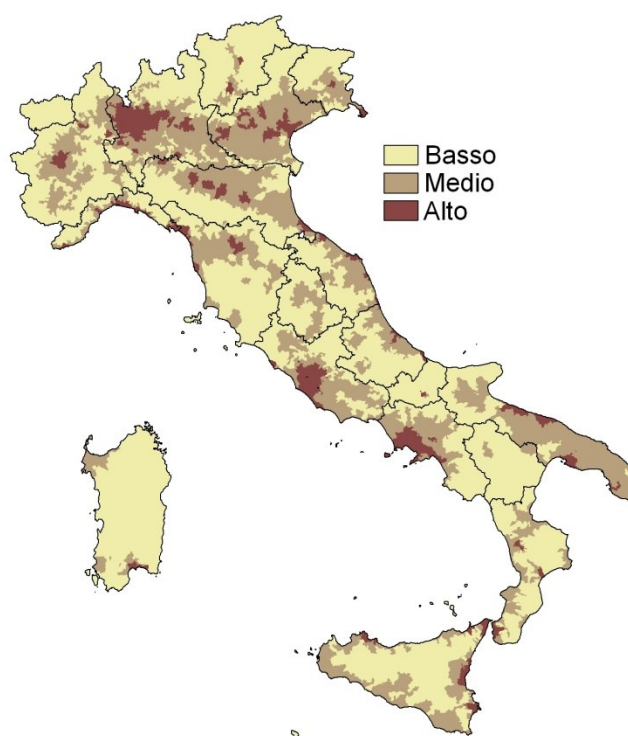


Figure 6 Degree of urbanization of Italian municipalities - Year 2001 (Source: Istat)

Over the last decade, the population of Puglia has grown by 1.47%, remaining quite stable around the 4 million inhabitants.

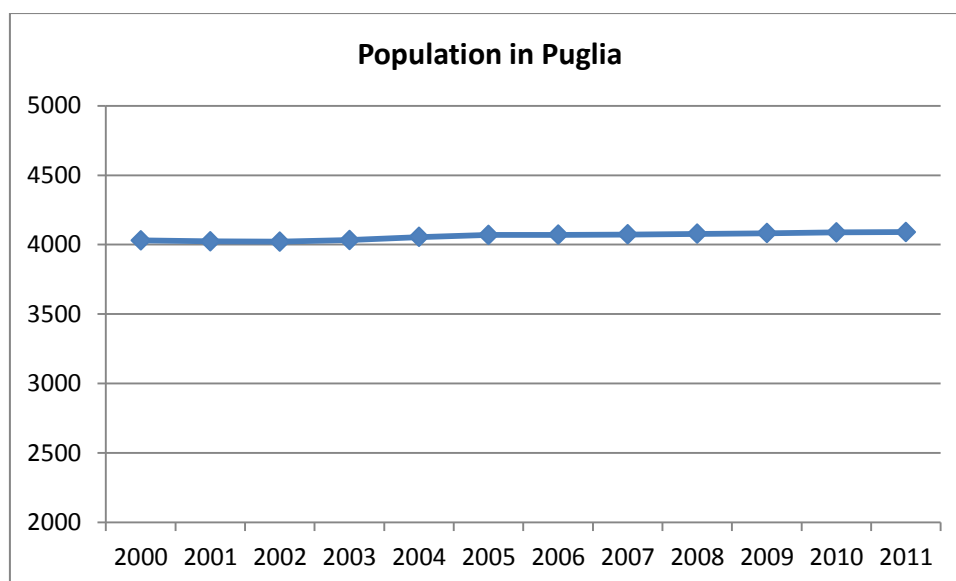


Figure 7 Overview of population in Puglia. Source: Eurostat (tgs00001).

The population of Puglia is younger than the Italian average. The share of young age groups (under 25) is 26.26%, while the national average is three points lower. On the contrary, the share of old age groups (over 65) is two points below the national average. However, over the last decade, Puglia's population is aging. In 1993, the share of young age groups was as high as 36.74%, in 2001, it was 31.2% and in 2012 it has decreased to 26.26%. Over the same period, the share of old groups has increased from 12.85% in 1993, 15.62% in 2001 and 18.97% in 2012.

The birth rate has fallen constantly over the last 30 years, from 16.3 per thousand in 1980 to 13.0 in 1990, to reach 8.8 per thousand in 2011. It is noteworthy that since 2006, Puglia's birthrate is below the national average.

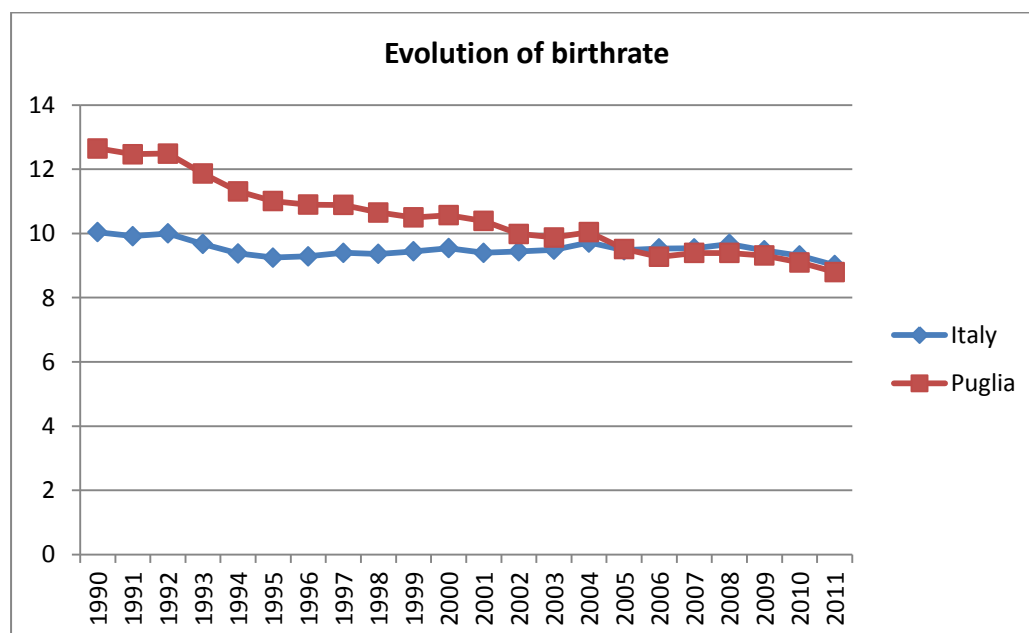


Figure 8 Overview of evolution of birthrate in Puglia. Source: Eurostat (demo_r_fagec and demo_r_pjangroup).

The death rate, which had fallen slightly in the 1980s, has risen ever since. Nonetheless, it still remains below the national average. These two components, births and deaths, have led to a positive natural growth⁸ of the population throughout the last decade, but also to an aging population.

Emigration from the region's depressed areas to northern Italy and the rest of Europe was very intense in the years between 1956 and 1971. This trend declined as economic conditions improved, to the point where there was net immigration in the years between 1982 and 1985. Since 1986 the stagnation in employment has led to a new inversion of the trend, caused not so much by an increase in the number of people leaving but by a fall in the number coming to live in the region.

2.4 Administrative structure

Italy is divided into 20 regions (regioni, singular regione), five of these regions having a special autonomous status that enables them to enact legislation on some of their local matters. The country is further divided into 110 provinces (province) and 8,100 municipalities (comuni). There are also 15 metropolitan cities (città metropolitane), established in 2009, but this administrative division is not yet operational.

The reform of the Italian Constitution in 2001 modified the structure of the Republic, conferring equal status to the different local government bodies on the inside of the republican's system: *comune*, *provincia*, *città metropolitane*, *Regioni e Stato*, which formerly represented only a mere administrative division of the State (Giardini et al. 2011).

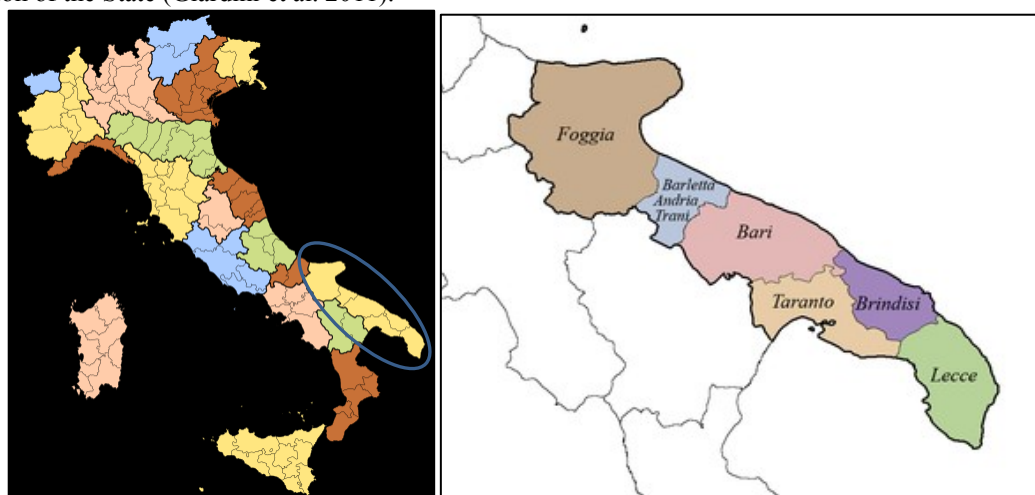


Figure 9 Administrative divisions Puglia.

Puglia is divided into six provinces Foggia, Bari, Barletta-Andria-Trani, Taranto, Brindisi and Lecce. The capital city of Puglia is Bari.

⁸ Natural population change is the difference between the number of live births and deaths during a given time period (usually one year). It can be either positive or negative.

2.5 Governance

Italy is a unitary parliamentary republic, in other words, it has a parliamentary government based on a proportional voting system. A peculiarity of the Italian Parliament is the representation given to Italian citizens permanently living abroad.

The regional organisation of the Italian State, in other words, the recognition of regions as local and autonomous authorities with their own powers and functions, was introduced by the Constitution in 1948. Then, in 2001, the reform of the Constitution, changed how legislative jurisdiction was divided upon the State and local authorities, increasing multi-level governance. Hence, regions were granted functions that were otherwise reserved to higher levels of governance. The key points of this change may be summarized as follows (Lion et al. 2003):

- Equal institutional ranking of the various local authorities as autonomous State components; they are allowed to have their own statutes, powers and functions, as well as financial autonomy for revenues and expenditures;
- The division of responsibilities between State and regions;
- The attribution of administrative responsibilities to the municipalities, in respect of the principle of subsidiarity.

In such a context, regional administrations are now responsible for policy making in the area of scientific and technological research and support to innovation for industrial sectors (while observing some fundamental principles set by national law). In the case of Puglia, regional authorities develop policy initiatives with the support of the recently created Regional Agency for Technology and Innovation (ARTI).

All these changes offer new opportunities to the regional administrations, as well as challenges. E.g. community roles of new stakeholders need to be promoted, partnerships and interaction among stakeholders needs to be increased, the evaluation and monitoring of policy initiatives needs to be reinforced, etc.

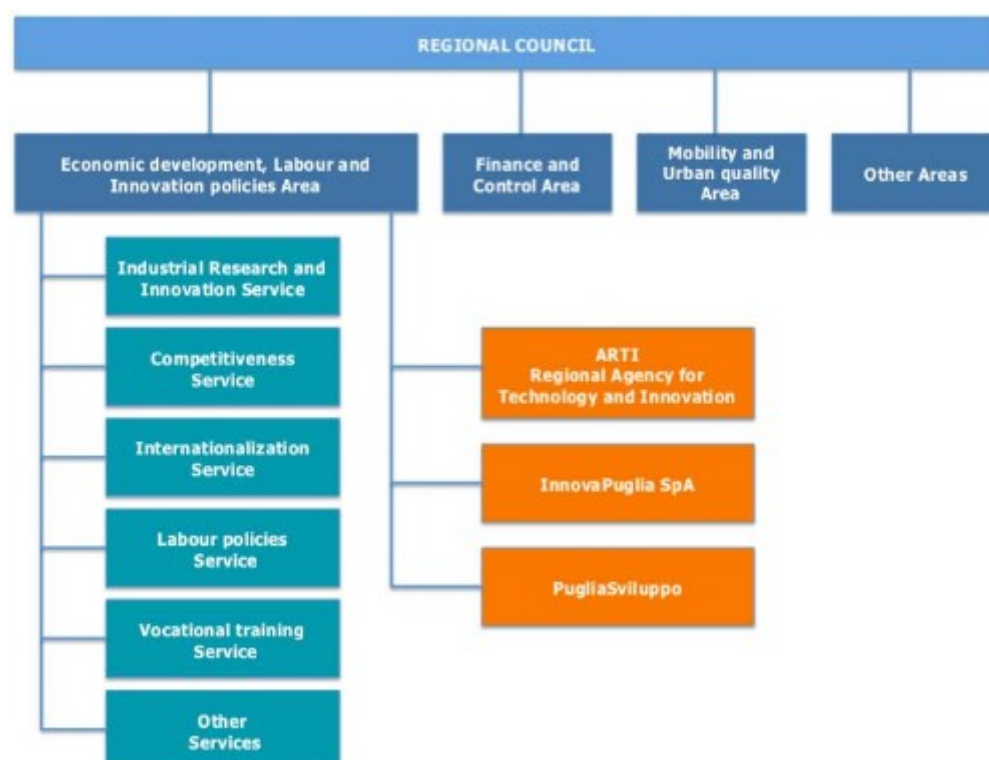


Figure 10 Regional Governance Structure.

3 Regional economy in Puglia

3.1 Overall economy of the region

There areas comprising the Mezzogiorno are all characterized by lagging behind the Northern regions in terms of socio-economic development. Even if they have registered a catch up trend along the years, the differences continue to be relevant. With regard to Puglia, its per capita GDP is one of the three lowest in Italy and represents about 69% of the EU average. In addition, there is great disparity of economic development within the region. Some areas are economically developed (province of Bari), some are starting to take off economically (Lecce), and others are in economic decline (Taranto) or suffering severe economic crisis (Foggia and Brindisi).

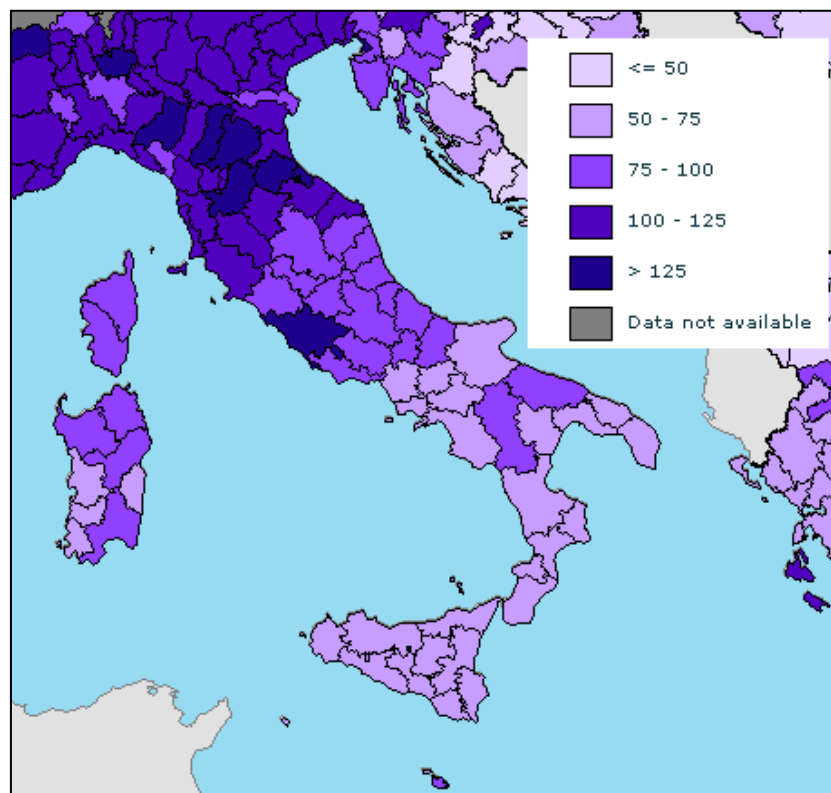


Figure 11 GDP per inhabitant, in purchasing power standard, in 2009 (% of the EU 27 average) (Source: <http://ec.europa.eu/eurostat/statistical-atlas/gis/viewer/>; nama_r_e3gdp)

In addition, in the context of the current economic crisis, the purchasing power standard (PPS) per inhabitant of all Italian regions, and as a consequence Italy's, has decreased. Hence, Italy's purchasing power is now in line with the EU average. This decrease in Puglia has been slightly sharper than the Italian average. But, since Puglia was already below the EU average, this decline places the region more behind in terms of PPS.

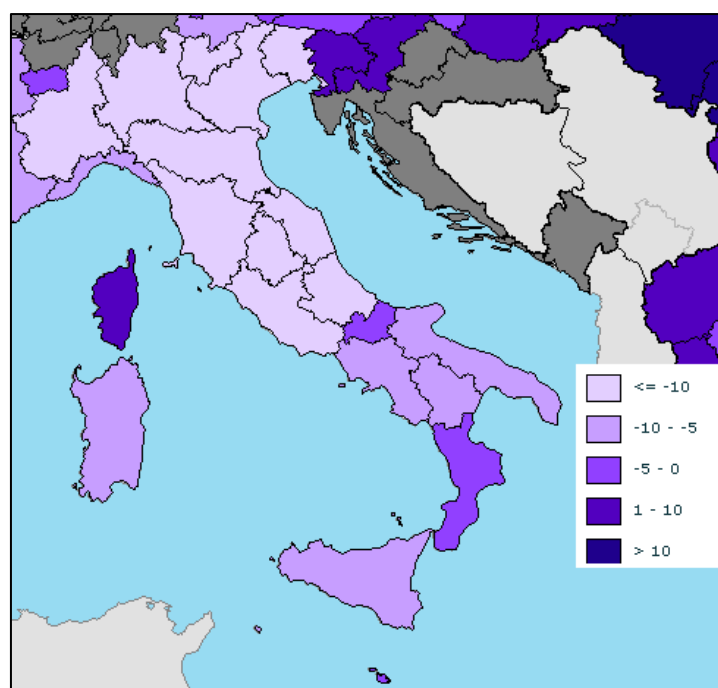


Figure 12 Change of GDP per inhabitant, purchasing power standard, 2000-2009 (percentage points between 2009 and 2000 in relation to the EU 27 average). (Source: <http://ec.europa.eu/eurostat/statistical-atlas/gis/viewer/> ; nama_r_e2gdp)

Table 2 Puglia's socio-economic profile. (Source: Istat)

PUGLIA	2000	2004	2009
Population and employment			
Resident Population (annual average in thousands)	4 030.1	4 054.6	4 086.6
Work units total (thousands)	1 309.3	1 316.4	1 283.2
Work unit employees (thousands)	901.6	929.1	927.4
Values per capita			
GDP per capita at market prices (current euro)	13 876.4	15 712.1	16 711.4
GDP at market prices per unit of labour (current euro)	42 712.2	48 394.4	53 220.8
National consumption per capita (current euro)	13 338.5	15 278.0	16 547.6*
Compensation of employees per unit of employees (current euro)	25 074.3	29 358.8	34 170.0
Economic accounts at current prices (million €)			
Gross domestic product	55 923.1	63 706.4	68 292.9
Net imports	9 654.8	12 388.5	12 676.4*
Total	65 577.9	76 095.0	82 371.1*
Final domestic consumption	53 755.5	61 946.2	67 401.5*
Final consumption expenditure of households	39 025.7	44 276.1	47 530.8
Final consumption expenditure of social transfers by private social institutions	120.8	168.1	192.1*
Final consumption expenditure of social transfers by public administrations	14 609.0	17 502.0	19 572.2*
Gross fixed capital formation	11 653.7	13 781.6	14 402.1*
Changes in inventories and valuables	168.7	367.2	567.5*

* 2007 data

However, from an economic point of view, Puglia is considered the most dynamic region in Southern Italy (Vecchi et al. 2011). Over the last years, there has been a transition from an economy based predominantly on Agriculture, to an economy which comprises large-scale industrial plants, a relevant number of SMEs and a raising tertiary sector.

In this regard, Puglia has been very focused on Agriculture (export leader in olive oil, wheat, tomatoes, wine) and Manufacturing in traditional “*made in Italy*” sectors, such as furniture, textile and shoes. Current trends have evolved towards new (for Puglia) Manufacturing sectors, such as automotive, energy, ICT, aerospace, etc. and Services.

In relation to manufacturing, Puglia has been a manufacturing powerhouse for the south of Italy, but in the last 20 years the industrial base of the region's economy has changed radically. Today, the area hosts only a small fraction of what used to be one of the key steel-producing areas in Italy. Alongside highly capital-intensive large-scale plants - such as ILVA (steel-making) in Taranto and Eni (petrochemicals) in Brindisi and Manfredonia - a network of small and medium-sized firms has gradually expanded in the following sectors and locations (Casalino et al. 2013):

- food processing and vehicles in the province of Foggia;
- footwear, textiles, wood and furniture in the Barletta area north of Bari;
- wood and furniture in the Murge area to the west;
- engineering, rubber, wood and furniture and computer software around Bari itself;
- textiles and clothing at Monopoli- Putignano in the south;
- footwear and textiles in the Casarano area in the south.

These days the most important feature of Puglia's manufacturing is the role played by its small and medium enterprises (SMEs).

The (economic) relevance of Manufacturing in Puglia is decreasing and its “greenness” is on question. The steel plant in Taranto represents a showcase of “cathedral in the desert”. It was built in the 1960s when due to a political decision of investing in industrial development in Southern Italy led to the establishment of capital-intensive industries, the so-called “cathedrals in the desert”. Over the years, the steel plant in Taranto has provided plenty of employment to the surrounding municipalities and in 2011 produced 30 percent of Italy's steel output. But, in 2002 a criminal law case was filed by the General Prosecutor in Taranto, accusing the management of the steel plant of criminal misbehavior in condoning inadequacy of industrial hygiene procedures with respect to the oldest batteries of the coke-oven plant. Moreover, in July 2012 magistrates ordered the closing of blast furnaces. Later courts ruled that production could continue if emissions were decreased. Finally, certain cancers are significantly higher around Taranto than in surrounding areas.

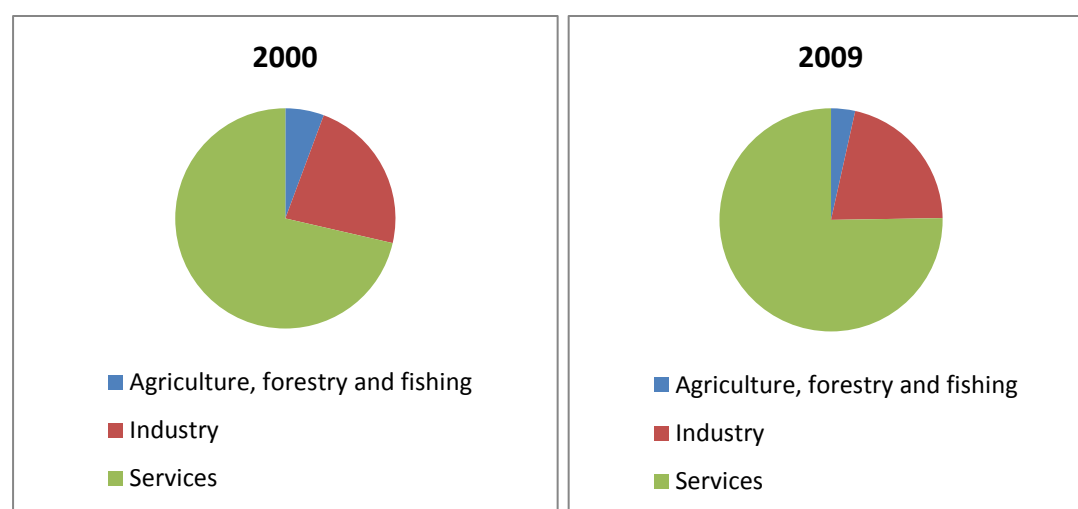


Figure 13 GVA composition in Puglia in 2000 and 2009. (Source: Istat)

When it comes to Services, Tourism has nearly tripled its share in GDP between 2006 and 2011, having become a major tourist destination in the Mediterranean area over the last decade. Tourism is intertwined with farming, thanks in part to regional, national and EU policies aimed at promoting “agri-tourism” (OECD, 2009). Alongside with Puglia’s mix of cultural and natural amenities, entrepreneurship and regional policies have also played an important role in fostering this sector. In this regard, the 2007-2013 ERDF Operational Programme for the region, aims at “*promoting new forms of tourism, the regional strategy will focus on promoting the environment, the ecosystem and biodiversity*”.

BOX 1: Strengths and weaknesses of Puglia:

Among the region's strong points are:

- an urban development widely scattered throughout the territory. This encourages decentralised urban growth based on the various poles of development around Foggia, Barletta, Bari, Monopoli-Putignano, Taranto, Brindisi, Lecce and Casarano;
- A number of major research and development centres for new technology, among which are Tecnopolis-CSATA near Bari and the 'Centro ricerche dei nuovi materiali' (New materials research centre) near Brindisi;
- An industrial base composed of small and medium-sized firms engaged in both traditional manufactures (textiles, clothing, wood and furniture, footwear) and modern industry (mechanical engineering, rubber, plastics and automotive).

Among the region's weak points are:

- A lack of integration between sectors of the economy - agriculture, industry, services - (especially in the provinces of Foggia, Brindisi and Taranto);
- The uncertainty as to the objectives and time-scale of restructuring in the major depressed industries (the iron and steel industry in Taranto and the power and chemicals industries in Brindisi);
- Puglia contains extensive depressed areas mainly in the interior and periphery of the region (Dauno hills, Murgia hills and lower Salente peninsula).

Source: http://circa.europa.eu/irc/dsis/regportraits/info/data/en/itf4_geo.htm

Even if the employment in high tech and knowledge-intensive industries is below the Italian average, Puglia is increasingly strengthening its innovation system. It is fostering clusters, alliances for innovation and research and development centres (e.g. Tecnopolis-CSATA and the software development centres near Bari, the Cittadella della ricerca -Centre for research and new materials- near Brindisi, etc.), all of which contribute to the competitiveness of Puglia's economy. From the green economy perspective, Puglia ranks high in Italian classifications of green entrepreneurship. According to GreenItaly report 2012 (Fondazione Symbola – Unioncamere, 2012), Over the period 2009 to 2012 Puglia sheltered more than 21,000 companies with active investments in environmental goods and services sectors. Bari province ranked on sixth position in Italy, with almost 9,000 companies actively involved in green sectors. Such figures imply that one out of four Puglian companies hold active investments in the green economy, making Puglia is placed slightly below the Italian average in terms of share of total companies with active investments in green sectors. In addition, Puglia is making progress by investing not only in traditional sectors, but also trying new technologies. At the moments new prospects are opening up for:

- the building industry, which is starting to concentrate on sustainability;
- renewable energy;
- transport, which is opening up to logistics and intermodality;
- agriculture, which is turning to new forms of organisation and distribution;
- manufacturing, which is specialising in innovative value chains;
- tourism, which is becoming less seasonal.

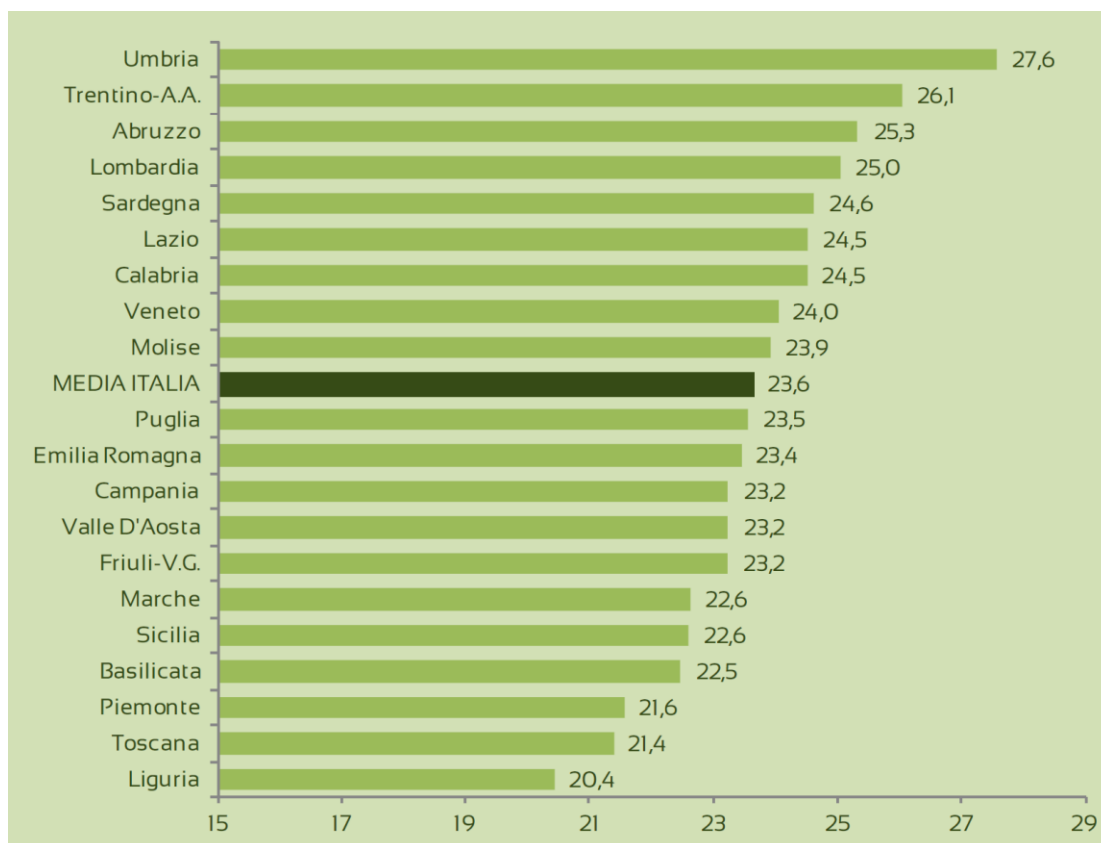


Figure 14 Share of companies that have invested in environmental goods and services sectors over the period 2009 to 2012 by Italian region (Source: *Fondazione Symbola – Unioncamere, 2012*)

Within this framework, from GREECO's perspective the most relevant sectors are:

- (Renewable) Energy production
- Green Research and Eco-innovation

3.2 Short overview of key green economy sectors in Puglia

(Renewable) Energy production:

Since the early 1990s, Puglia has been a net exporter of electricity to the rest of the country and its regional labour market is well endowed with specific skills in energy production. In this regard, Puglia's universities and national research centres are specialised in energy and the region has specific demonstration processes launched by the national government in the field of concentrated solar power (CSP).

Besides, Puglia is the leading region in Italy in renewable energy (RE) production⁹. In 2011 its total installed capacity was 1.3 GW for wind, almost 1 GW for photovoltaic energy (PV) and 0.14 GW for biomass and waste energy, which respectively represent 21%, 17% and 9% of the national totals (OECD 2012).

In addition, renewable energy production in Puglia is in line with the priorities defined by the 2007-2013 ERDF Operational Programme for the region. This OP explicitly foresees

⁹ <http://www.solarserver.com/solar-magazine/solar-news/current/2011/kw37/italy-becomes-the-worlds-largest-pv-market-gse-announces-installation-of-65-gw-in-2011-expects-12-gw-by-the-end-of-the-year.html>

increasing the amount of energy produced from renewable resources. That is why this sector has been selected for GREECO research.

Green Research and Eco-innovation:

Puglia is one of the least innovative Italian regions. However, in recent year it has progressed both in terms of innovation capacity and of awareness raising.

Total regional EPO filings accounted to the modest figure of 39.8 over the period 2000-08. However, EPO filings grew by 13.5% over the period considered: a much higher rate than the Italian and EU average (respectively, 3.1% and 0.9%) (RIM 2011). EPO filings accounted for 0.01% filings per thousand inhabitants and they are concentrated in two main technological fields: low-tech (33.8) and transport (22.6) (Ibid.).

Along these lines, even if Gross Expenditure in Research and Development (GERD)¹⁰ as a share of GDP is still below the Italian average (0.77% in Puglia, 1.26% in Italy, in 2010), it has grown was faster than both the Italian average and the EU average. It is remarkable the increase of 20% occurred between 2005 and 2007. However, in the context of the economic crisis, both this trend has slowed down.

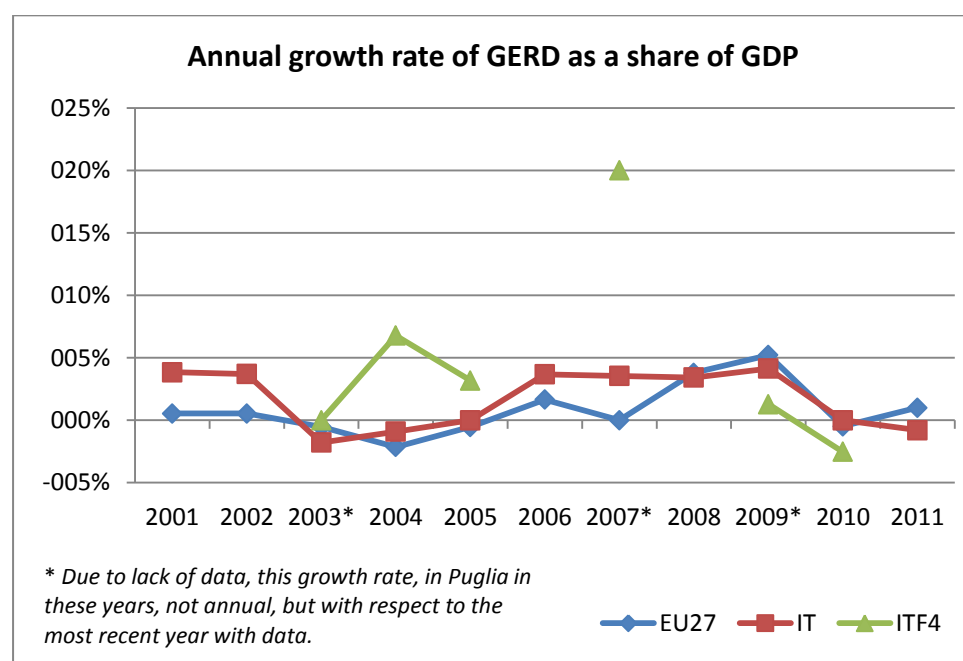


Figure 15 Annual growth rate of GERD as a share of GDP for EU27, Italy and Puglia in the 2001-2011 period. Source: Eurostat(rd_e_gerdreg).

Over the last years, in addition to the Puglia Regional Operational Programme ERDF 2007-2013, and the subsequent Framework Programme Agreement Framework Programme Agreement - National Operational Programme (NOP) "Research and Competitiveness" Puglia 2007-2013, in 2009 the Regional strategy for research and innovation in Puglia was published. This strategy has been developed with the support of ARTI (Regional Agency for Technology and Innovation). In this regard, it should be highlighted that since 2005, three organisations supporting innovation in Puglia have been set up: ARTI, Pugliasviluppo and InnovaPuglia. Furthermore, Puglia has recently presented its RIS 3 Strategy (Strategy for Smart Specialization).

¹⁰ Gross domestic expenditure on R&D (GERD) is consequently composed of: Business enterprise expenditure on R&D (BERD), Higher Education expenditure on R&D (HERD), Government expenditure on R&D (GOVERD) and Private Non-profit expenditure on R&D (PNPRD).

Against this backdrop, and considering the key role that green research and eco-innovation can play to leverage green growth potentials, this sector has been considered of particular relevance for GREECO research within this case study.

Nonetheless, it is also worth mentioning a recent and highly relevant cooperation project between the regions of Puglia and Emilia-Romagna and China: RENEWAL. This project, managed by ARTI on behalf of the Puglia region, was run from May 2011 to December 2012 and focused on three green economy sectors: environmental protection, renewable energy and sustainable building. The green building sector might well experience a consistent expansion in the years to come. Notwithstanding the fact that Puglia region has witnessed a net loss of employment in that sector in recent times, just as in many other European regions have, it has to be acknowledged that according to Puglia estimates relying on ENEA data¹¹ the potential market of the sustainable construction sector could reach a value of 8 billion euros in 2019. Currently, this sector is reviewing its strategy to grow in line with sustainable development, focusing on new techniques, eco-compatible materials and the recovery of the territory and buildings.

¹¹ http://www.arti.puglia.it/fileadmin/user_files/download/PUG_IST__ING_CIN_corretto_copia_OK.pdf

3.3 Interrelations among selected sectors

Firstly, the above selected sectors, that is to say, Energy and Green Research and Eco-Innovation, are linked by the 2007-2013 ERDF Operational Programme for Puglia. This Programme is made up of 8 priorities:

1. Promotion and dissemination of research and innovation for competitiveness.
2. Sustainable and efficient use of environmental and energy resources for development.
3. Social inclusion and services to enhance the quality of life and the attractiveness of the region.
4. Promoting the potential of natural and cultural resources to improve the attractiveness and development of the region.
5. Networks and mobility links.
6. Competitiveness of productive systems and employment.
7. Competitiveness and attractiveness of cities and urban systems.
8. Governance, institutional capacity and competitive and efficient markets.

Table 3 Selected sectors and their relation with the 2007-2013 ERDF Operational Programme for Puglia.

Sector	1	2	3	4	5	6	7	8
(Renewable) Energy Production		D						
Green Research & Eco-innovation	D	S						

* D: stands for Direct, S: stands for: Support

In addition, the expected impacts of the ERDF Operational Programme for Puglia, are fully aligned with the expected outputs of green economic development: economic growth, employment growth, and decrease of environmental depletion:

BOX 2: Objectives and Expected impacts of the ERDF Operational Programme for Puglia:

Objectives:

- enhancing the attractiveness of the region, by improving accessibility, guaranteeing the quality of its services and by safeguarding the potential of the environment;
- promoting innovation, entrepreneurship and development of the knowledge economy and also by promoting specialisation and productive districts;
- creating increased conditions of well-being and social inclusion.

Expected Impacts:

- A growth rate in GDP between 2.4 and 3.1% (average annual percentage variation in real terms).
- A growth rate in employment which will reach a level of between 48.6 and 50%.
- Reduction in greenhouse gases, in particular CO₂, is estimated at around 6.5%, as a result of improved public transport, with the accent on rail transport and a subsequent reduction in the use of cars. This will also be achieved through a steady increase in the production of renewable energies.

In addition to this connection through the ERDF Operational Programme for Puglia, other linkages between the sectors may be observed. For instance, Puglia is the leading region in Italy with regard to renewable energy production. This leading role is supported by local research and development centres (i.e. Green Research & Eco-innovation organizations),

which are specialized in renewable forms of energy production and transfer. In Puglia, the research activities on the energy topic are carried out at the four Public Universities (the University of Bari, the Polytechnic of Bari, the University of Foggia and the University of Salento), but also at both private (e.g. ENEL, FIAT, Ansaldo) and at local offices of public research centres, namely ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), CNR (National Research Council), CRA (National Council for Agricultural Research and Experimentation) (ARTI 2013). Through a questionnaire collected from about 500 Apulian actors operating in the energy sector, ARTI calculated that, in 2008, in Apulia about 441 researchers operated on the following themes: wind energy, solar energy, biomasses/biofuels, energy efficiency solutions, combustion processes/new fuels/cogeneration. About half of researchers (244) belong to public structures (Universities and local offices of National research organizations), and the remaining (197) work for private companies (ibid.). In addition, the DITNE (National District for Energy Technologies) created in 2008, is the cornerstone of the energy strategy of Puglia and since 2012 and also leads the recently created Energy Cluster.

Besides, in the context of transforming regional industry and making it more competitive, the RIS 3 strategy fosters changes in the value chains by supporting the innovation demand of local companies. This need for transformation provides the interrelation between the Green Research & Eco-innovation and Manufacture sectors. Moreover, in Puglia, the presence of large-scale manufacturing activities and the specialization in electricity production, and subsequent availability of skills, has had a positive influence in the regional capacity to specialize in the renewable energy sector (OECD 2011).

However, the development of solar and wind farms has an impact in the landscape of Puglia and hence, it may potentially have an impact in Tourism. Even if no conflict has been detected yet, it is a fact that renewable energy deployment may change land use and in doing so, transform landscape.

4 Sectors relevant for the Green Economy in Puglia

4.1 Energy production

4.1.1 Performance of the Energy sector¹²

The electric service in Puglia is strongly connected to the initiatives of the Società Meridionale di Elettricità (SME) and of its subsidiary Società Generale Pugliese di Elettricità. The latter was set up in 1912, with regard to the plan of developing the Sila hydroelectric potentials. Since the beginning it was clear that the energy that could be produced by the plants in Sila needed a consumption increase in the nearby regions starting with Puglia, a region with large and medium cities and an agricultural territory in full development, especially in the provinces of Bari and Foggia.

The progressive industrialization of the region led ENEL to install two large plants in Brindisi and to upgrade the one in Taranto. The plants in Brindisi, situated near a large harbor, have a particularly high production (the Federico II power plant is one of the largest in Europe) and technological importance.

¹² The OECD stated the lack of data on Renewable Energy employment.

BOX 3: Enel Group Coal Power Plant (Federico II):

Built in 1991, the Federico II Coal Power Plant of Brindisi, with a power of 2640 MW, it is the largest power plant in Italy and one of the largest coal power plants in Europe. It consists of 4 thermoelectric units with a power of 660 MW each. The constructions of large thermoelectric power plants, made marginal the transfer of hydroelectric energy between Puglia and Calabria, Campania and Abruzzo, even if the landscape is still characterized by old and new power lines.

Its size also makes it the largest single source of CO₂ emissions of Italy. For this reason, Enel is investing in energy efficiency and environmental protection measures (clean coal). In 2012 Enel has laid the first foundation stone to begin construction works on the coal storage domes at the Federico II power plant in Brindisi. In this regard, this plant has also been chosen to test out Octavius, the FP7 project that aims at enhancing carbon capture and storage processes.

As aforementioned, Puglia is specialized in electricity (energy) production; first only from traditional sources, then both from traditional and renewable sources. With a total production of 34 786 GWh and regional demand of only 17 394 GWh (2010), Puglia is a net exporter of electricity to the rest of the country (OECD 2012). Around 11% of this energy production comes from renewable sources, namely wind and solar (GSE 2010).

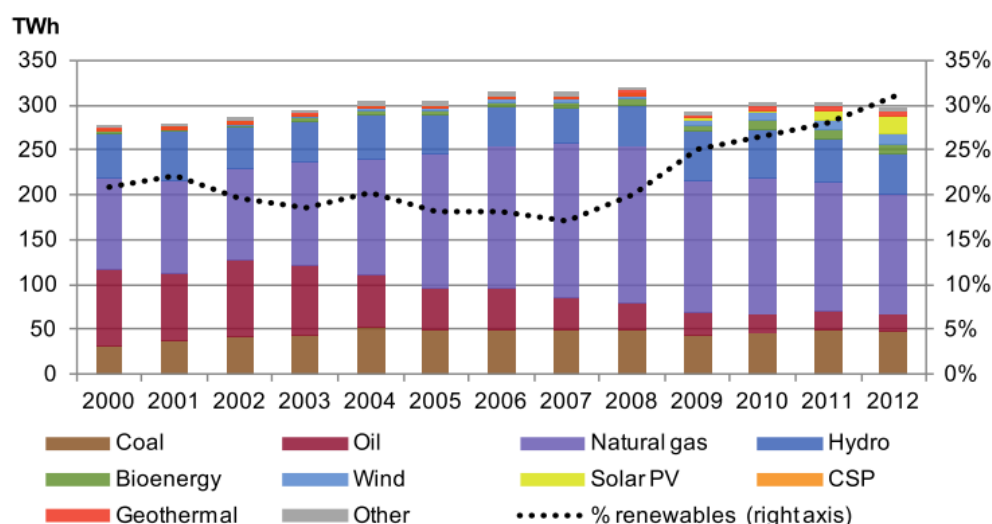


Figure 16 Italy power generation by source and renewable share of total power generation. (Source: IEA 2013)

Puglia started specializing in the renewable energy production in 2005 and to date it accounts for 20% of the national total of photovoltaic (PV) electricity generation, which turns it into the region with the highest generation, and almost 23% of the national total of wind power, only behind Sicilia (GSE 2011).

Table 4 Renewable energy generation in Puglia (GWh) (Source GSE (2010) and GSE (2011))

	2010	2011
Photovoltaic	412 (22% of total)	2096 (20% of total)
Wind power	2103 (23% of total)	2256 (22.8% of total)

The increase in PV generation between 2010 and 2011 was remarkable not only for Puglia, but for Italy as a whole (see figure below).

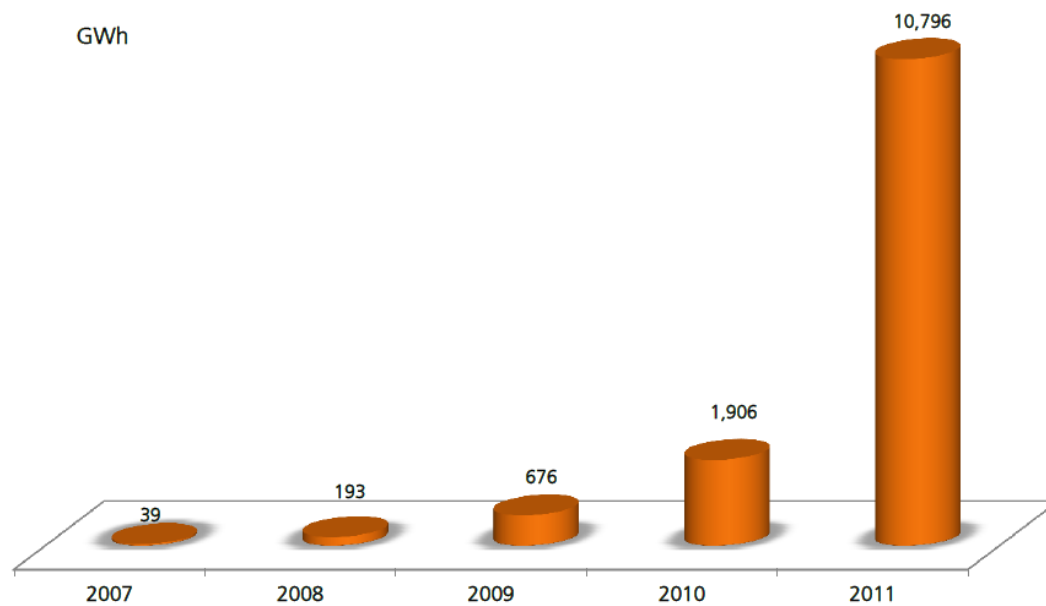


Figure 17 Photovoltaic generation in Italy (Source: GSE (2011)).

Nonetheless, it is worth noticing that Puglia due to its above average sun irradiance (around 1700 KWh/m²) and the simplification of the authorisation process for the installation of PVs, it outperforms other Italian regions in PV energy generation. In this regard, the greatest capacity of PV has been installed in Puglia, with 1.68 GW in 17,800 plants. It is followed by Lombardi and Veneto in terms of capacity and plants and by Emilia-Romagna in terms of generation (1092 GWh in 2011). In 2012 the Puglian city of Lecce completed the largest PV rooftop plant in Southern Italy, with 3 MW of installed power at the parking area of the University campus. When it comes to wind power, the wind resources are spatially sensitive. Therefore, wind power farms are located in the north of Puglia, in the mountains of Foggia, where the wind speed average is 6-7 m/s. Wind power installations have remained quite stable between 2010 and 2011 but they almost doubled between 2008 and 2009 (OECD 2012).

Finally, the Puglia's specialisation in agriculture could provide substantial residues for biomass that could be used as feedstock for the production of energy. Nonetheless, despite of its potential, biomass is still marginal within the national energy profile: 2825 MW gross maximum capacity of bioenergy power plants, versus 12773 of PV or 6936 of wind. The Regional Programme for Energy and Environment (PEAR) has a specific focus on the local supply chain for biomass production, but despite a few small installations since 2010, total capacity was still just 139 MW in 2011.

4.1.2 Key milestones

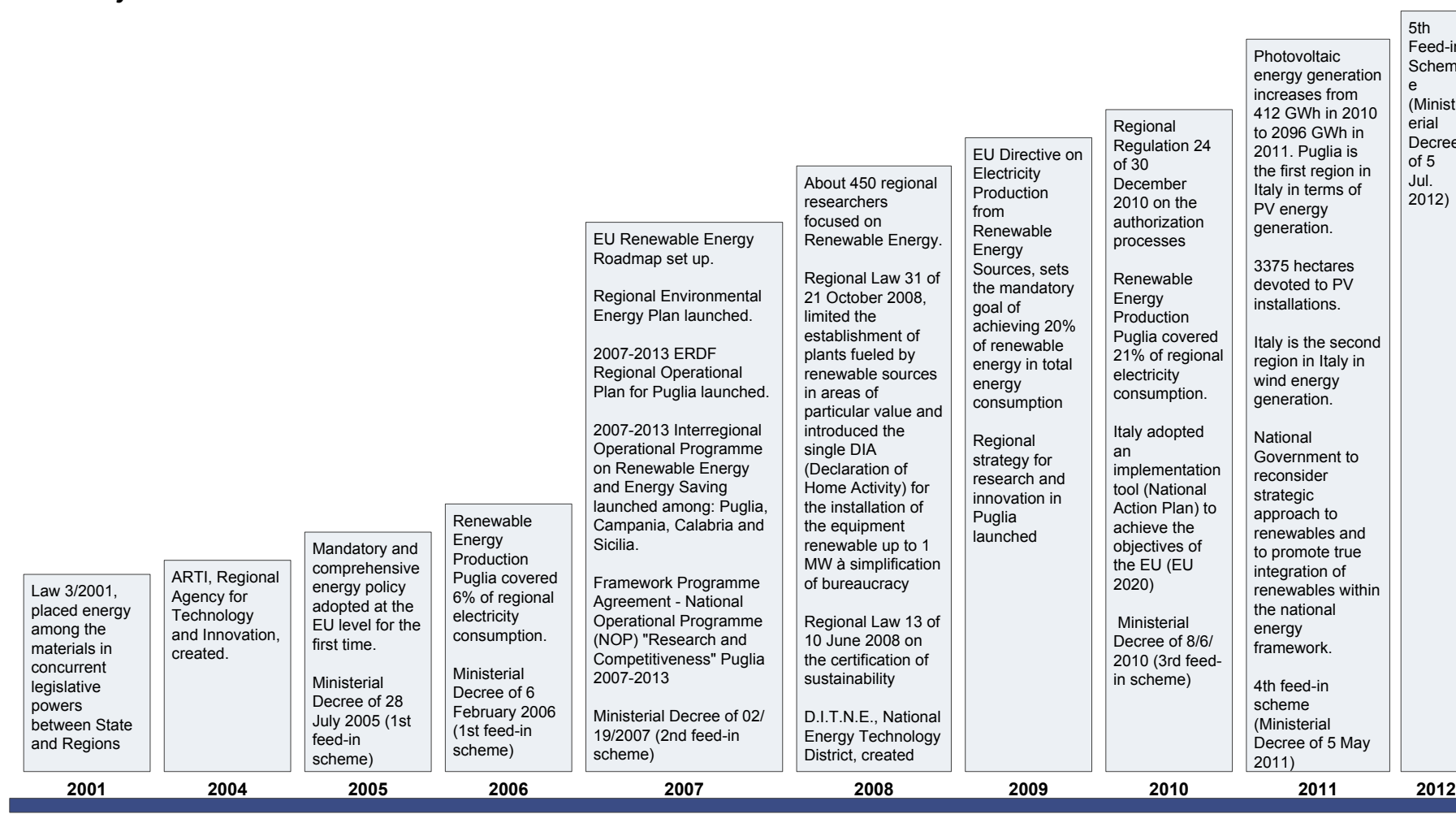


Figure 18 Key milestones of Energy Production sector in Puglia.

4.1.3 Drivers, barriers and enabling conditions

Please note that the since the role played by ERDF funding is cross-sectoral, it will be jointly analysed in section “6. Horizontal drivers and enablers”.

4.1.3.1 Policies as a driver

European environmental policies, as well as, national and regional policies, are supporting the process of transition to a green economy in Puglia. The initial driver for Puglia to invest in renewable energy was to lower CO2 emissions¹³, while creating jobs.

4.1.3.1.1 *EU policy*

The European Union influences Puglia's policy mainly through the environmental and agricultural policies, as well as the Cohesion Funds.

From the green economy perspective, there are two headline policies that characterise the sector: Energy 2020 (meant as a translation of Europe 2020 in terms of energy) and the ‘Climate and energy package,’ which was agreed by the European Parliament and Council in December 2008. Today, these policy goals are accompanied by the 20-20-20 targets; namely 20% of final energy consumption from RES, 20% reduction on GHG emissions and 20% reduction in primary energy consumption by 2020. Italy's national target for renewable energy is set at 17% of its gross final energy consumption for 2020 (from 5.2% in 2005).

In 2005 a mandatory and comprehensive energy policy was adopted for the first time at the EU level. Then, in 2006, the European Commission issued the Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy, which asked Member States to implement a European energy policy. In 2007 this Green Paper was translated into mandatory shares of RE production in the form of the Renewable Energy Roadmap; these were further increased in 2009 in the EU's Directive on Electricity Production from Renewable Energy Sources (the so-called RES Directive). In addition, in 2009 the Lisbon Treaty removed formal barriers and established shared competences between the EU and its Member States in energy policy. Nonetheless, Member States are ultimately responsible for their national energy mix and exploitation of indigenous energy resources.

This policy framework set the ground for the upsurge of RES in Italy, and in Puglia in particular.

4.1.3.1.2 *National policy*

The national government is the interface between regional governments and EU strategy and also sets energy tariffs and defines the overall energy strategy. In addition, it has jurisdiction over environmental issues and shares responsibility for energy policy with regional governments and it implements EU directives aimed at improving environmental performance.

With regard to Renewable Energy policy, several ministries are involved (the Ministry of the Economy, the Ministry of Economic Development, the Ministry of Agriculture, Forestry and Food, and the Ministry of the Environment). Hence, making the interaction and coordination at the national level complex and giving relevance to the role of the regional government.

Until recently, the central government lacked an integrated approach to RE, supporting deployment merely to fulfil EU requirements rather than to foster a true paradigm shift in the national energy model. But then, in 2010, Italy adopted an implementation tool (National Action Plan) to achieve the objectives EU 2020 Objectives.

¹³ Puglia's CO2 emissions are second only to the most industrialised region in Italy.

Table 5 Italy main targets and support policies for renewable electricity (*Source: IEA 2013*)

Targets and quotas	Support scheme	Other support
<p>NES: Target of 35% to 38% (120 TWh to 130 TWh) renewables in electricity consumption by 2020.</p> <p>National Renewable Energy Action Plan: Binding target: 17% of renewable energy in gross final energy consumption in 2020. Indicative 2020 split: 26.4% of electricity production from renewable sources provided by: 17.8 GW hydropower; 0.92 GW geothermal; 8 GW solar PV; 0.6 GW CSP; 3 MW ocean; 12 GW wind onshore; 0.68 GW wind offshore.</p> <p>Updated target for solar PV: 23 GW of solar PV by 2016.</p>	<p>Conto Energia (Ministerial Decree July 2012): Capped FITs for solar PV installations with premiums for electricity consumed on-site. Special tariffs are also provided for concentrating solar PV and other types of non-conventional installations.</p> <p>Support schemes for non-solar PV plants (Ministerial Decree July 2012): Applies from 1 January 2013. Provides:</p> <ul style="list-style-type: none"> • a FIT system for RES installations with a capacity ≤ 1MW; • a sliding FIP for RES plants with a capacity > 1MW. <p>Three ways to access the incentives:</p> <ul style="list-style-type: none"> • directly for very small plants and other marginal cases (<i>i.e.</i> wind ≤ 60 kW; hydro ≤ 50 kW-250 kW; biogas ≤ 100 kW; biomass ≤ 200 kW); • application to a registry for wind, bioenergy and wave/tidal plants under 5 MW, for hydropower under 10 MW, for geothermal under 20 MW; • auction for wind and bioenergy plants over 5 MW, hydropower over 10 MW, geothermal over 20 MW. <p>The decree provides annual capacity caps to access to auctions and registries.</p> <p>Renewable energy quota obligation: Electricity producers and importers are required to supply a certain share of renewable power. Compliance with quota can be also satisfied by means of tradable green certificates. The system is to phase-out from 2013-15 with existing plants converted to a FIT.</p> <p>Net metering for distributed systems: applies to renewable systems up to 200 kW and is provided as an alternative to support mechanisms described above.</p>	<p>Grid access and priority dispatch: Grid connection and priority dispatch are guaranteed by the TSO/DSOs.</p>

A non-exhaustive overview of the measures adopted by Italy to promote renewable energy, may be summarised as follows:

- Priority access of RES and CHP energy to the grid
- Obligation for large electricity generators and importer to feed a given proportion of new RES into the power system (sanctions available in case of non-compliance)
- Tradable green certificates
- Feed-in-tariffs

Support for biomass comes through the CAP, which is managed by the central and regional government.

4.1.3.1.3 Regional policy

Italian regions have acquired important functions in the field of renewable energy with the reform of Title V of the Constitution, implemented by Law 3/2001, which has placed energy among the materials in concurrent legislative powers between the State and the Regions.

The regions have in fact gained a central role due to their administrative functions on the authorization aspects of plants powered by renewable sources. This role was important because, in the absence of national guidelines, some regions have introduced autonomous regulations regarding the location of the plants and lightening of the national bureaucratic procedures.

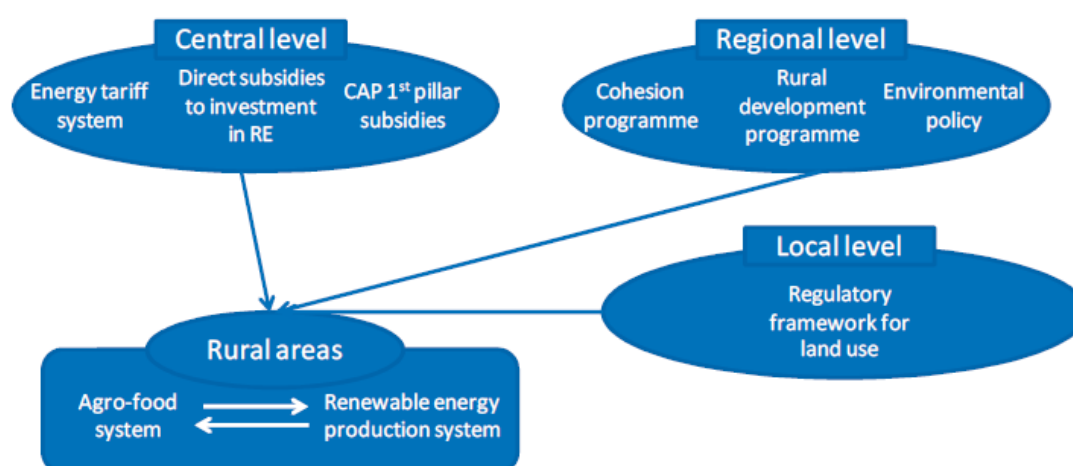


Figure 19 Renewable Energy Policy Framework in Puglia. (Source: OECD 2012)

Since 2007 the Puglia region has its own independent Regional Environmental Energy Plan (PEAR), which is currently under revision. In addition to making a survey of the energy needs of the territory, this plan shall formulate guidelines for 2016. In particular:

- reduction of CO₂ emissions into the atmosphere;
- energy efficiency;
- development of energy production from renewable sources (solar, wind, biomass, geothermal, etc.).
- clear opposition to the development of energy from nuclear sources

After the adoption of this plan, Puglia has developed a broad legislative and regulatory framework that has fostered the rapid development of renewable energy sources. The key milestone of this process was Regional Law 31 of 21 October 2008, which limited the establishment of plants fuelled by renewable sources in areas of particular value and introduced the single DIA (Declaration of Home Activity) for the installation of the equipment renewable up to 1 MW, while the national law provided lower thresholds: 60 kW for wind power, 20 kW for PV, 200 kW for biomass. This resulted in a simplification of the bureaucracy for authorization of PV plants and spurred their deployment.

Other recent policy milestones may be summarized as follows:

- Regional Regulation 24 of 30 December 2010 on the authorization processes;
- Regional Law 13 of 10 June 2008 on the certification of sustainability
- POI energy, Interregional Operational Programme between 4 convergence regions of Southern Italy: Puglia, Campania, Calabria and Sicily. The program has a budget of around € 1.6 billion and finances actions to improve energy efficiency and development of renewable energy sources and supply chains.
- Puglia, through the ERDF OP 2007-2013, promoted, with more than 100 million euro, energy saving and the use of solar in public buildings, non-residential.

4.1.3.2 Institutions as an internal driver

Puglia has a remarkable landscape of institutions operating in the field of renewable energy, which have contributed to and supported the large deployment of renewable energy, PV in special. These institutions range from both public and private research institutions, Technology Districts, to public organizations. The most prominent are briefly introduced below.

Research institutions:

In Puglia, the research activities on the energy topic are carried out at the four Public Universities (the University of Bari, the Polytechnic of Bari, the University of Foggia and the University of Salento), but also at both private (e.g. ENEL, FIAT, Ansaldo) and at local offices of public research centres, namely ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), CNR (National Research Council), CRA (National Council for Agricultural Research and Experimentation). However, it should be noted that the expertise of Puglia in renewable energy relies stronger in project engineering, installation and maintenance know-how, rather than on technology development and research (ARTI 2013).

Technology Districts: D.I.T.N.E.:

In addition, the DITNE (National District for Energy Technologies) created in 2008, is the cornerstone of the energy strategy of Puglia and since 2012 and also leads the recently created Energy Cluster.

D.I.T.N.E was set up in Brindisi, with the aim to strengthen contact and scientific cooperation between research and industrial institutions, strengthen competitiveness of the region, international wide visibility and encourage quantitative growth of business and skills in the field of renewable energy and production of electricity. Its main goals are:

DiTNE, in synergy with DHITECH (for hi-tech) in Lecce, District of Mechatronics of Bari and DARE of Foggia (for food) , will help to create in Apulia, a public-private research network and technology transfer in the field of energy. DiTNE promotes development and production of new components, constituting in this way, a strong and strategic choice for sustainable industrialization at the national level as well as in the Apulian Region.

Public organizations:

→ARTI:

In 2004 the Puglia Regional Government created ARTI- Regional Agency for Technology and Innovation, a public body, whose primary mission is that of promoting and consolidating the regional system of innovation. The Agency is particularly committed in: (i) supporting the regional government in programming and managing the regional policies on innovation and competitiveness; (ii) supporting innovation in companies; facilitating the international networking of all the regional research and innovation actors; (iii) fostering the dialogue between industry and science and between science and the society.

ARTI is located in the Tecnopolis Science and Technology Park near the Apulia Region chief town of Bari and has an internal staff of 14 qualified employees plus a network of senior consultants working on a project base. The energy sector is one in which ARTI is particularly active and engaged, having supported the Regional Administration in many feasibility studies and pilot initiatives. ARTI staff has a longstanding experience in managing and leading EU projects (VI and VII Framework Program, Interreg IVC, MED etc.).

The ARTI activity is structured around elaboration of knowledge, promotion of innovative activities and knowledge diffusion.

→GSE

GSE is the state-owned company which promotes and supports renewable energy sources (RES) in Italy.

In particular, GSE fosters sustainable development by providing support for renewable electricity (RES-E) generation and by taking actions to build awareness of environmentally-efficient energy uses.

The granting of support by GSE requires a careful technical assessment of the plants in order to check their compliance with sector-specific legislation.

In the past few years, GSE's technical responsibilities for qualification and verification of plants have been extended to the assessment of the architectural integration of solar photovoltaic (PV) plants into buildings and to energy efficiency.

The GSE main activities are:

- Support for renewable electricity
- Purchase of electricity from producers & resale in the market
- Support to institutions and to the Public Administration
- Promotion of renewables and of the renewable-energy industry
- Virtual gas storage and CO2 auctions
- Promotion of energy efficiency and thermal energy

Other relevant stakeholders in innovation policy are InnovaPuglia and PugliaSviluppo. InnovaPuglia is an intermediate body that was created in 2008 from the merger between the science and technology park Tecnopolis Srl and FinPuglia SpA, the regional financial agency. InnovaPuglia provides technical support to the regional administration in the implementation of regional technological investment programmes and is the public agency for ICT. PugliaSviluppo is another intermediate body that provides support to the regional administration in defining and implementing initiatives in support of innovation and internalization of local productive systems.

4.1.3.3 Financing as an internal driver

The production of energy from renewable sources is promoted in Italy by a complex system of incentives the most prominent being the Fee-in-scheme, or Feed-in-tariff (FIT) and the "Quota system" (ARTI 2013).

The feed-in scheme is the programme which grants incentives for electricity generated by photovoltaic (PV) plants connected to the grid. Italy introduced this support scheme in 2005 (Ministerial Decree of 28 July 2005 – 1st feed-in scheme). FITs originally supported both small off-grid PV installations of up to 20 kW, and larger grid-connected PV installations of up to 1 MW, providing operators investing in RE with a bonus on top of the market electricity price for a period of 20 years (IEA, 2009). The scheme is now regulated by the Ministerial Decree of 6 July 2012 (5th feed-in scheme). Under the FIT scheme, PV plants with a minimum capacity of 1 kW and connected to the grid may benefit from a feed-in tariff, which is based on the electricity produced. The tariff differs depending on the capacity and type of plant and is granted over a period of 20 years.

The 5th feed-in scheme will cease to have effect 30 calendar days after reaching an indicative cumulative cost of incentives of € 6.7 billion per year (including costs allocated for plants whose position in the relevant Registries does not exceed the applicable cost limit). Based on the data reported by GSE through its Photovoltaic counter, AEEG will determine the cessation of the scheme. However, the 4th feed-in scheme will continue to apply to certain parties. Unlike the previous support schemes, the 5th feed-in scheme grants an all-inclusive feed-in tariff to the share of net electricity injected into the grid and a premium tariff to the share of net electricity consumed on site.

The availability of FITs, especially in their early version, fostered an exponential growth in PV fields (Gazheli and Di Corato, 2011). This caused a speculative PV bubble generating large longterm rents for investors and correspondingly high energy costs for consumers (OECD

2012), which lead to a redesign of the incentives in 2011 and 2012, by gradual reduction in FITs for PV.

When it comes to the “Quota system”, it foresees the establishment of a share of energy for renewable sources to be fed to the grid. This share may be provided by direct production or by acquiring the equivalent share of RES from a third party, by means the “green certificates”¹⁴.

4.1.3.4 Description of problems and barriers encountered within sector

In spite of the presence of these large power plants, the region’s energy sector suffers from distribution bottlenecks, with a regional grid density of 64 m/km² compared to a national average of 73 (OECD 2012). These bottlenecks and the inability of the current grid to handle the intermittent renewable energy will need to be tackled, so that it does not become a barrier to further development (ARTI 2013).

Further barriers to economic development of renewable energy vary according to the technology considered. However, in general they include: high investment costs, lack of information, costs not yet competitive when compared to traditional solutions, policy uncertainties, bureaucratic burdens, economic crisis, lack of transparency, indirect incentives to traditional systems, etc. (ARTI 2013).

An example of such policy uncertainties is the suboptimal coordination of national and regional agendas with regard to feed in schemes. Puglia put forward a very much simplified authorization process in 2008, which led to a very large deployment of PV fields. However, it also raised the cost of the RE policy in Italy, and forced the national government to redesign incentives, creating uncertainty on the national market and impinging upon the coherent deployment of RE all over the country (OECD 2012). The 5th feed-in scheme has set an upper limit for incentives of 6.7 billion euro per year. Nonetheless, some voices have raised concerns on the potential negative effect this limitation of financial support may have on PV deployment.

In addition, mitigation of and adaptation to climate change is an emerging topic in the region and will surely require an optimal incentive systems to address it more effectively than in the past (ARTI 2013).

Finally, the impact of renewable energy production on rural economies, such as that of Puglia, has not lived up to expectations (OECD 2012). Besides, even if renewable energy policies aimed at taking into account linkages and synergies with other regional policies, in the end, it has mostly been implemented as a sectoral stand-alone policy. Therefore, a challenge for the coming years will be to better integrate and coordinate policy efforts to maximise impact.

4.1.4 Spatial dimensions of the development of the sector

As aforementioned, wind resources are spatially sensitive. Therefore, wind power farms are located in the north of Puglia, in the mountains of Foggia, where the wind speed average is 6-7 m/s.

Due to its above average sun irradiance (around 1700 KWh/m²) and the simplification of the authorisation process for the installation of PVs, Puglia outperforms other Italian regions in PV energy generation. In this regard, large-scale PV deployment has used valuable agricultural land, 3375 hectares by 2011 (GSE 2011).

In such a context, PV fields and large wind farms have partially modified the rural landscape in Puglia, which is a touristic asset. However, Puglia’s regional renewable energy strategy has evolved over time and learnt by doing. E.g.

- Puglia is one of the first regions to adopt landscape guidelines.
- When local communities opposed to large wind farms in Foggia or PV fields in agricultural land, the regional government changed its approach towards more sustainable patterns (OECD 2012).

¹⁴ Tradable green certificates (tradable commodities proving that a certain volume of electricity is generated from new RES) are used to fulfil the RES-E obligation.

In addition, municipalities have the competence to give permission for wind farms based on the municipality's spatial plan. It should be noted that this plan, following regional criteria, should exclude protected areas, urban areas, high value landscape areas, etc., as well as, provide guidelines with regard to plant density, territorial distribution, and availability of infrastructure such as roads and electricity networks (ibid).

4.1.5 Potential for development of the sector

Puglia has been specialized in electricity (energy) production for decades; first only from traditional sources, then both from traditional and renewable sources. Between 2000 and 2010, the main objective of Puglia has been to increase the renewable energy production.

According to ARTI (2013), for the next decade, the main challenges will be to (i) manage wisely the diffusion of green technologies and to (ii) grasp the opportunity to combine the progress in renewable energy generation and local economic development.

The new specifications of the National Energy bill (Conto Energia Nazionale) and the new regional authorization procedures have strongly discouraged the emergence of large fields of PV arrays, rewarding instead solutions integrated in the urban environment. Further initiatives, yet in a preliminary stage, should develop in this direction, towards smart grids.

As to the combination of progress in renewable energy generation and local economic development, it refers both to the employment potential of the renewable industry (one of the few growing industries in this economic phase) and to use the levers of energy efficiency to reduce the energy costs in the region, by making the production system and local government more efficient. Taking into account the public buildings only (social housing, hospitals, schools, etc.) there is a potential energy consumption saving of 38%, equivalent to a reduction of € 220 million in energy costs each year.

To manage and seize the opportunities of this new scenario, some priorities are highlighted:

- Activate initiatives for greater sharing of energy choices in the territory, strengthening the institutional and administrative capacity of the municipalities, assisting in the development of local environmental energy plans, supporting participative models of citizen involvement on the basis of methodologies already developed at European level.
- Support solutions that will safeguard the natural environment, encouraging the use of installations with low visual impact, such as offshore wind, and the repowering of outdated equipment, to minimize the surface area occupied by new plants.
- Promote interventions that enhance urban design, with redevelopment construction and use of micro-generation electrical and thermal plants integrated through construction practices shared with designers and architects, through the dissemination of practices known as urban greening.
- Strengthen policies on innovation and research, which are preconditions for developing a market of skills and a supply chain able to compete in a highly globalized market such as energy.
- Finally, to focus on energy efficiency as a priority not only in terms of construction, but also in transport and production processes in order to reduce the cost of energy and make regional systems more competitive.

The next steps in Italy and Puglia towards the achievement of the 20-20-20 goal, should not be regarded as a burden or an opportunity for speculation with public funds at this time of economic crisis. On the contrary, it is to be considered a real paradigm shift in technology that will affect consumption patterns, mobility and economic development, with the ultimate goal of improving the quality of life of people.

4.2 Green Research and Eco-innovation

4.2.1 Performance of the sector

Over the last years, Puglia's innovation performance has increased by almost 27 %¹⁵, it is one position higher in the ranking of Italian innovative regions and has evolved from a modest-high innovator in 2009 (RIS 2012) to a moderate-medium innovator in 2011 (Ibid.). However, despite this progress and increasing awareness and capacity, Puglia remains one of the least innovative Italian regions.

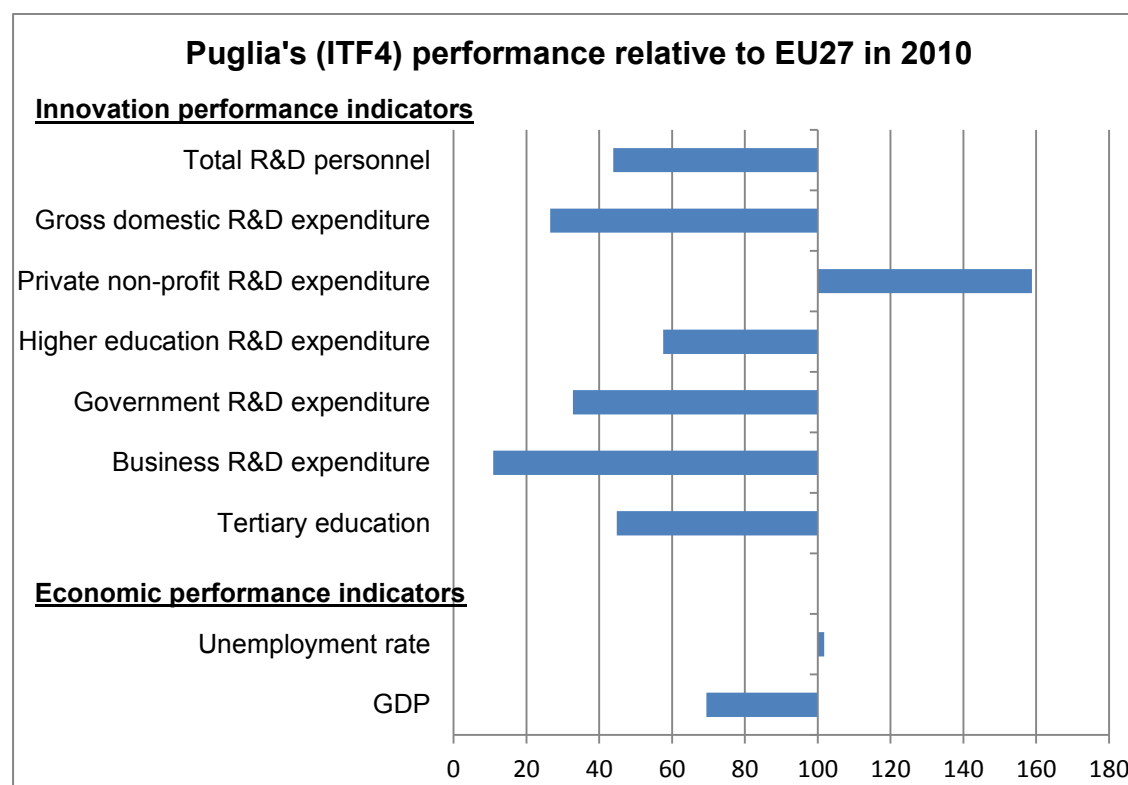


Figure 20 Economic and innovation performance of Puglia in 2010 in relation to EU27.

Source: Eurostat data: *nama_r_e2gdp*, *lfst_r_lfu3pers*, *edat_lfse*, *rd_e_gerdreg*, *demo_r_d2jan*, *rd_p_persreg*.

Along these lines (see figure above), Puglia is below EU27 average innovation performance in terms of R&D personnel, total R&D expenditure and population with tertiary education. Nonetheless, it is remarkable that when it comes to private non-profit R&D expenditure, it is well above the EU 27 average.

With regard to education, the average share of economically active population with tertiary education is low in Italy (15.7% in 2012) and even lower in Puglia (12.4 % in 2012). However, this share is growing a little faster than the EU27 share, 44% and 42% respectively over the 2000-2012 period. Despite efforts in improving human capital in Puglia, the region still has a lower than average share of people involved in life-long learning (4.9% of the regional population, vs. 5.6% and 8.5% in EU over the period 2002-2008) and as the growth rate is similar to EU values (35%) much investment needs being done in this area. One potential reason for this is the fact that job opportunities are limited in the region, forcing young graduates to emigrate from Puglia to Northern Italian regions and abroad in search for work (RIM 2011).

Total regional EPO filings accounted to the modest figure of 39.8 over the period 2000-08. However, EPO filings grew by 13.5% over the period considered: a much higher rate than the

¹⁵ Cluster Observatory data of the Regional Innovation Scoreboard (RIS) for 2007 and 2011.

Italian and EU average (respectively, 3.1% and 0.9%) (RIM 2011). EPO filings accounted for 0.01% filings per thousand inhabitants and they are concentrated in two main technological fields: low-tech (33.8) and transport (22.6) (Ibid.).

Besides, even if Gross Expenditure in Research and Development (GERD)¹⁶ as a share of GDP is still below the Italian average (0.77% in Puglia, 1.26% in Italy, in 2010), it has grown faster than both the Italian average and the EU average. It is remarkable the increase of 20% occurred between 2005 and 2007. However, in the context of the economic crisis, this trend has slowed down. Since Puglia under-industrialised with respect to the rest of Italy (especially compared to the northern regions), the contribution of BERD (see footnote) to GERD is more limited than in other Italian regions. In 2010, BERD accounted for 134.9 m€ and corresponded to around 25% of GERD. However, when it comes to PNPRD (see footnote), Puglia is among the top-three Italian regions in terms of private non-profit R&D expenditure. This could be explained by the regional innovation system and the myriad of research and innovation institutions created over the last decades. See below the structure of the Regional Innovation System (RIS).

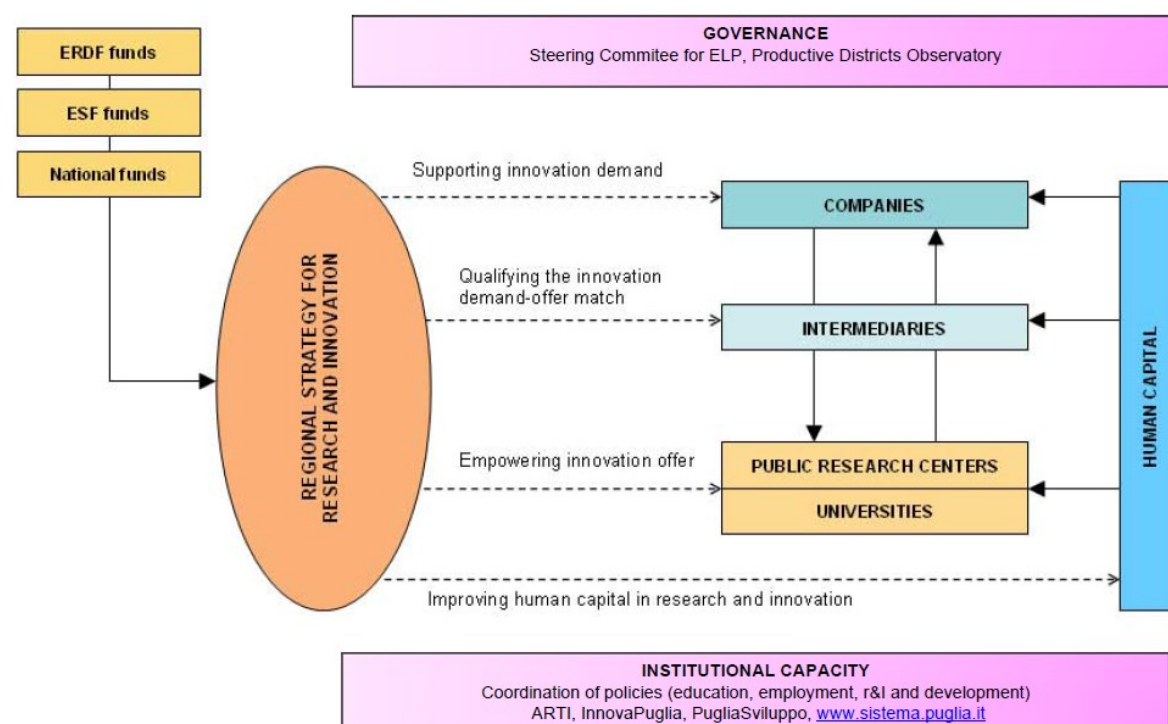


Figure 21 Regional RIS. Source: Agrimi et al. (2012).

With regard to the Government expenditure in environmental protection, the annual growth trend has also slowed down and even started to decrease from 2009 onwards (see figure below)¹⁷. Nonetheless, the environmental protection expenditure (EPE) in 2010 in Puglia, doubles that of 2004. Therefore, it is to be expected that when the economic crisis is over the annual increase in EPE will be resumed.

¹⁶ Gross domestic expenditure on R&D (GERD) is composed of: Business enterprise expenditure on R&D (BERD), Higher Education expenditure on R&D (HERD), Government expenditure on R&D (GOVERD) and Private Non-profit expenditure on R&D (PNPRD).

¹⁷ The most recent data are those for 2010 (accessed 17th July 2013).

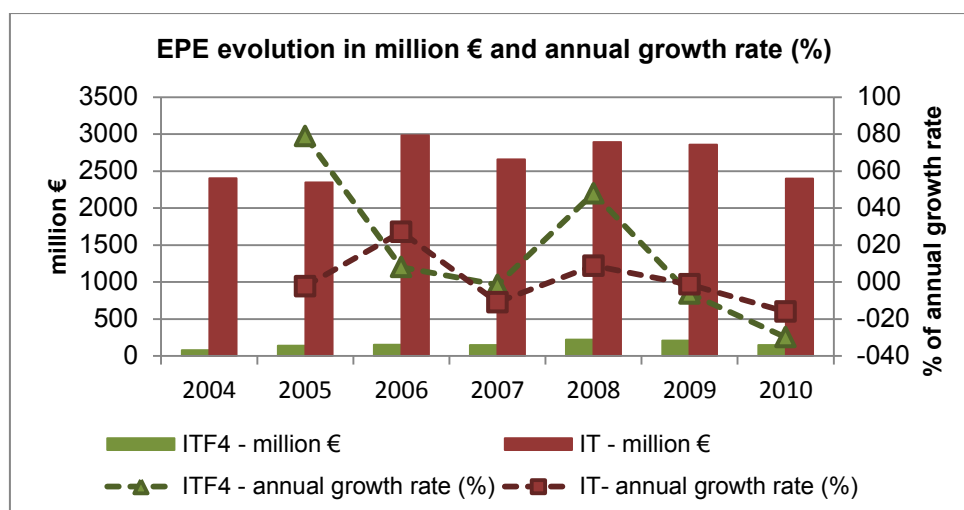


Figure 22 Environmental Protection Expenditure of General Government in Italy and Puglia over the 2004-2010 period. *Source: Eurostat (env_ac_exp4r2).*

As aforesaid (section 4.1.3), Puglia has a good public research infrastructure and thus, research activities are primarily concentrated in research institutions and focused on basic research. Over the years, technological districts have bloomed and are aimed at boosting innovation in the region. In this context, technological districts are territorial aggregations included to network and linked to the international environment, able to support local industrial growth based on innovation and research. Generally the creation of a technological district tends to accelerate scientific and technological cooperation between leading companies and public actors in positions of excellence in a particular technology area.

- DHITECH – High Tech
- DARE – Technologies for Agrofood
- MEDIS – Mechatronics
- DiTNE – Renewable Energies

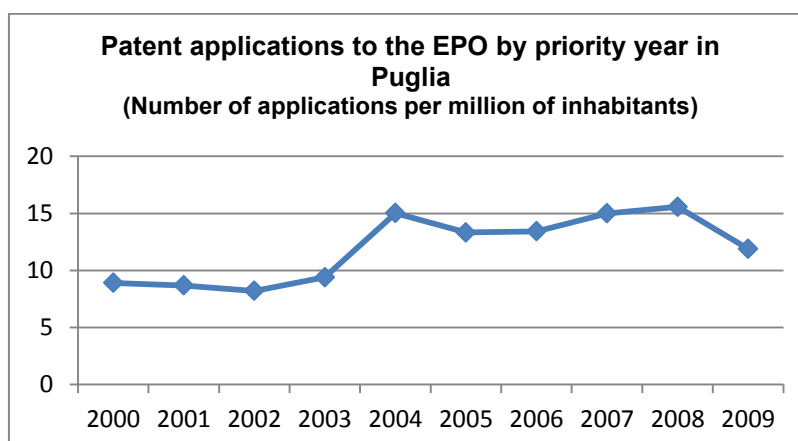


Figure 23 Patent applications to the EPO over the 2000-2009 period in Puglia (number of applications per million of inhabitants). *Source: Eurostat (tgs00040).*

In addition, as shown in the chart above, since the steps forward in relation to the RIS in the early 2000s (see key milestones), the number of patents filed in Puglia has increased remarkably. Then, from 2005 onwards, the number of patents has been steadily growing, until the slowdown in 2009, in the context of the economic crisis.

In summary, even if Puglia's performance is still below EU27, it has made remarkable progress in recent years. That is why, this is one of the key sectors for the green transition in Puglia. However, this sector faces the challenge of recovery in the context of the economic crisis.

4.2.2 Key milestones

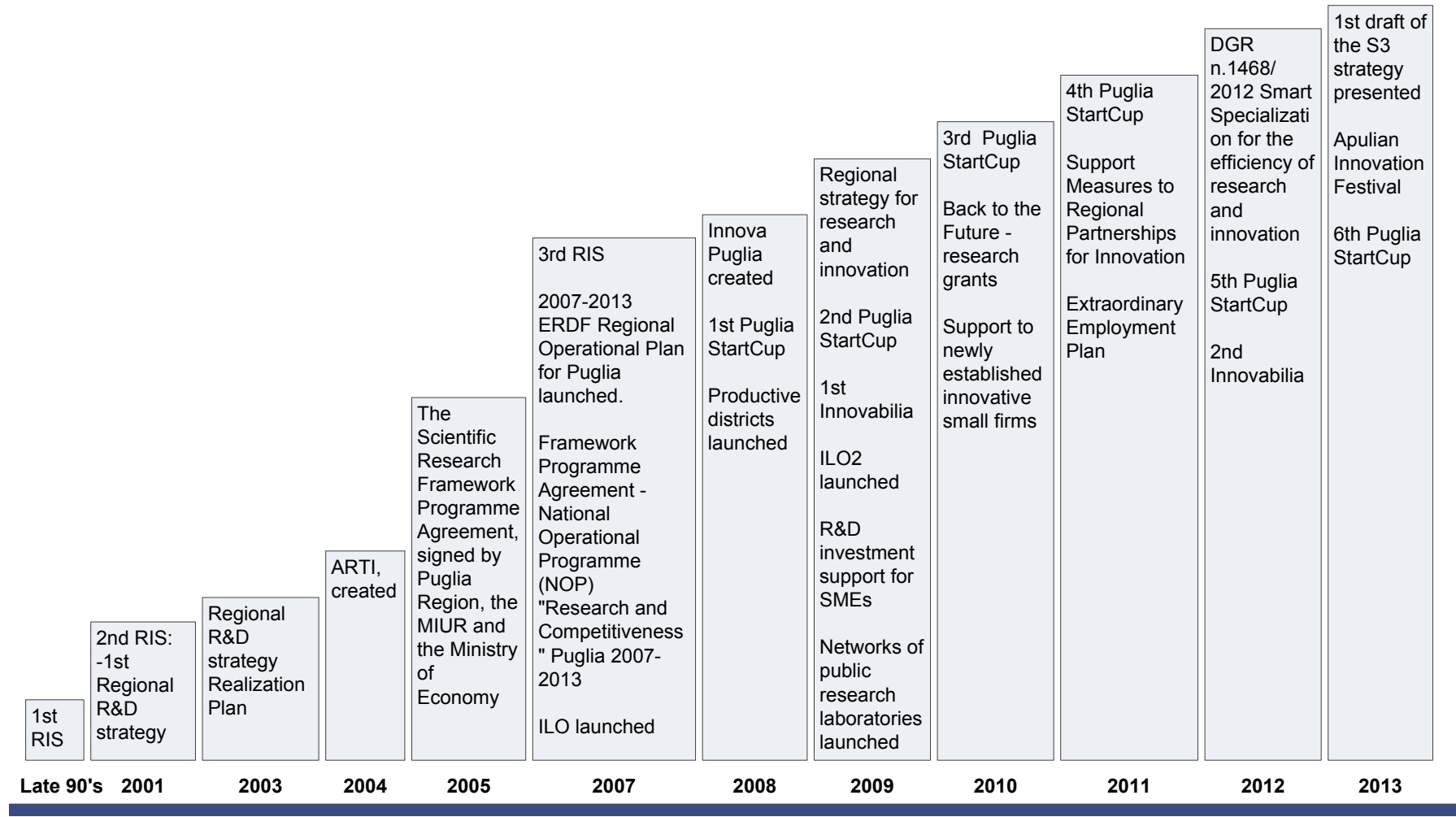


Figure 24 Key milestones of the Innovation sector in Puglia.

4.2.3 Drivers, barriers and enabling conditions

Please note that the since the role played by ERDF funding is cross-sectoral, it will be jointly analysed in section “6. Horizontal drivers and enablers”.

4.2.3.1 Policies as a driver

In Puglia, the regional administration has shown increasing awareness about innovation and research policy over the last decades.

The first Regional Innovation Strategy (RIS) was launched in the late 90's and was based on three broad lines of action:

- To qualify and specialize the regional innovation infrastructure;
- To support the Demand / Supply match of Innovation services;
- To support North - South and Euro-Mediterranean partnerships.

With the second RIS (2000-2006), the first regional R&D strategy was established (in 2001), alongside with the associated Realization Plan (2003). The objective of this primer strategy was to create a regional innovation district fostering integration between regional scientific institutions and enterprises. This involved the creation / consolidation of regional innovation poles. It should be noted that, this initiative was promoted with the support of EC funds (the Regional Operational Programme – ROP-) and National funds and relied on five pillars:

- support to demand for innovation;
- support to regional research activity;
- networking between local research institutions,
- other institutions and businesses;
- creation of a permanent regional observatory on innovation; investment in human capital.

As part of its innovation strategy in 2004 the regional government created the regional agency for technology and innovation (ARTI). In addition, in 2005 the Scientific Research Framework Programme Agreement (APQ) was signed by Puglia Region, the MIUR and the Ministry of Economy (Agrimi et al. 2012). A new version of this Framework Programme Agreement was published in 2009, in the context of the third RIS (2007-2013). This APQ implements the objectives set by the National Operational Programme - Research and Competitiveness and its initiatives are co-funded by the ERDF. The APQ Puglia amounts to €405m and has four actions¹⁸:

- Science-technology areas transforming the regional economy (€150m): To strengthen the research and innovation potential in the innovative sectors of Aerospace/Aviation, Environment, ICT, biotechnologies and life sciences, agro-food.
- Networks strengthening the science-technology regional potential (€225m): To support the innovative potential of clusters of universities, research centres, enterprises, promoting the development of high-tech value chains and technological districts.
- Improvement of science-technology infrastructures (€20m): To support research infrastructures in the areas of advanced materials and agro-food industry.
- Programmatic integration of the regional system (€10m): To support the adoption of best practices developed in other regions (awareness raising, consultancies, etc).

Furthermore, in 2009 an updated regional strategy for research and innovation in Puglia was published. This strategy set the priorities and long-term objectives for Puglia to support innovation activity, the main goals being:

- growth of innovation demand
- productivity growth
- increase the technological content of regional products and services
- increase internationalisation of regional value chains

¹⁸ <http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/index.cfm?q=p.policy&n=14743>

This strategy put forward that regional policy should consider the twofold composition of Apulian industrial activities: traditional versus high tech industries. Hence, it aims to increase the value added and productivity in traditional sectors and attract foreign investment and promote start-ups in the high tech sector.

STRENGTHS <ul style="list-style-type: none"> ■ Technological excellence poles ■ original R&I sectors ■ services providers ■ Growth of informatics and research industry ■ Growing demand for innovative services in the field of culture + environment ■ Regional propulsive role in realizing policies for innovation development 	WEAKNESSES <ul style="list-style-type: none"> ■ Weak link between universities and enterprises ■ Low demand for real services ■ Reduced R&D expense,
THREATS <p>Lack of financial instruments for medium term investments in R&D</p>	OPPORTUNITIES <p>Investments made in information society related domains</p>

Figure 25 SWOT of the regional system of innovation. *Source: Agrimi et al. 2012.*

Along these lines, regional policies in Puglia have had three macro objectives (Regione Puglia, 2012):

- Strengthen of attractiveness of the region.
- Promote of innovation, entrepreneurship and of the development of knowledge economy.
- Create better conditions for employability, cohesion and social inclusion.

Table 6 Promotion of innovation, entrepreneurship and of the development of knowledge economy 2004-2008 (*Source: ibid*)

	Puglia	Southern Italy	Italy
Expenditure in R&D	+ 37,51%	+ 22,39%	+ 26,57%
R&D Employed	+ 52,19%	+ 31,22%	+ 45,72%

Currently the regional government in Puglia is making a huge effort for coordinating the various regional policies towards the common goal of promoting employment through innovation and human capital. This coordination process involves harmonizing the myriad of regional policies addressing youth entrepreneurship through creativity, the new set of policies set up in the light of Europe 2020 (regional innovation partnership, innovation services, living labs, pre commercial procurement, etc.) and social innovation and corporate social responsibility policies (Agrimi 2013). The two most important mechanisms are the Progetto Gaia (the Gaia Project) and the inter-departmental working group created for the Piano Straordinario per il Lavoro 2011 (Extraordinary Employment Plan 2011). The 'Progetto Gaia' was introduced in 2008 (regional law n. 161/2008, 22nd February) and reformed completely the internal organisation of regional departments. Before the implementation of the project the regional governance system was organised in offices dealing with specific economic sectors (agriculture, craftsmanship, etc.). The project introduced 'super-managers' that supervise 8 general directorates promoting the horizontal integration of common issues across different economic sectors. This reform greatly improved the understanding of common needs and the integration between different policy initiatives.

Besides, a more effective monitoring system is also being implemented and Puglia is moving towards a policy impact assessment (see figure below).

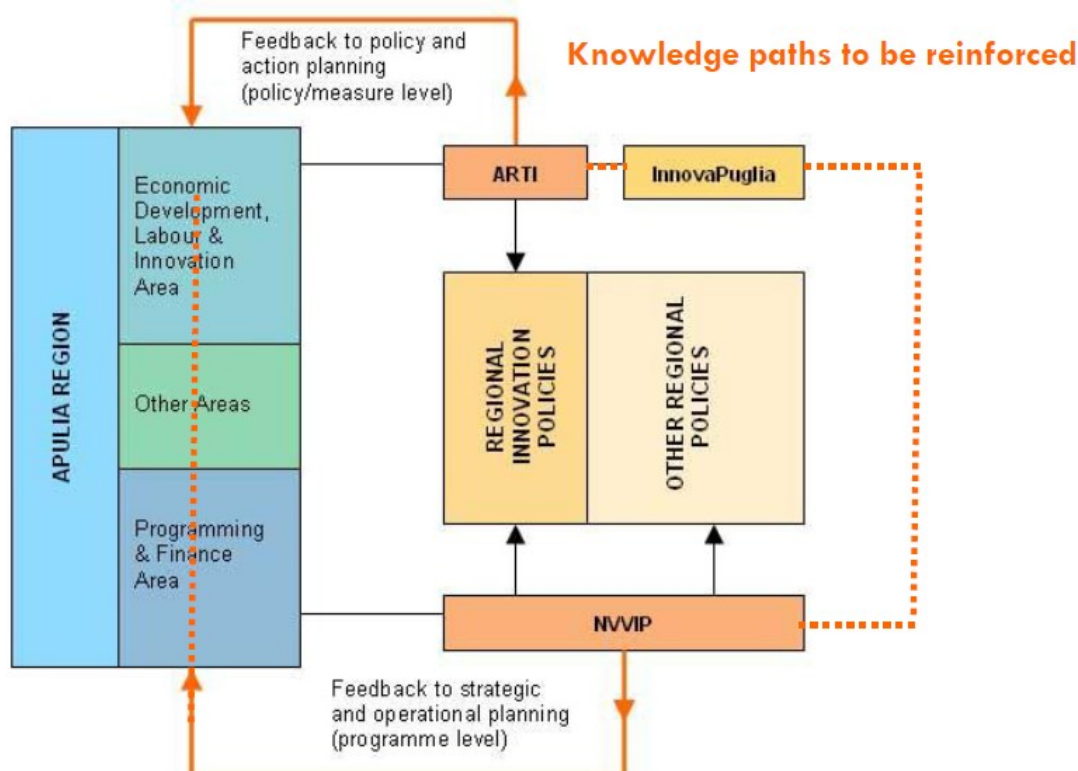


Figure 26 Regional Evaluation and Monitoring System *Source: Agrimi 2013.*

Finally, the next major policy step in Puglia in the innovation sector is to elaborate a Research and Innovation Strategy for Smart Specialisation (RIS³).

BOX 4: A brief chronology of the steps towards RIS3 in Puglia:

- Peer review with S3 Platform - May 2012, Sevilla (IPST)
- The political start up of the RIS3 (DGR 1468/2012) – July 2012
- An Open Scenario Building Process has been launched (with Formez) – since September 2012
- An auto-evaluation exercise with Stakeholders in February 2013
- First draft of the RIS3 strategy to be presented in the Apulian innovation festival (23 may 2013) (Casalino et al. 2013) → Smart Puglia
- Session on “Key enabling technologies and smart specialisation for a competitive Italy” in Bari, 23th of July 2013

The Smart Puglia strategy¹⁹ aims to deliver a knowledge based economy, focusing on transport and mobility, creative industries, tourism, environment, energy but also responding to social inclusion, education and electronic government. It relies on innovation oriented analysis of the knowledge and value chains methodology. It is worth noticing that this strategy has been designed by stakeholder engagement and progress and outputs will be monitored. Hence, the evolution of those variables that the RIS3 aims to influence will be evaluated, as well as, the expected changes to the regional baseline.

The Economic development, Labour and Innovation policies Department will ensure the coordination with the other regional areas and with the regional council and ARTI, InnovaPuglia and PugliaSviluppo are the implementing bodies (*Agrimi 2013*).

¹⁹ Smart Puglia video: http://www.sistema.puglia.it/portal/page/portal/datipuglia/smart_puglia

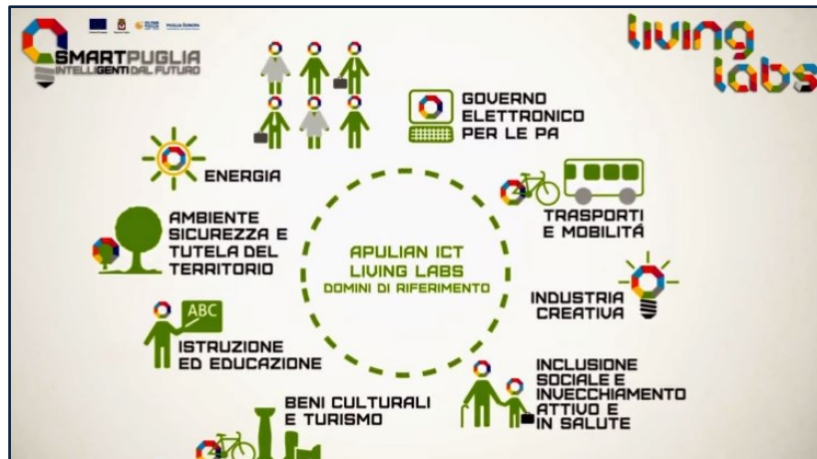


Figure 27 Smart Puglia: an overview.

4.2.3.2 *Institutions as an internal driver*

Puglia, despite its size, has (Agrimi 2013):

- 5 Universities
- More than 30 Public and Private Research Centers
- 6 Inter-regional Centres of Competence
- 3 Enterprise Incubators
- 7 Industrial Liaison Offices
- 21 Public Research Infrastructures
- 6 Technological Districts
- 17 Productive Districts

all of which have contributed to a rapid evolution of the regional innovation system from the early 90's to nowadays. In the following section the most influential actors are dealt with in more detail.

Universities

In Puglia, university research, is very focused on the energy topic, in fact, four of the five universities in Puglia are very active in the field: the University of Bari, the Polytechnic of Bari, the University of Foggia and the University of Salento.

Research Institutions

As aforementioned, in Puglia there are local offices of public research centres, namely ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), CNR (National Research Council), CRA (National Council for Agricultural Research and Experimentation), which carry out relevant research activities (ARTI 2013). All in all, there are more than 30 public and private research centres in the region.

Industrial Liaison Offices

The Regional Industrial Liaison Offices network (ILO) is fostered by ARTI and has the overarching goal of establishing best practices in knowledge transfer and valorization of research results, in doing so it promotes networks between regional research institutions. The initiative also involves the following organisations, the University of Bari, the Polytechnic University of Bari, the Universities of Foggia, Lecce, LUM Jean Monnet and the public research organisations CNR and ENEA.

Moreover, ILO aims to reinforce collaboration between research organisations and regional businesses, focusing on commercial exploitation of academic intellectual property and the promotion and consolidation of start-ups and spin-offs (spin-offs, patents, Technology Transfer agreements, individual innovations needs, etc.).

In summary, ILO is oriented to:

- increase commercial valorisation of the results of scientific research
- bridge public research institutions to local demand for innovation
- reinforce the professional capacity of ILO staff
- diffuse the innovative results of the regional innovation system

Technological districts

Technological Districts are bodies that foster the integration between the knowledge resources of universities and research centers and the innovation needs of companies in specific technological areas. They have been formally created in some Italian regions, including Apulia, thanks to a State-Regions agreement. In Puglia six technological districts have been set up:

- DHITECH: Nanotech
- DARE: Technologies for Agrofood
- MEDIS: Mechatronics
- DiTNE: Renewable Energies
- HBio: Human Health
- DAP: Aerospace

Productive Districts (RL 23/2007)

Productive districts are characterized by a high concentration of enterprises (SMEs in especial) each of which is integrated into a production system with relevant expertise and active support to local economy and by the presence of social and institutional stakeholders with capacities for supporting the local economy. The policy objectives of such productive districts are mainly three: (1) increase the competitiveness and innovative capacity in order to expand their presence in foreign markets; (2) enhance the creation and development of new enterprises particularly in activities with high technological content; (3) intensify the processes of size growth.

According to ARTI (2013) it is remarkable the role of DIPAR (i.e. Regional Productive District for Environment and Reuse) for managing the scarce water resources of Puglia. DIPAR brings together the Apulian Aqueduct, the Regional Water Authority, the Water Research Institute of the National Research Council (IRSA-CNR), the Mediterranean Agronomic Institute (IAMB-CIHEAM), four universities, one polytechnic, and 193 industries / SMEs. It is this extensive network of experts what enables Puglia to distribute water to its inhabitants although it lacks superficial water and developed research on innovative water treatment technologies, suitable for this water scarcity context.

Other relevant stakeholders in innovation policy are ARTI, InnovaPuglia and PugliaSviluppo.

ARTI was created in 2005 to promote and consolidate the RIS and to foster the collaboration between public and private actors. The creation of ARTI represented an important step in the organisation and coordination of innovation policy. Since its creation, IT started collecting statistical data carrying out studies that support the regional administration in the design and implementation of regional policy. After the evaluation of initiatives ARTI gives feedback to the regional administration for improvement of future calls of initiatives and their design (RIM 2011). Nowadays, ARTI is also very active in the RIS³ strategy.

InnovaPuglia is an intermediate body that was created in 2008 from the merger between the science and technology park Tecnopolis Srl and FinPuglia SpA, the regional financial agency. InnovaPuglia provides technical support to the regional administration in the implementation of regional technological investment programmes and is the public agency for ICT.

PugliaSviluppo is another intermediate body that provides support to the regional administration in defining and implementing initiatives in support of innovation and internalization of local productive systems.

4.2.3.3 *Financing as an internal driver*

Puglia has a wide variety of innovation support measures, the most prominent of which may be summarized in the table below. This array of measures has enabled Puglia to progress steadily in the path towards smart specialization.

Table 7 Overview of current financial support to innovation in Puglia (*Source: RIM 2011*)

Measure	Budget	Organisation responsible
Productive districts	No financial resources allocated, strategic initiative aimed at regulating cluster formation.	Regione Puglia Area Politiche per lo sviluppo, il Lavoro, e l'Innovazione – Servizio ricerca e competitività.
Technological district in the agro-food	No financial resources have been provided till now. The preliminary funds to startup the District were provided to agrofood SMEs following a public call for projects.	D.A.Re. was implemented within the Framework Programme Agreement between the Puglia Region, the Ministry of Research and the Ministry of Economics.
Regional Centres for food technologies (Ce.R.T.A.)	€ 9.118.479 (70% funded by MIUR)	Technological district in the agro-food sector (D.A.Re) Academic institutions Food industry consortia
ILO Puglia (Industrial Liaison Offices)	€8,000,000 (2009-2010)	ARTI - Agenzia Regionale per la Tecnologia e l'Innovazione
Support to SMEs and consortia	€88,000,000 (ERDF co-funded)	Regione Puglia Area Politiche per lo sviluppo, il Lavoro, e l'Innovazione – Servizio Ricerca e competitività.
Regional Framework Contracts	€ 156,000,000 (ERDF cofunded)	Regione Puglia Area Politiche per lo sviluppo, il Lavoro, e l'Innovazione – Servizio Ricerca e competitività.
Support to micro and small enterprises for initial investments -Titolo II	€ 99,500,000 (ERDF cofunded)	Regione Puglia Area Politiche per lo sviluppo, il Lavoro, e l'Innovazione – Servizio Ricerca e competitività.
Support to SMEs networks for the diffusion of ICT	€ 10,000,000 (ERDF cofunded)	Regione Puglia Area Politiche per lo sviluppo, il Lavoro, e l'Innovazione – Servizio Ricerca e competitività.

4.2.3.4 Description of problems and barriers encountered within sector

Even if progress has been made in Puglia's innovation performance and it has good policy coverage, a wide array of support measures and a holistic network of stakeholders, it still lags behind in innovation performance and economic behaviour when compared to other European regions. The increasing availability of researchers and research productivity is not sufficient to bridge the gap between knowledge centres and industry. Besides, even if firm's awareness towards innovation is increasing, the demand for innovation is still low. This combined with the fact, that still the majority of industrial activity is focused on traditional activities, leads to a productivity that needs increasing, for instance by means of employing ICT. In summary, the main barriers or weaknesses of Puglia to be overcome to deliver a smart and specialized region are (Agrimi 2013):

- Weak link between universities and enterprises
- Low demand for real services
- High specialization in traditional industry
- Low propensity to technological transfer towards the final product
- Families low propensity to innovative services consumption (culture, leisure)
- Moderate presence of young people with medium-high level education
- Public Administration inadequate instrumental endowment
- Reduced R&D expense, with the aim of pursuing an important economic growth

4.2.4 **Spatial dimensions of the development of the sector**

(Eco)innovation performance relies heavily on the relationships between firms, science infrastructure, producers and users, inter-firms and last but not least between firms and the wider institutional environment. Furthermore, such mechanisms are strongly influenced by spatial proximity. That is to say, the level of innovative capability of a region influences directly the ways in which technology is diffused within the region. Moreover, research has shown that knowledge production tends to be geographically concentrated. (Annoni et al., 2010). In addition, research has shown that innovation tends to be higher in core-regions and systematically lower in lagging regions. The reasons for this are twofold. On the input side, core regions provide greater potential diversity of specialization opportunities and greater potential home market. On the output side, they provide higher level of connectedness. (McCann et al. 2011). These conclusions are coherent with the results of the Regional Innovation Scoreboard (henceforth RIS 2012), according to which moderate and modest innovators would be located mainly in Eastern and Southern Europe, that is to say: Puglia.

In summary, geographical proximity matters in business performance and in the creation of innovation (e.g. it leads to different types of spillovers, productivity and efficiency, but most importantly knowledge spillovers). In addition, at the regional level, geographical concentrations of linked industries, like clusters, are of increasing importance. In fact, regional clusters could lead to higher competitiveness for firms that are part of them due to the higher innovation rate and availability of specialized resources (Annoni et al., 2010). Along these lines, Puglia has promoted such knowledge spillovers by means of the setting up of Productive Districts, Technology Districts and various sectoral clusters:



Figure 28 Apulian Cluster overview (Source: Agrimi 2013).

4.2.5 Potential for development of the sector

As aforementioned, Puglia is still lagging behind in terms of innovation performance and it has barriers to overcome if it is to become a smart and specialized region. Nonetheless, the progress made over the last two decades in terms of (i) setting up the policy and legislative documents, (ii) setting up the institutions, such as ARTI, (iii) raising awareness, (iv) facilitating stakeholder interaction (clusters, technology and productive districts), etc. all of which is needed to a functioning and efficient regional innovation system, has been remarkable. Still, some challenges remain, namely:

- Increasing demand for innovation and university-industry linkages
- Improving productivity
- Promotion of research-based initiatives.

However, Puglia is well prepared to face these challenges due to the relatively high number of young researchers, SME involvement and emerging new business. In addition the forthcoming Smart Puglia strategy, framed in the RIS³, will also contribute to definitely overcome these barriers.

5 Horizontal drivers and enablers

5.1 Cohesion Funds ERDF

The European Regional Development Fund (ERDF) contributes to the Regional Strategy for Research and Innovation in Puglia and accordingly co-funds some of its initiatives, through the Regional Operational Programme (ROP) for Puglia. This ROP was approved on 20th November 2007, the European Commission for the 2007-2013. The ROP is funded with €5.2m and resources are provided as follows: the EC 50% (through the ERDF amounts), the Italian government 35% and the regional administration the remaining 15%. The principal aim of the ROP is to promote full convergence of the regional economy in terms of growth and employment, while ensuring sustainability. To fulfill this aim it comprises three objectives:

1. Enhancing the attractiveness of the region in terms of accessibility, quality of services, environmental potential:
 - Improving structural supply
 - Offering a minimum set of basic collective services
 - Regenerating the environment
 - Improving the quality of urban life
 - Integrating local development
2. Promoting innovation, entrepreneurship and development of the knowledge economy (e.g. productive districts)
 - Supporting businesses' path in technological innovation, dimensional growth and internationalisation
 - Attracting new investments
3. Increasing well-being and social inclusion.
 - Training (initial training for skilled work, higher and further education, active policies of employment and continuous training)
 - Social inclusion and health

The expected impact of the ROP is the increase of GDP, growth in employment and greenhouse gases reduction. In order to deliver such impacts, the ROP identifies the following eight priority axes:

- Promotion and dissemination of research and innovation for competitiveness
- Sustainable and efficient use of environmental and energy resources for development
- Social inclusion and services to enhance the quality of life and the attractiveness of the region
- Promoting the potential of natural and cultural resources to improve the attractiveness and development of the region
- Networks and mobility links
- Competitiveness of productive systems and employment
- Competitiveness and attractiveness of cities and urban systems
- Governance, institutional capacity and competitive and efficient markets

Table 8 Breakdown of finances by priority axis.

Priority Axis	EU Investment	National Public Contribution	Total Public Contribution
Promotion and dissemination of research and innovation for competitiveness	290 500 000	290 500 000	581 000 000
Sustainable and efficient use of environmental and energy resources for development	454 000 000	454 000 000	908 000 000
Social inclusion and services to enhance the quality of life and the attractiveness of the region	285 000 000	285 000 000	570 000 000
Promoting the potential of natural and cultural resources to improve the attractiveness and development of the region	196 000 000	196 000 000	392 000 000
Networks and mobility links	525 000 000	525 000 000	1 050 000 000
Competitiveness of productive systems and employment	551 000 000	551 000 000	1 102 000 000
Competitiveness and attractiveness of cities and urban systems	260 000 000	260 000 000	520 000 000
Governance, institutional capacity and competitive and efficient markets	57 521 978	57 521 978	115 043 956
Total	2 619 021 978	2 619 021 978	5 238 043 956

Table 9 Breakdown of resources allocated by PIT (Integrated Territorial Project) in Puglia (*Source: Vecchi et al. 2011*).

PIT	PIT allocated financial resources	Financial resources committed by Public beneficiaris	% of financial commitments
PIT1 Tavoliere	68.161.374,31	38.083.153,16	56
PIT2 Nord Barese	78.759.972,52	69.446.632,78	88
PIT3 Bari	71.486.806,72	55.106.273,14	77
PIT4 Murgia	105.468.609,24	76.032.740,97	72
PIT5 Valle d'Itria	50.854.485,17	45.976.879,87	90
PIT6 Taranto	51.306.492,47	47.282.635,57	92
PIT7 Brindisi	44.879.304,25	39.537.146,52	88
PIT8 Jonico Salentina	89.806.717,00	48.456.450,98	54
PIT9 Salentino Leccese	50.285.424,21	47.050.286,27	94
PIT10 Monti Dauni	94.552.295,95	85.055.312,46	90
TOTAL	705.561.481,84	552.027.511,72	78,2

In terms of outputs and results of the initiatives co-funded with ERDF funds, the main achievements of the PIT (see table above for resource allocation) that could be directly related to the green economy have been in the fields of environmental protection and risk prevention, urban and rural regeneration, infrastructure improvement, creation of employment agencies and internationalization of local products and territorial marketing.

5.2 Italian Network Contracts

In recent years, a model of networking has taken shape in which universities, public and private research centres and other institutions collaborate in trying out new products and processes and promote the transfer of technologies. Nanotechnology, laser microprocessing, magnetic resonance and advance research techniques applied to energy, health, agriculture and food, aerospace, mechatronics – these are the main sectors at the centre of the new “Made in Apulia” research landscape. In this context, the four technological clusters based in Apulia also have a leading role: Dhitech for high-tech, D.A.Re, for agriculture and food, Medis for Mechatronics and Di.T.Ne for renewable energy.

Building on this networking structure, a relevant policy instrument that have been mentioned by some Italian reports as a ‘powerful accelerator’ (Fondazione Symbola – Unioncamere, 2012) for green transformation are the Network Contracts adopted in 2009 under the auspices of the Small Business Act (SBA). The Network Contracts were introduced in 2009 as a new tool that aims at enhancing collaboration among firms to increase their potential for innovation, research, and development. One of their main goals of Network Contracts is to overcome the typical lack of scale economies that characterise Small and Medium Enterprises (SMEs).

According to the abovementioned GreenItaly 2012 report Fondazione Symbola – Unioncamere, 2012), thanks to this programme, many companies have made investments in the green economy that would not have been made otherwise, considering the barriers that SMEs have to face when operating in isolation is such an uncertain context of operation.

Ten out of the eighty-seven ‘green’ Network contracts signed by Italian firms by mid- 2012 were located in Puglia, which is the most active region in the Mezzogiorno. Furthermore, these ten Puglian network contracts targeting investments on renewables, eco-efficiency, green building and related green activities, represent one third of all contracts signed within the territory at that point in time. This ratio, one of the highest among Italian regions, renders the idea of the strong focus that Puglian companies have put on the green economy.

6 Assessment of the regions’ potential to develop green economy in the future

As aforementioned, Puglia is still lagging behind in terms of innovation performance and it has barriers to overcome if it is to become a smart and specialized region. Nonetheless, the progress made over the last two decades and the forthcoming Smart Puglia strategy, framed in the RIS³, will contribute to enhance Puglia’s competitiveness.

Moreover, Puglia already has an outstanding performance in the renewable energy sector and the next steps towards the achievement of the 20-20-20 goal will represent an opportunity of future growth of the sector. Since it will promote a real paradigm shift in technology that will affect consumption patterns, mobility and economic.

Besides, green tourism is also likely to grow in the coming years. Over the last decade, the Puglia has become a major tourist destination in the Mediterranean area (it has nearly tripled its share in GDP between 2006 and 2011). Furthermore, alongside with Puglia’s mix of cultural and natural amenities, entrepreneurship and regional policies have also played an important role in fostering this sector. In such a context, it comes as no surprise the bloom of eco-friendly tourism accommodation and activities.

Despite past expansion, Puglia region still has quite large renewable energy potentials. ARTI (2013) considers that Renewable Energy Production is the most promising green sector in Puglia. According to this Agency, “the most promising technological options are represented by distributed and integrated biomass, wind and solar (thermal and photovoltaic) applications and sustainable building operations, due to (i) the collaboration between research and industry, (ii) the existence of specific professional expertise, (iii) the priorities identified by the national and Community financial support instruments, and (iv) in general, by the favourable environmental and climatic conditions of the Mediterranean Area”.

In turn, in a 2013 report the IEA forecasts that Italy's renewable capacity will grow by 12 GW over the period 2012 to 2018. Still, the IEA stresses that, despite generous incentives, which made renewable deployment economically attractive to date, will be gradually removed, Italy is likely to maintain attractiveness for some segments, particularly for PV. This sector's cumulative capacity would be around 24 GW by 2018, with annual capacity additions near 1-1.5 GW, a share of which will surely be generated within Puglia region. Finally, further opportunities are also expected to arise in dynamic sectors such as organic farming. Figures show that Italian agricultural sector, which is characterised by high quality standards and strong penetration of organic farming, has been able to react to the global crisis better than many other in the country, at least in the initial phases of the crisis. The Italian statistical office, Istat, reported the largest increase in the recruitment of new employees with a record increase of 10.1% over the same quarter of 2011, in sharp contrast with the general trend of employment. For the first time in more than ten years, it was registered an increase of young farmers, with a 4.2% increase in the number of new establishments.

Puglia is no exception to this general trend. Besides, the region has strong potentialities related to the biogeographic diversity of its territory. Acting together with the historical isolation of agrarian communities in the region, this geographic variety has given place to an astonishingly rich and assorted agricultural production. The region shelters more than a thousand local varieties of agricultural products, including 40 varieties of olive-trees, 60 varieties of grape and 189 varieties of almond, among hundreds of other varieties of fruits and orchard vegetables (Trotta, 2013). This diversity gives place to a vast range of top quality agricultural products that are consumed locally but also exported to other Italian regions and abroad.

Additionally, the transformation of such geographically-bound endowments into economic competitive advantages is at the core of the recently approved regional strategies for the region. In particular, the Piano Strategico Regionale 2007-2013 explicitly aims to transform these assets into revitalized economic engines for the Region. The combination of all these factors offer good foundations for an even stronger role of quality organic agricultural production in the years to come.

7 The road ahead: Transferability and conclusions

Puglia is an Italian NUTS 2 region, NUTS 2 region comprising the following NUTS 3 provinces: Foggia, Bari, Brindisi, Lecce and Taranto. It should be noted a new province, Arletta-Andria-Trani (BAT), was created in 2004. The latter is excluded from ESPON typologies. Due to its location it has access to the Ionian Sea and has a long coastline on the Adriatic Sea. According to ESPON typologies for NUTS3, Puglia has areas that are considered metropolitan, coastal, mountainous, border and in industrial transition.

Despite the slowdown in economic growth in the context of the Europe wide economic crisis, Puglia continues to develop its potential by fostering research and innovation. This investment in innovation is taking place not only in leading sectors, but also in traditional ones. At the moments new prospects are opening up for²⁰:

- the building industry, which is starting to concentrate on sustainability;
- renewable energy;
- transport, which is opening up to logistics and intermodality;
- agriculture, which is turning to new forms of organisation and distribution;
- manufacturing, which is specialising in innovative value chains;
- tourism, which is becoming less seasonal.

The Apulian experience in renewable energy (PV in especial) is often mentioned as a best practice and according to ARTI (2013) could be easily transferable to other regions with similar characteristics (e.g. sun irradiance).

BOX 5: Lessons learnt from Puglia's renewable energy (RE) implementation (OECD 2012):

"Puglia's pioneering role in RE deployment should be recognised. While RE policy has been far from perfect in the region, the authorities have proved able to organise local resources to tap into innovative development opportunities. The regional RE strategy has evolved through a process of "learning by doing" in which the authorities are constantly trying to minimise distortions and maximise the benefits related to RE deployment. For example, when local communities expressed their opposition to large wind farms in mountainous areas or PV installations on valuable agricultural land, the regional government changed its approach and favoured a more sustainable pattern. This capacity to adapt demonstrates flexibility and the ability to discuss issues openly. This is critical in a policy domain like RE, which is relatively new and where no established understanding of "best practice" yet exists. This approach has underpinned the social acceptance of RE by the regional population in spite of extensive deployment. It is also aided by the fact that regional interventions aim to maximise benefits for host communities rather than for individual investors."

With regard to fostering innovation and research, in recent years, the Puglian administration has gained responsibilities in innovation policy making and proceeded to reform the regional innovation system.

Puglia has a well-established university system that is evenly distributed across the territory, able to create a level of expertise to meet the needs of the territory. In addition, training provision is completed by numerous specialised activities, offered both by the universities and by training centres and business schools which, in close contact with employers, respond quickly to the professional requirements of businesses. In addition, in recent years, a model of networking has taken shape in which universities, public and private research centres and other institutions collaborate in trying out new products and processes and promote the transfer of technologies. In this context, the four technological clusters based in Apulia also have a leading role: Dhitech for high-tech, D.A.Re, for agriculture and food, Medis for Mechatronics and Di.T.Ne for renewable energy. The productive clusters, directly link the key

²⁰ http://www.arti.puglia.it/fileadmin/user_files/download/PUG_IST_ING_CIN_corretto_copia_OK.pdf

players in specific areas (universities, industries, SMEs, etc.) for facilitating business opportunities; in doing so they aim to generate a virtuous circle that enhances competitiveness.

Along these lines, a relevant Italian policy instrument, highlighted by Italian reports (Fondazione Symbola – Unioncamere, 2012), for its relevance for fostering the green transition are Network Contracts. These Network Contracts were introduced in 2009 as a new tool that aims at enhancing collaboration among firms to increase their potential for innovation, research, and development. One of their main goals of Network Contracts is to overcome the typical lack of scale economies that characterise Small and Medium Enterprises (SMEs). Even if it is early to assess the impact and the degree of success, so far, these contracts have enabled that SMEs in Puglia make investments in green economy (e.g. renewables, eco-efficiency, green building, etc.) that would not have been made otherwise.

However, even if the initiatives fostered by Puglia related to innovation and green economy, are promising and have been well received by local actors, it is too early to evaluate the success of the measures. For instance, Productive Districts were launched in 2008, but the majority were not established until 2009-2011. Nonetheless, this measure is recommended as an example of regional good practice by the Regional Innovation Monitor of the European Commission²¹.

All in all, Puglia is well positioned to achieve the green economy transition. Over the last years it has promoted policy measures to enhance the regional innovation system and promote partnerships and networking. On top of that it already has a leading position in some green economy sectors, such as renewable energy.

Finally, and especially relevant, Puglia is currently developing the regional smart specialization strategy for the 2014-2020 period, which will provide the framework for such a green transition. This strategy is being constructed by a stakeholder consultation process, which will surely maximize its adoption and impact.

²¹ <http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/index.cfm?q=p.home>

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