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MONITORING THE SDGs IN PUGLIA REGION

ITALY

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Table of Contents

ABSTRACT

This report presents and discusses the methodological approach for the validation of the regional monitoring set for the Sustainable Development Goals (SDGs) in the framework of the REGIONS 2030 pilot project for the Puglia region. It describes available indicators and criteria used to select proxy and additional indicators to the ones proposed by the JRC.

The indicator set provided by the JRC to monitor the sustainable development goals at the regional level appears to offer an adequate comprehension of the regional goals' achievement. More specifically, it was possible to collect and analyse data for 65 indicators out of the 83 identified by the JRC. Of these, 39 are perfectly aligned with the data source suggested by the JRC, while for the remaining 26, alternative data sources had to be used, but still based on official statistics.

The 18 indicators for which it was not possible to find data were replaced by indicators capable: of respecting the same target identified by the JRC; of reflecting regional strategies and regional peculiarities; of using official data from national statistical sources and therefore reproducible for all Italian regions. Only one out of 18 indicators had no valid alternative: Official Development Assistance.

In addition to these 17 replacement indicators, a further 13 indicators capable of monitoring certain specificities of the regional sustainability development strategy were proposed, in particular relating to gender issues culture and sustainable tourism, blue-economy, hydrogen economy.

The analysis of statistical trends for both the short term and the long run shows how the Puglia Region is evolving between lights and shadows. Approximately half of the 65 indicators for which data were collected report a trend in the expected direction. The trend appears to be particularly positive in the following goals: 1 (no poverty), 7 (clean energy), 9 (innovation), 16 (peace) and 17 (partnerships). Whereas the direction seems to go away from the desired direction in the following goals: 4 (education), 5 (gender equality) and 8 (decent work).

These results may contribute to better recalibrate the monitoring plan of the Regional Sustainable Development Strategy in Puglia.

FOREWORD

In order to design better policies that can promote sustainable development, the availability of a coherent and comprehensive monitoring framework with a relevant set of indicators, such as the SDGs, is key. In addition, the COVID-19 pandemic has demonstrated the importance of timely and accurate data for the monitoring of these indicators over time and across space, so that there is also an understanding of the impact of potential disruptions on the achievement of the SDGs. To achieve sustainable development and leave no one and nowhere behind, having comparable and robust local outcome indicators that can inform policy decisions at different levels is key. This project supports the engagement of another level of government in the localisation and implementation of the SDGs. The idea is to broaden the ecosystem of stakeholders involved in this effort, in order to coordinate and amplify impact.

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EXECUTIVE SUMMARY

This report contributes to the REGIONS2030 pilot project that develops a list of indicators to monitor the SDGs in European regions. The contribution is made through an analysis of this list indicators for the case of the Puglia region. The analysis addresses availability, suitability and possible alternatives, complements and additions to this list of indicators.

POLICY CONTEXT

The Regional administrative awareness about the SDGs is rather strong, supported by national laws. In fact, Puglia was the first Italian region to adopt the Equitable and Sustainable Well-being indicators (BES) to analyse the effects of economic decisions, incorporating them into the financial and budgetary planning of the Region. The process to adopt the Regional Sustainable Development Strategy (SRSvS) started in April 2019, and the system of Regional Sustainable Development Goals (RSDGs) moves within the framework defined by the Regional Government Program, adopted in November 2020 to combine competitiveness, attractiveness, and solidarity, as requested both by the 2030 Agenda and the National Strategy for Sustainable Development.

In July 2022, the Puglia Voluntary Local Review (VLR) was presented at the High Level Political Forum of the United Nations in New York. It was a first attempt to combine cohesion policy objectives, gender agenda commitments, strategic climate choices and regional government policies into a single sustainable development policy vision.

KEY CONCLUSIONS

Monitoring of the SDGs based on regionally available indicators is possible. Nonetheless, more efforts need to be made: firstly, by data producers to invest further in some kind of spatial statistics, and secondly, by regional administration to define more precise and concrete regional strategies.

MAIN FINDINGS

Of the 83 indicators in the JRC data set, data could be collected for 65. With the exception of goal 14, all goals were covered by the data collected, with 44 out of 53 targets being covered. Eighty per cent of the data collected came from official statistical sources. The historical series were sufficiently long to allow analysis of short and long term dynamics. On the basis of the regional strategy for sustainable development and the characteristics of the Puglia region, the 18 indicators for which it was not possible to collect data have been replaced by 17 alternative indicators. These 17 cover the same objectives as the original ones and almost all of them come from official statistical sources. Finally, it has been possible to identify 13 additional indicators that are able to cover other targets of regional interest: digital divide, culture, sustainability of tourism, gender agenda, strengthening of services for vulnerable people, blue economy.

RELATED AND FUTURE JRC WORK

Support the thematic tables of regions with data producers and develop some regional summary measures related to transport performance, transparency, and official development assistance. Promote regional experimental indicators on food waste. Pooling the 10 Pilot regions' experience.

1. INTRODUCTION

The region of Puglia is situated in the Southeast of Italy and covers an area of 19 363 km2. The landscape is flat and partly hilly. The coastline is longer than any other Italian region, and it faces the Adriatic Sea to the East and the Ionian Sea to the South-West. The neighbouring regions are Molise to the North, Basilicata and Campania to the West. Puglia hosts about 4 million inhabitants (6% of the Italian population) with a high population density (around 210 inhabitants/ km^2) being one of the most densely populated regions in Italy. The population is distributed among 257 municipalities, 10% of which exceed 25 thousand inhabitants, with one Metropolitan City (Bari) and 5 provinces (Foggia, Taranto, Brindisi, Lecce e Barletta-Andria-Trani).

The European Union Cohesion Policy classifies Puglia as one of the less developed regions: its GDP per capita is less than 75% of the European Union average (62% in 2021). Consequently, Puglia records poor results for several other development indicators mainly related to employment, education, income, innovation. Nonetheless, there are many productive excellences, and its manufacturing sector is rather varied: the region hosts the largest steel mill in Europe, and several large companies in the food industry, Made in Italy, aerospace, pharmaceutical and shipbuilding. In recent years, the region has experienced a tourism boom, with a significant increase of tourist in-flows: tourism is one of the strategic sectors and it is considered a driving force for the local economy.

Awareness about the SDGs is rather strong at the administrative level, and it benefits from national laws supporting this path. The local government, in fact, was the first in Italy to adopt the Equitable and Sustainable Well-being indicators (BES) to analyse the effects of economic decisions, incorporating them into the financial and budgetary planning of the Region (Regional Law No. 47/2019). BES indicators and the SDGs have many points of contact as they both contribute to provide a quality information base and to measure wellbeing and sustainable development. Puglia started to build its own Regional Sustainable Development Strategy (RSDvS) in April 2019. The definition of the system of Regional Sustainable Development Goals (RSDGs) of Puglia moves within the framework defined by the Regional Government Program, adopted on November 26, 2020, with which the Regional Council outlined the strategies and policies to combine competitiveness, attractiveness and solidarity, as requested both by the 2030 Agenda and the National Strategy for Sustainable Development.

The RSDGs coherently cross the goals of the 2030 Agenda and the Policies defined by the 2021-2027 Community programming, the regional Gender Agenda and the strategy of adaptation to Climate Change, targeting regional choices in the field of environmental, social and economic sustainability.

The Governmental Program of the Puglia Region provides for a specific commitment to reducing the gender gap and a strong boost to gender policies in all sectors. This finds further foundation in the UN 2030 Agenda for sustainable development, identified as an essential cornerstone for the declination of regional development strategies within the programming processes.

Therefore, with resolution no. 365 of 8 March 2021, an impetus was given to the drafting of a Gender Agenda as a systematic, articulated and multidisciplinary intervention capable of radically reversing the guidelines of development so that the gender gap is bridged and the conditions for a real equal access of women to the constitutionally guaranteed rights of work and quality of life, most importantly, by guaranteeing the conditions so that the gender perspective and the needs of women are fully integrated in the decision-making tables and in the planning processes.

This resolution provides that the Gender Agenda is translated into a strategic vision document integrated with the regional Sustainability Strategy that outlines indications in terms of global, specific and operational objectives to be integrated into all regional policies having in this regard the following priority axes, deriving from the analysis of the main socio-economic indicators.

The Gender Agenda, therefore, constitutes an integral and substantial part of the Regional Strategy for Sustainable Development (RSDvS) and a reference document for specific planning documents, also with reference to the monitoring and evaluation systems of the interventions.

Great attention was devoted also to SDG 4, in the belief that only a large investment in the human and social capital of children and young people can be the strongest lever to counter social marginality and to reduce inequalities, as well as to increase the competitiveness of Apulian production systems and the attractiveness of the Puglia Region. Therefore, the Regional Plan for tackling educational poverty which, as shared by the Regional Council in the session of the 15th of March 2021, Communication SUR / COM / 2021/0h0010, identifies

access to knowledge, intended both as a contrast to educational poverty and as an extraordinary plan for training and research, as one of its fundamental pillars.

Finally, for the implementation of the RSDvS, the implementation of a Regional Strategy for Adaptation to Climate Change (SRACC), a path initiated by the Puglia Region with DGR n. 1575 of 17/09/2020, in order to systematize the experiences and information currently available on the climate phenomenon and identify adequate measures capable of strengthening the resilience of territories. As regards environmental matters, other strategic regional building blocks are: the start of the process of defining a strategy for the regional Blue Economy in June 2022; the approval of the final document of the Hydrogen Strategy, #H2Puglia2030, by the Regional Government with resolution no. 1799 of 5 December 2022. This strategic document represents a high-level vision of the regional administration that places the decarbonisation policy at the centre and offers a perspective framework that affects the policies of energy transition, research & development, innovation, transport, environment, with the aim of integrating the hydrogen value chain, enhancing the prominence of the territory through an articulated path of sharing with the main regional stakeholders. Moreover, the Puglia region is also completely redesigning its Regional Energy and Environmental Plan (PEAR).

In addition, the Region of Puglia presented its VLR with 9 other Italian Regions together with VNR Italy on July 15, 2022 at the High-Level Political Forum of the United Nations in New York.

Participation in the Region2030 project is a further step that the local government decided to walk along the Regional Sustainable Development Strategy started in 2019.

2. ANALYSIS OF INDICATORS IN THE JRC DATASET

The set of indicators proposed by the JRC include 83 indicators, broken down into the SGDs as shown in Table 1. The table also shows the number of indicators for which data could be collected (65 indicators in total) and the number of indicators for which data could not be collected (18 indicators). Among the 83 JRC indicators, we found references for 65 indicators, completing as many as 6 out of 17 goals: 2, 4, 8, 9, 13, and 15. Goal 14 is the only for which it has not possible collect any indicators (0 out of 3), for all other goals, data were always collected for at least 50% of the indicators.

Table 1. JRC Indicators collected data by SDGs goal and availability for the Puglia region.

SDGs	Data indicators available	Data indicators Not available	Number indicators
SDG 1	2	2	4
SDG 2	4	0	4
SDG 3	4	1	5
SDG 4	7	0	7
SDG 5	6	1	7
SDG 6	2	2	4
SDG 7	2	2	4
SDG 8	10	0	10
SDG 9	5	0	5
SDG 10	1	1	2
SDG 11	7	2	9
SDG 12	1	2	3
SDG 13	4	0	4
SDG 14	0	3	3
SDG 15	4	0	4
SDG 16	3	1	4
SDG 17	3	1	4
TOTAL	65	18	83

Source: Own elaboration on JRC dataset

As can be seen from Table 2, the high number of data collected for the 83 indicators makes it possible to cover the 80% of the targets identified in the initial data set: 42 out of 52 targets. The Ten targets for which no indicator could be collected are the following: 1.1, 1.5, 6.1, 7.1, 10.2, 12.2, 12.3, 14.1, 14.5 and 17.2.

Table 2. Number of indicators provided by JRC dataset with data available or not by SDGs Target.

SDGs Target	Number of indicators with data available and collected	Number of indicators with NOT available data
1.1 (extreme poverty)		1
1.2 (reduce poverty)	2	
1.5 (exposure to vulnerability)		1
2.2 (end malnutrition)	1	
2.3 (agricultural productivity)	2	
2.4 (sustainable food production)	1	

3.2 (preventable death of newborns)	1	
3.3 (epidemics and diseases)	1	
3.8 (universal health coverage)	1	
3.c (health financing and recruitment)	1	1
4.1 (primary and secondary education)	1	
4.2 (access to early childhood education)	1	
4.3 (vocational and tertiary education)	3	
4.5 (gender and other disparities in education)	1	
4.6 (youth and adult literacy)	1	
5.1 (gender discrimination)	1	
5.2 (gender violence)	2	
5.4 (unpaid work)	1	1
5.5 (women participation and leadership)	2	
6.1 (universal access to water)		1
6.3 (water quality)	2	1
7.1 (access to energy)		1
7.2 (share of renewable energy)	1	1
7.3 (energy efficiency)	1	
8.1 (economic growth)	1	
8.2 (economic productivity)	1	
8.3 (job creation)	1	
8.5 (productive employment)	5	
8.6 (youth not in employment, education or training)	1	
8.8 (labour rights)	1	
9.2 (sustainable industrialization)	1	
9.5 (promote innovation)	4	
10.2 (inclusion irrespective of status)		1
10.4 (greater equality)	1	
11.1 (access to housing)	1	
11.2 (access to transport systems)	3	1
11.3 (sustainable urbanization)	1	1
11.6 (environmental impact)	2	
12.2 (management of natural resources)		1
12.3 (reduce food waste)		1
12.4 (chemical management)	1	
13.2 (climate change measures into policy)	4	
14.1 (reduce marine pollution)		1
14.5 (coastal and marine areas)		2
15.1 (restoration of ecosystems)	2	
15.5 (degradation of habi	1	
15.5 (degradation of habitats)	1	
16.5 (reduce corruption)	1	
16.6 (effective institutions)	2	1
17.12 (imports from least developed countries)	1	
17.2 (development assistance commitments)		1
17.6 (regional and international cooperation)	1	
17.8 (enabling technology)	1	
Total	65	18

Source own elaboration

Among the 65 available indicators suitable for measuring the SDGs for the Puglia regions, 39 have exactly the same data source as the JRC (perfect alignment), while for the remaining 26 indicators it is necessary to propose data providers other than the JRC (Table 3. Number of indicators with data collected by goal.). Table 3 shows that up to ten Goals have more than 50 % of the indicators with data from the same source. It has not been possible to collect data using the same, identical source for even one of the indicators relating to the following goals: 6, 7 and 12.

The JRC data sources, in fact, are often site specific for one or more EU member States (or territories at NUTS2 level), which made information not suitable for Puglia. For these 26 indicators, we suggest specific official statistics, fairly updated.

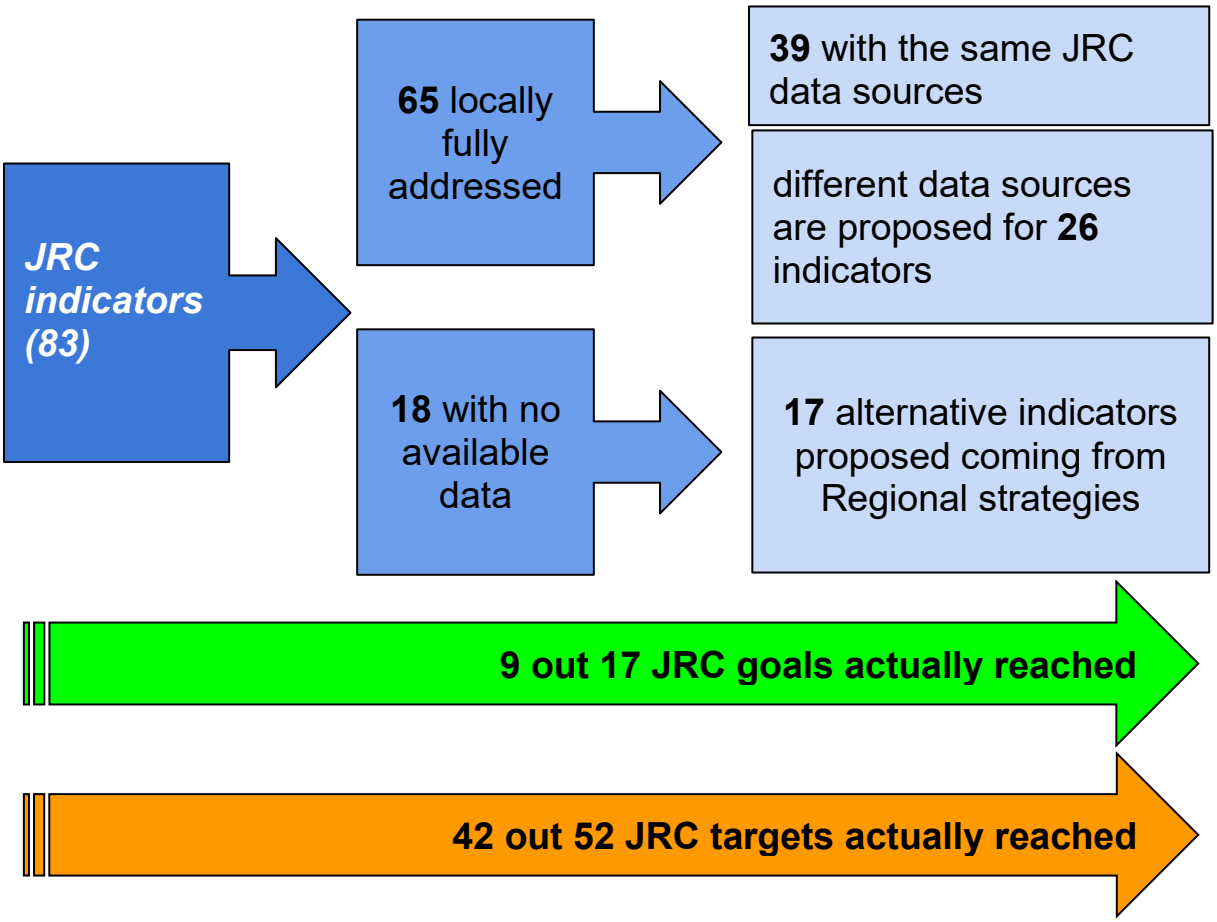
Results are briefly shown in Figure 1.

Table 3. Number of indicators with data collected by goal.

Goal	Number of indicators with data available and collected	Identical source JRC	Not Identical source JRC
SDG 1	2	2	0
SDG 2	4	1	3
SDG 3	4	3	1
SDG 4	7	6	1
SDG 5	6	3	3
SDG 6	2	0	2
SDG 7	2	0	2
SDG 8	10	8	2
SDG 9	5	3	2
SDG 10	1	1	
SDG 11	7	4	3
SDG 12	1	0	1
SDG 13	4	3	1
SDG 15	4	1	3
SDG 16	3	2	1
SDG 17	3	2	1
TOTAL	65	39	26

Source: Own elaboration on JRC dataset All tables should have a source.

Figure 1. Results in brief.



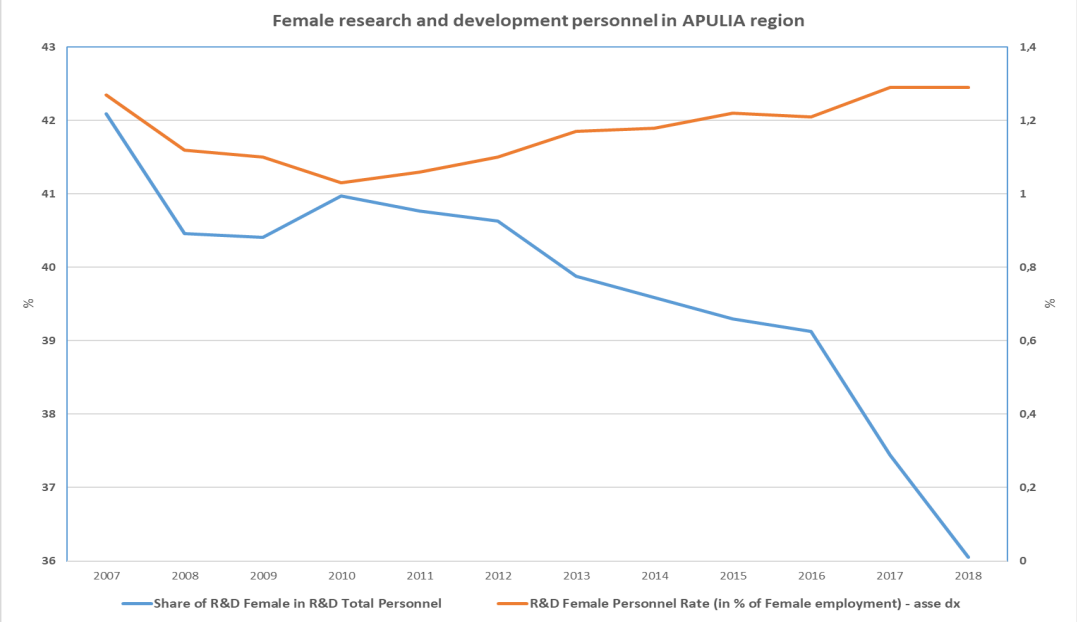
Source: own elaborations

2.1 Indicators with matching the JRC's data source.

Although data sources match for 39 JRC indicators, a few of them still need a deepening in some aspects (eg. definitions, measure, etc.); for instance:

— "*Female research and development personnel*" needs disambiguation: does it stand for "*R&D Female Personnel Rate in % of Female employment*" or "*Share of R&D Female in R&D Total Personnel*"? Given the target of the goal selected within the JRC dataset (5.5 women participation and leadership), we opt for the second type of measurement, since it better fits the goal. Plotting the two-time series against each other, in fact, substantiates relevant differences (Figure 2); in the first option, the number of women employed as research and development personnel is related to the total number of employed women. In the second case, the same number is related to the total number of R&D personnel. Thus, the first case shows the evolution in the employment of female R&D personnel on the whole of female employment, while in the second case the analysis focuses entirely on R&D to assess how many women participate in it. In summary, female employment in R&D grows because of investments in R&D, but the R&D sector in Puglia suffers from an increasing discrimination towards women employment.

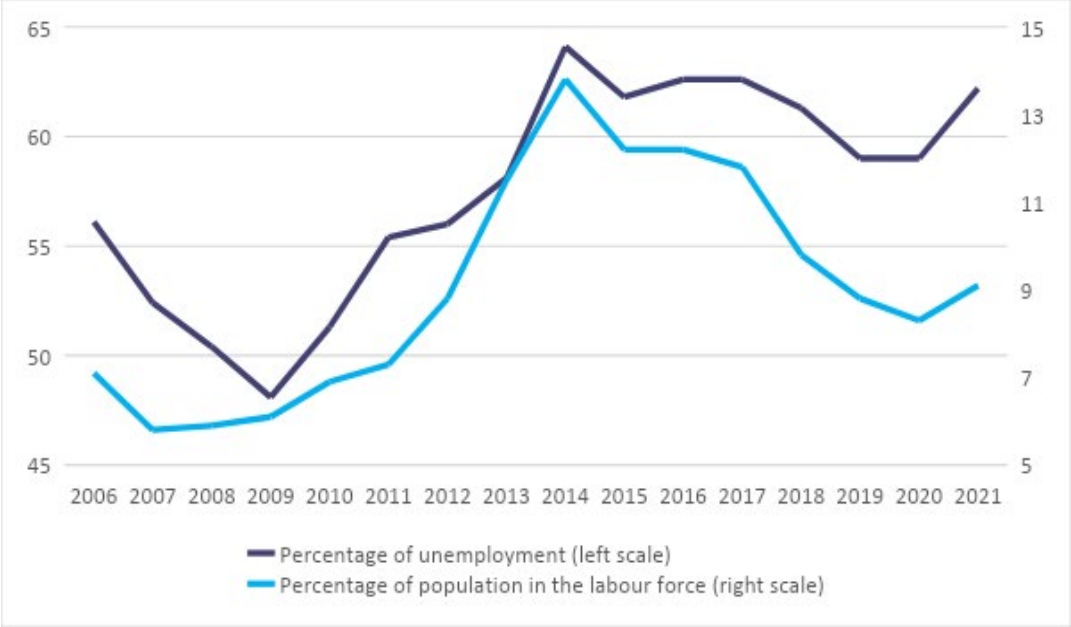
Figure 2. "R&D Female Personnel Rate in % of Female employment" VS "Share of R&D Female in R&D Total Personnel".



Source: OECD

— "*Long-term unemployment (12 months and more)*" could be read as "*Percentage of unemployment*" or "*Percentage of population in the labour force*"; the choice for the first indicator was easier than before, since it is closer to the reference goal and also the two options have a very similar trend (Figure 3).

Figure 3. "Long-term unemployment (12 months and more)" as "Percentage of unemployment" or "Percentage of population in the labour force.

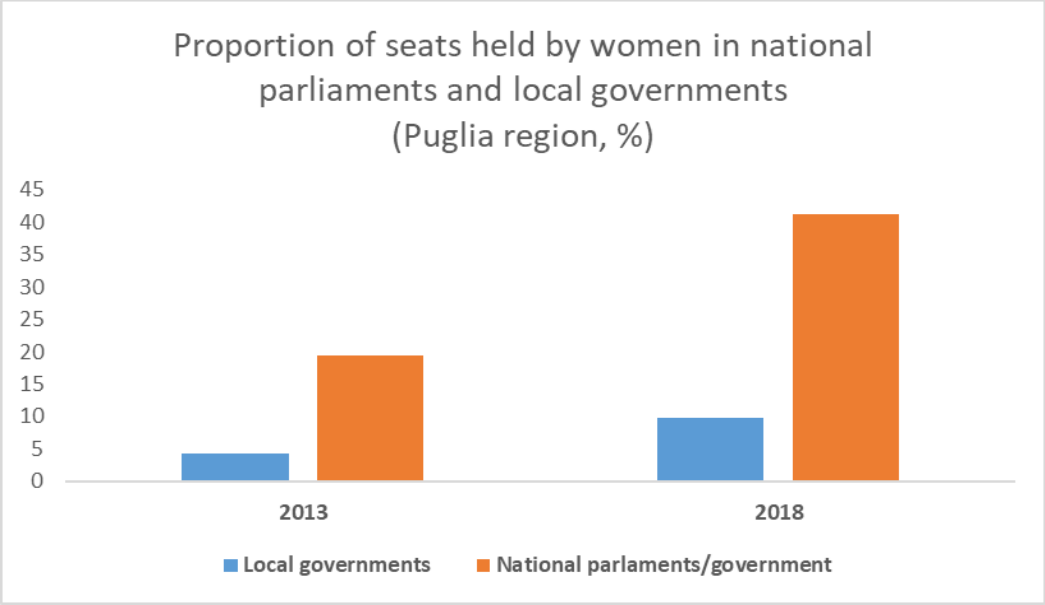


Source: Eurostat

— The "*Women in parliament and government*" indicator was forced to fit local government. Measuring the number of women actually standing in parliament or government, in fact, could be influenced by the relative electoral weight of the region thus not being representative of reality (see Figure 4). Therefore, this indicator

should be weighted on the total number of regional elected members over the national parliament or, better, the index should be measured on local government.

Figure 4. Apulian women in national parliament and local government.



Source: Istat

Time series for 39 indicators are available with the same JRC data source. Nonetheless, for two cases data refers only to one year: "*Female disadvantage index*" (Goal 10) and "*Gini index of disposable income (after taxes and transfers)*" (Goal 5), and the latter records old data. By contrast, 5 indicators have a quite long time-series although not fully updated. For instance, the indicator "*Patent applications to the EPO*'' is stuck at 2012, the "*PCT co-patent applications that are done with foreign regions*" and the "*Households expenses dedicated to housing costs*" indexes are stuck to 2015; the remaining 3 outdated indicators are surveyed every 10 or 5 years, thus explaining the time lag.

Figure 5. Number of indicators aligned (available with the same source), by goal and time series.

Time series	SDGs_1	SDGs_2	SDGs_3	SDGs_4	SDGs_5	SDGs_8	SDGs_9	SDGs_10	SDGs_11	SDGs_13	SDGs_15	SDGs_16	SDGs_17	Total
2013								1						1
2021					1									1
1977-2012							1							1
1990-2020			1						2					3
1993-2020			1											1
1994-2020							2							2
1995-2019						1								1
1995-2020						1								1
1999-2021						3								3
2000-2015									1					1
2000-2016											1			1
2000-2020						2								2
2000-2021			1	1										2
2001-2015													1	1
2001-2019					1									1
2003-2017					1									1
2004-2019		1												1
2004-2020	1													1
2004-2021	1													1
2010-2021												2		2
2011-2021						1							1	2
2013-2020				5										5
2013-2021										1				1
2015-2030										2				2
2015-2050									1					1
Total	**2**	**1**	**3**	**6**	**3**	**8**	**3**	**1**	**4**	**3**	**1**	**2**	**2**	**39**

Source: own elaborations

2.2 The indicators not aligned (different source)

As already shown, 26 indicators have a different data source from the JRC's, for the following main reasons:

- for 18 indicators the original source was not able to measure the phenomena for the Puglia region, being site specific for one or more territories at NUTS2 level. This is the case for 18 indicators out of 26 (e.g. Euska di Energia for the indicator Energy intensity; or Public Health Agency of Sweden for overweight rate; and so on). For these 14 indicators we suggest specific official statistics, fairly updated.
- for 1 indicator no source of data was indicated: "*Imports from developing countries*". In this case data source coming from official data was chosen: Istat.
- the data source provided by the JRC dataset of 7 indicators was not updated or has a low survey frequency. In these seven cases, it was preferred to use a different data source, because it guarantees a larger number of observations, or a higher frequency, or because it comes from official statistics. For example, the "*Firm creation*" indicator (SDG n.8) extracted by OECD, considered as an experimental indicator. The alternative use of a very similar indicator such as the Eurostat "*Birth rate*" calculated as the number of enterprise births in the reference period (t) divided by the number of enterprises active in the same "t" (in %) ensure an official source, a longer time series and more qualitatively stable and reliable data. Another example is the "*Organic farming: areas with different crop*" indicators, available only with a three-year frequency from Eurostat (as provided by the JRC's dataset). However, measuring the area itself is not fully indicative of a real growth process, and it does not effectively compare between the EU Regions. For these reasons it is be more appropriate to use the following indicator: "*Share of utilized agricultural land under organic farming*" calculated as "*share of land under organic farming (according to the Regulation no. 834/2007/EC) over the whole utilized agricultural land (arable land + permanent crops + permanent pastures and meadows)*". The source of the data is the Ministry of Agricultural, Food and Forestry Policies National information system on organic agriculture (Sinab). Using this indicator would give a longer time series, an annual frequency and data available for all the Italian regions.

Figure 6 lists 26 indicators discussed above. As can be seen from this figure, as many as 12 of these indicators are present in goals 2, 5, 11, 15 (three indicators for each goal); a further eight are present in goals 6, 7, 8 and 9 (two for each of these); and finally one indicator is present in each of the following goals 3, 4, 12, 13, 16, 17. The data collected for these 26 indicators are all derived from official statistical sources: official national statistics institutes (e.g., Istat, for 13 indicators out of 26) or international statistical institute (Eurostat, 6 indexes out of 26).

The availability of data from official statistical sources also provides a high degree of update and frequency of data. As table 4 shows official data sources update these 26 indicators with a very good frequency: 20 out of 26 seven years. Since they are structural indicators, higher frequencies are not necessary.

Figure 6. Indicators collected data with different data sources from the JRC's.

SDG	Indicator Name_Final Dataset	Type	Year of availability	JRC Source	Source	SDG Target(s)
2	Gross Value Added (GVA) of agriculture, livestock and fishing	Official	2021	Eustat (Instituto Vasco de Estadistica)	ISTAT	2.3 (agricultural productivity)
2	Organic farming: areas with different crops	Official	2020	Eurostat, Regional Statistics	Ministry of Agricultural, Food and Forestry Policies National information system on organic agriculture (Sinab)	2.4 (sustainable food production)
2	Overweight rate	Official	2021	Public Health Agency of Sweden	ISTAT	2.2 (end malnutrition)
3	Deaths due to Covid-19	Official	2020	CNE (National Centre of Epidemiology)	Eurostat, Regional Statistics	3.3 (epidemics and diseases)
4	Women 30-34 years old with higher education level	Official	2021	Eustat (Instituto Vasco de Estadistica)	Eurostat, Regional Statistics	4.5 (gender and other disparities in education), 4.6 (youth and adult literacy)
5	Fatal victims of gender-based violence at the hands of their partners or ex partners	Official	2021	INE (National Statistics Institute)	Istat and Ministry of the Interior - Murder database of the Central Directorate of Criminal Police	5.2 (gender violence)
5	Victims of violence against women	Experimental	2020	Ministry of Equality	Istat-Department for Equal Opportunities	5.2 (gender violence)
5	Women in parliament and government	Official	2021	INE (National Statistics Institute)	ISTAT - Processing of data from the Chamber of Deputies and the Senate (Processing of data from Regional councils)	5.5 (women participation and leadership)
6	Share (%) of water bodies that reached ecological quality standards (high or fair) over the entire surface water bodies (rivers and lakes)	Official	2015	NILSA (Navarra de Infraestucturas Locales)	Istituto Protezionzione Ambiente (ISPRA)	6.3 (water quality)
6	Share (%) of groundwater that reached chemical quality standards (good) over the entire groundwater	Official	2015	NILSA (Navarra de Infraestucturas Locales)	Istituto Protezionzione Ambiente (ISPRA)	6.3 (water quality)
7	Electricity production that comes from renewable sources	Official	2020	Organisation for Economic Cooperation and Development (OECD)	ISTAT on Terna data	7.2 (share of renewable energy)
7	Energy intensity	Official	2020	Euskadi Energia	ISTAT - ENEA	7.3 (energy efficiency)
8	Occupational accidents	Official	2020	National Institute for Occupational Safety and Health (SPAIN	ISTAT - INAIL	8.8 (labour rights)
8	Firm creation	Official	2020	Organisation for Economic Cooperation and Development (OECD)	Eurostat, Regional Statistics	8.3 (job creation)
9	GVA of the industry with respect to the GVA of the total sectors (current price)	Official	2019	INE (National Statistics Institute)	OECD	9.2 (sustainable industrialization)
9	Employment in high-technology manufacturing as a percentage of total manufacturing employment	Official	2020	Organisation for Economic Cooperation and Development (OECD)	Eurostat, Regional Statistics	9.5 (promote innovation)
11	Land use	Experimental	2018	European Commission, Joint Research Centre	LUCAS - EUROSTAT	11.3 (sustainable urbanization)
11	PM2.5 Emissions	Official	2020	European Commission, Joint Research Centre	Istat - Processing of data from Ispra	11.6 (environmental impact)
11	Household and commercial waste generation per inhabitant	Official	2020	Statistics Portugal	Istat elaboration on ISPRA data	11.6 (environmental impact)
12	Hazardous Waste	Official	2020	INE (National Statistics Institute)	Istat elaboration on ISPRA data	12.4 (chemical management)
13	Greenhouse Gas Emissions	Official	2018	Department of Tourism/Economics of the Regional Government	OECD	13.2 (climate change measures into policy)
15	Terrestrial protected areas as a percentage of total area	Experimental	2021	Organisation for Economic Cooperation and Development (OECD)	Istituto Protezionzione Ambiente (ISPRA)	15.5 (degradation of habitats)
15	Land Abandonment	Experimental	2018	European Commission, Joint Research Centre	LUCAS - EUROSTAT	15.1 (restoration of ecosystems)
15	Forest area over total surface area	Official	2015	Ministry for the Ecological Transition and the Demographic Challenge	FAO-INFC Global Forest Resources Assessment	15.1 (restoration of ecosystems)
16	Participation in the last elections	Official	2022	INE (National Statistics Institute)	OECD	16.6 (effective institutions)
17	Imports from developing countries	Official	2021	Own elaboration (regional government)	ISTAT	17.12 (imports from least developed countries)

Source own elaboration

Table 4. Number of indicators collected with a different source, by Goal and time series.

Time coverage / Goals	SDG _2	SDG _3	SDG _4	SDG _5	SDG _6	SDG _7	SDG _8	SDG _9	SDG _11	SDG _12	SDG _13	SDG _15	SDG _16	SDG _17	Total
2015					2										2
2020		1													1
1994-2021			1												1
1996-2020									1						1
2000-2020									1						1
2000-2021	1													1	2
2001-2018											1				1

2001-2021	1														1
2004-2020						1									1
2005, 2015												1			1
2005-2019								1							1
2008-2020							1								1
2008-2021								1							1
2009-2018									1						1
2009-2019						1									1
2010-2021	1														1
2011-2020							1								1
2012, 2015, 2018												1			1
2012-2021				1								1			2
2013-2021				1											1
2014-2018													1		1
2014-2020										1					1
2019-2021				1											1
Total	**3**	**1**	**1**	**3**	**2**	**2**	**2**	**2**	**3**	**1**	**1**	**3**	**1**	**1**	**26**

Source own elaboration

2.3 The indicators not available

As mentioned above, there are 18 indicators for which no data could be found, broken down as follows: 3 indicators relate to goal 14; respectively 2 for each goal, relate to goals 1, 6, 7, 11, 12; finally, the remaining 5 relate to goals 3, 5, 10, 16 and 17. The main reasons for which it was not possible to collect data are listed and examined below:

— Data are available only at large level of territorial aggregation (i.e., NUTS1) due to the sampling schemes; this reason regards the following indicators:

- "Unemployment of people with disabilities" (SDG 10);
- "People affected by energy poverty" (SDG 7);
- "Material and social deprivation" (SDG 1);
- "Self-reported unmet need for medical examination" (SDG 3);
- "Inactive population rate due to caregiving responsibilities" (SDG 5).

— The phenomenon the index points out does not apply to local specificities; This applies to the following indicators:

- "Electricity production that comes from nuclear power" (SDG 7);
- "Estuarine with high water quality" (SDG 14).

  In Italy there are no nuclear power plants and in the Puglia region there are no rivers and estuarine for which it is possible to measure the phenomenon. For these reasons, these indicators are not suitable to measure SDGs in the Puglia region.

— The indicator is not fully defined or explained within the JRC dataset (case study or experimental statistics); specifically, it applies to the following indexes:

- “Affected people due to disasters” (SDG 1)
- “Transport performance” (SDG 11);
- “Carbon Footprint” (SDG 12).
- “Food waste” (SGD 12);
- “Transparency index “(SDG 16);
- “Official Development Assistance” (SDG 17);

— The indicator needs further investigation with domain experts in order to understand if it actually fits the JRC goal. It applies mainly to those indicators grouped in the SDG 6 and 14:

- “Population served by safely managed drinking water supply services” (SDG 6);
- “Population connected to wastewater with at least secondary treatment” (SDG 6);
- “Difference between built-up area growth rate and population growth rate” (SDG 11);
- “Protected coastal area as a percentage of total coastal area” (SDG 14);
- “Coastal areas with good/very good water quality” (SDG 14).

3. HORIZONTAL ANALYSIS OF METADATA

Of the 65 indicators out of the 83 that were considered suitable for the measurement of the SDGs for the Puglia region and for which it was possible to collect data, 49 come from official statistical sources and 16 come from experimental sources.

It is worth noting that most of the data sources are available from official national sources (e.g. 12 indicators come from ISTAT) or international statistical services (32 indicators from EUROSTAT and 9 from OECD), which allows benchmarking with other regions, including European ones (Table 6). There is a greater variety of different sources for goals 2, 11, 15 and 17. On the other hand, goals 1, 3, 4, 8 and 9 present indicators from only one source.

The wide availability of data from official statistics makes it easier to have a good frequency of observation of the indicators. As Table 5 shows the indicators listed so far can be organized also by their survey frequency: 80% of the indicators are surveyed yearly, the remaining 33% of the indicators are surveyed on a 3-years to 10-years base. Some indexes receive non-recurring updates because of specific issues (e.g., elections). It is worth noting that the environmental data (Objectives 6, 15, 11) tend to have a lower frequency.

The combination of data from official statistical sources with a frequency of update of one year means that long or sufficiently long time series are available for 55 of the 65 indicators. There are only 8 indicators for which data are available for only one year, in goals 3, 5, 6, 10, 12, 14, as shown in Table 7.

These data sources also provide relatively long and comprehensive time series (Table 7).

Table 5. Number of JRC indicators (available) collected, by frequency and goal.

Goal /Frequency	Annual	Decade	Per election cycle	Quinquennial	sixennual	Triannual	Total
SDG_1	2						**2**
SDG_2	4						**4**
SDG_3	4						**4**
SDG_4	7						**7**
SDG_5	5						**5**
SDG_6					2		**2**
SDG_7	2						**2**
SDG_8	10						**10**
SDG_9	5						**5**
SDG_10	1						**1**
SDG_11	5	1				1	**7**
SDG_12	1						**1**
SDG_13	2	2					**4**
SDG_15		1		1		2	**4**
SDG_16			1	2			**3**
SDG_17	3						**3**
Total	51	4	1	3	2	3	**65**

Source: Own elaboration on JRC dataset All tables should have a source.

Table 6. Number of JRC indicators (available) collected, by source of data and goal.

Goal / Source	E.C.	Eurostat	FAO	ISTAT	ISPRA	Ministry of Agricultural	OECD	Univ. Gothenburg	Total
SDG_1		2							**2**
SDG_2				2		1	1		**4**
SDG_3		4							**4**
SDG_4		7							**7**
SDG_5	1			3			2		**6**
SDG_6					2				**2**
SDG_7				2					**2**
SDG_8		9		1					**10**
SDG_9		4					1		**5**
SDG_10							1		**1**
SDG_11	1	3		2			1		**7**
SDG_12				1					**1**
SDG_13	2	1					1		**4**
SDG_15	1	1	1		1				**4**
SDG_16							1	2	**3**
SDG_17		1		1			1		**3**
Total	5	32	1	12	3	1	9	2	**65**

Source: own elaboration

Table 7. Number of JRC indicators (available) collected, by time series and goal.

Time coverage	SDG_1	SDG_2	SDG_3	SDG_4	SDG_5	SDG_6	SDG_7	SDG_8	SDG_9	SDG_10	SDG_11	SDG_12	SDG_13	SDG_15	SDG_16	SDG_17	Total
2013										1							1
2015						2											2
2020			1														1
2021					1												1
1977-2012									1								1
1990-2020			1								2						3
1993-2020			1														1
1994-2020									2								2
1994-2021				1													1
1995-2019								1									1
1995-2020								1									1

1996-2020											1						1
1999-2021								3									3
2000-2015											1						1
2000-2016														1			1
2000-2020								1			1						2
2000-2021		1	1	1				1								1	5
2001-2015																1	1
2001-2018													1				1
2001-2019					1												1
2001-2021		1															1
2003-2018					1												1
2004-2019		1															1
2004-2020	1						1										2
2004-2021	1																1
2005, 2015														1			1
2005-2019									1								1
2008-2020								1									1
2008-2021									1								1
2009-2018											1						1
2009-2019							1										1
2010-2021		1													2		3
2011-2020								1									1
2011-2021								1								1	2
2012, 2015, 2018														1			1
2012-2021					1									1			2
2013-2020				5													5
2013-2021					1								1				2

2014-2018															1		1
2014-2020												1					1
2015-2030													2				2
2015-2050											1						1
2019-2021					1												1
Total	**2**	**4**	**4**	**7**	**6**	**2**	**2**	**10**	**5**	**1**	**7**	**1**	**4**	**4**	**3**	**3**	**65**

Source: own elaboration

4. STATISTICAL ANALYSIS OF INDICATORS IN THE JRC DATASET

The large availability of data collected, capable of covering almost all the goals identified (with the exception of 14) and almost all the targets, combined with a sufficiently long time series, makes it possible to develop short-term long-term synthetic indicators as well as to carry out a punctual analysis.

4.1 Overall analysis

The overall analysis[1] of the sustainable development indicators presented here compares two different focuses: long term trend analysis along the whole time window from 2000 to the latest update available (2021 for most of cases), and a short term trend analysis along the last 3 available years.

The synthetic representation of the trends measured by the indicators is achieved by calculating their changes in the short term (usually t over t-3) and in the long term (usually t over 2000 or last available year). The changes are then classified according to the values of a Compound Annual Growth Rate (CAGR). For indicators with a positive direction (i.e., those whose increase indicates convergence towards the objectives) the long-term trend is considered: significant progress, if CAGR>1%; moderate progress if 0.0%≤CAGR≤1%; moderate worsening if -1%≤CAGR≤0.0%, worsening, if CAGR<-1%. For the short term, a threshold of ± 1% is considered. Naturally, the scale is applied in the opposite direction for indicators with a negative direction.

The overall picture is fairly positive, with 46% of the measures improving: 21 indicators evidence a significant positive trend toward the desirable direction (in the long term trend), while only 8 show a moderate positive trend (see figure 8). For 10 indicators it was not possible to determine long-term trends because of a lack of data. On the other hand, 38% of the indicators show a deteriorating trend. The long-term analysis shows a particularly negative outcome for 12 indicators (above an average annual loss of 1%) and a moderate negative outcome for the other 12.

In the short term trend, the analysed indicators seem to be even slightly better, although there has been a reduction in the number of indicators for which short-term analysis has been possible. In fact, some of them were not sufficiently up to date and therefore it did not make much sense to carry out a short-term analysis.

In fact, for 17 indicators it was not possible to calculate a short-term trend. There are 22 indicators with a clearly positive trend in the desired direction (in the short-term trend), while only 6 indicators show a moderately positive trend (see Figure 8). By contrast, 27% of the indicators show a deteriorating trend. In the short term, 13 indicators show strongly negative and 5 moderately negative trends (see Figure 7).

Looking at these trends for each target, it is interesting to note that there are no one with a clear and unambiguous trend, i.e. where all the indicators show the same direction. Instead, it is common to observe a certain diversity of outcomes simultaneously. The only exceptions are Goals 7 and 1, where all indicators collected move in the same positive direction, and Goal 4, where all indicators show negative signs.

Similarly, no particular differences seem to exist between short-term and long-term trends within the various targets. The only indicators that show some positive short-term changes compared to the long-term trend are in Goal 2, where three out of four indicators become positive, and Goal 4, where three out of seven indicators seem to be moving, albeit moderately, in the right direction. Goal 8, on the other hand, seems to show strong negative trends in the short term.

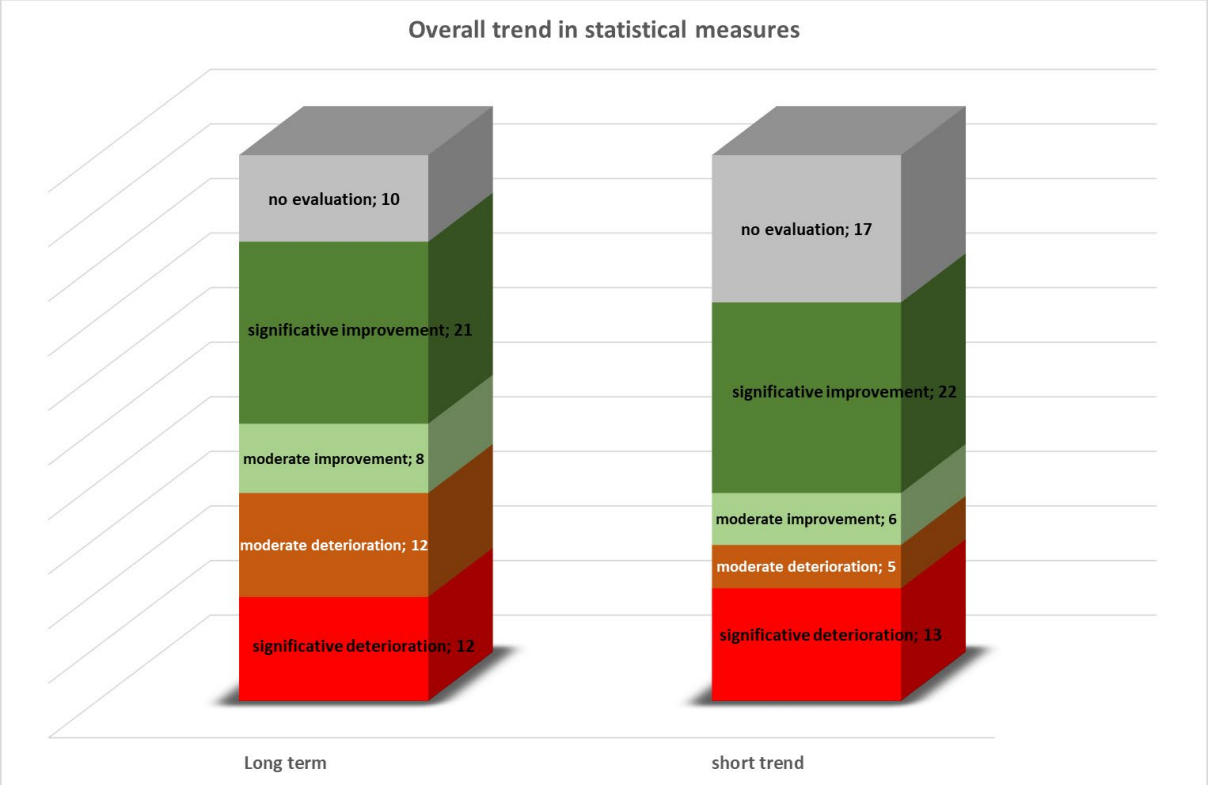
In detail, it is possible to report an overall positive trend towards the desirable direction for the following goals: 1, 7, 9, 16 and 17 (see Figure 8). In the short term, there is also the Goal 2.

[1] The synthetic representation of the trends measured by the indicators is achieved by calculating their changes in the short term (usually t over t-3) and in the long term (usually t over 2000 or last available year). The changes are then classified according to the values of a Compound Annual Growth Rate (CAGR). For indicators with a positive direction (i.e., those whose increase indicates convergence towards the objectives) the long-term trend is considered: significant progress, if CAGR>1%; moderate progress if 0.0%≤CAGR≤1%; moderate worsening if -1%≤CAGR≤0.0%, worsening, if CAGR<-1%. For the short term, a threshold of ± 1% is considered. Naturally, the scale is applied in the opposite direction for indicators with a negative direction.

The corresponding withdrawal from the desirable direction hits the following goals: 4, 5 and 8.

The pandemic biennium did play a significant role in either slowing down or even worsen the progress observed in the previous years. On the other hand, digital transition, lockdown and emergency closures did actually impress a strong acceleration for firms, people and organizations.

Figure 7. The overall analysis of the sustainable development indicators by long term and short-term trend.



Source: own elaboration

Figure 8. Long term and Short term trend by indicator.

SDG	Indicator Name	Time coverage	SDG Target(s)	Trend since 2000 (or first year available)	Short trend (3 y)
1	Persons living in households with very low work intensity	2004-2021	1.2 (reduce poverty)	✓	↗
1	Persons at risk of poverty or social exclusion	2004-2020	1.2 (reduce poverty)	✓	✓
2	Gross Value Added (GVA) of agriculture, livestock and fishing	2000-2021	2.3 (agricultural productivity)	↘	✓
2	Organic farming: areas with different crops	2010-2021	2.4 (sustainable food production)	✓	✓
2	Productivity (Gross Value Added per worker) in agriculture, forestry and fishing	2004-2019	2.3 (agricultural productivity)	↘	↗
2	Overweight rate	2001-2021	2.2 (end malnutrition)	↘	✓
3	Deaths due to Covid-19	2020	3.3 (epidemics and diseases)		
3	Health personnel	2000-2021	3.c (health financing and recruitment)	✓	↗
3	Hospital beds	1993-2020	3.8 (universal health coverage)	✗	✗
3	Infant mortality	1990-2020	3.2 (preventable death of newborns)	✓	✓
4	Women 30-34 years old with higher education level	1994-2021	4.5 (gender and other disparities in education), 4.6 (youth and adult literacy)	✓	✗
4	Students enrolled in tertiary education	2013-2020	4.3 (vocational and tertiary education)	↘	✓
4	Participation in education	2013-2020	4.3 (vocational and tertiary education)	✗	↗
4	Pupils enrolled in early childhood education	2013-2020	4.2 (access to early childhood education)	✗	✗
4	Early leavers from education and training	2000-2021	4.6 (youth and adult literacy)	✗	↗
4	Participation rates in selected education levels	2013-2020	4.1 (primary and secondary education)	↘	✓
4	Distribution of pupils and students enrolled in general and vocational programmes	2013-2020	4.3 (vocational and tertiary education)	✗	✗
5	Fatal victims of gender-based violence at the hands of their partners or ex partners	2019-2021	5.2 (gender violence)		
5	Victims of violence against women	2013-2021	5.2 (gender violence)	✓	✗
5	Female research and development personnel	2003-2018	5.5 (women participation and leadership)	✗	✗
5	Women in parliament and government	2012-2021	5.5 (women participation and leadership)	✓	✓
5	Female achievement/disadvantage index	2021	5.1 (gender discrimination)		
5	Gender gap in part-time employment incidence	2001-2019	5.4 (unpaid work)	✗	✗
7	Electricity production that comes from renewable sources	2004-2020	7.2 (share of renewable energy)	✓	✓
7	Energy intensity	2009-2019	7.3 (energy efficiency)	✓	✓
8	Occupational accidents	2008-2020	8.8 (labour rights)	↗	✓
8	Economic activity	1999-2021	8.5 (productive employment)	↘	↘
8	Unemployment	2011-2021	8.5 (productive employment)	✓	✓
8	Firm creation	2011-2020	8.3 (job creation)	↘	✗
8	Employment	1999-2021	8.5 (productive employment)	↘	↘
8	GDP at current market prices	2000-2020	8.1 (economic growth)	↗	✗
8	GVA at basic prices	1995-2020	8.2 (economic productivity)	↗	✗
8	Long-term unemployment (12 months and more)	1999-2021	8.5 (productive employment)	↘	↘
8	Compensation of employees	1995-2019	8.5 (productive employment)	✓	✓
8	Young people neither in employment nor in education and training	2000-2021	8.6 (youth not in employment, education or training)	↗	✗

SDG	Indicator Name	Time coverage	SDG Target(s)	Trend since 2000 (or first year available)	Short trend (3- y)
9	GVA of the industry with respect to the GVA of the total sectors (current price)	2005-2019	9.2 (sustainable industrialization)	↘	↘
9	Gross Domestic Expenditure on R&D	1994-2020	9.5 (promote innovation)	✓	✓
9	R&D personnel and researchers	1994-2020	9.5 (promote innovation)	✓	✓
9	Employment in high-technology manufacturing as a percentage of total manufacturing employment	2008-2021	9.5 (promote innovation)	✓	✓
9	Patent applications to the EPO	1977-2012	9.5 (promote innovation)	↗	
10	Gini index of disposable income (after taxes and transfers)	2013	10.4 (greater equality)		
11	Households expenses dedicated to housing costs	2000-2015	11.1 (access to housing)	✗	
11	Daily accessibility	2015-2050	11.2 (access to transport systems)		
11	Stock of vehicles (passenger cars)	1990-2020	11.2 (access to transport systems)	✗	✗
11	Land use	2009-2018	11.3 (sustainable urbanization)		
11	PM2.5 Emissions	2000-2020	11.6 (environmental impact)	✓	✓
11	Household and commercial waste generation per inhabitant	1996-2020	11.6 (environmental impact)	↘	↘
11	Victims in road accidents	1990-2020	11.2 (access to transport systems)	✓	✓
12	Hazardous Waste	2014-2020	12.4 (chemical management)	✗	↗
13	PM10 Emissions	2015-2030	13.2 (climate change measures into policy)		
13	CO2 Emissions	2015-2030	13.2 (climate change measures into policy)		
13	Greenhouse Gas Emissions	2001-2018	13.2 (climate change measures into policy)	↗	
13	Cooling and heating degree days	2013-2021	13.2 (climate change measures into policy)	↘	✗
15	Terrestrial protected areas as a percentage of total area	2012-2021	15.5 (degradation of habi		
15	Estimated soil erosion	2000-2016	15.5 (degradation of habitats)	↗	
15	Land Abandonment	2012, 2015, 2018	15.1 (restoration of ecosystems)		
15	Forest area over total surface area	2005, 2015	15.1 (restoration of ecosystems)	↗	
16	Participation in the last elections	2014-2018	16.6 (effective institutions)	✗	
16	Quality of Government Index	2010-2021	16.6 (effective institutions)	✓	✓
16	Extract from QGI an indicator on corruption	2010-2021	16.5 (reduce corruption)	✓	✓
17	Imports from developing countries	2000-2021	17.12 (imports from least developed countries)	✓	✓
17	PCT co-patent applications that are done with foreign regions	2001-2015	17.6 (regional and international cooperation)	✗	
17	Individuals who used the internet for interaction with public authorities	2011-2021	17.8 (enabling technology)	✓	✓

Legend	
✓	Significant progress towards the desired direction (greater than 1% per year
↗	Moderate progress towards the desired direction less than 1% per year)
↘	Moderate movement away from the desidered direction (less than 1% per year)
✗	Significant movement away from the desidered direction (greater than 1% per year)
	No evaluation (series are too short or irregular)

Source: own elaboration

4.2 Statistical trends examined by Goals.

The wide availability of the data collected for all the objectives, with the exception of Goal 14, makes it possible to carry out a point-by-point analysis.

4.2.1 Goal 1. End poverty in all its forms everywhere

For the first sustainable development goal, we collected data for these two indicators:

- "Person living in households with very low work intensity";
- "Persons at risk of poverty or social exclusion".

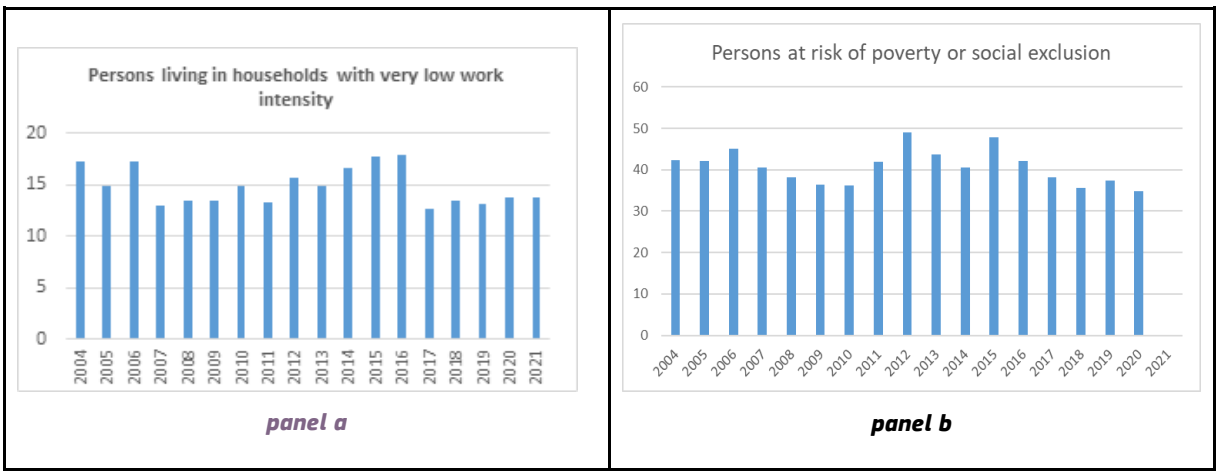
Data retrieved from the Eu-Silc (European Union Statistics on Income and Living Conditions) Survey offer additional measures of poverty. In 2021, 36% of residents in Puglia lived at risk of poverty or social exclusion, and 14% lived in households with low work intensity. The "*Person living in households with very low work intensity*" index shows a fluctuating share of people living with very low work intensity that decreased between 2004 and 2007, growing in 2016 and then going back to the values recorded around 2010 (see figure 9, panel a).

The "*Persons at risk of poverty or social exclusion*" index shows a similar performance (figure 10, panel b): the share of people at risk of poverty or social exclusion lowers until 2008 and then raises in conjunction with the two economic crises in 2008 and 2011 until 2015, when the trend lowers again.

Income support measures (citizenship income and other extraordinary measures) limited the drastic increase in poverty during the Covid emergency. The post-Covid recovery recorded by the Italian economy in 2021 also seems to have partially reduced the share of Apulians at risk of poverty or social exclusion.

The reduction in the risk of poverty or social exclusion particularly affected Puglia and fewer other Southern regions. The South remains the area of the Country with the highest percentage of individuals at risk of poverty or social exclusion (41.2%), stable compared to 2020 (41%) and decreasing compared to 2019 (42.2%). The risk of poverty or social exclusion was higher among individuals in households with three or more children (41.1% compared with 39.7% in 2020 and 34.7% in 2019), among single people (30.6%) and in single-parent households (33.1%).

Figure 9. SDG-1 indicators statistical trends.



Source: Eurostat

4.2.2 Goal 2 - End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Data availability for Goal 2 restricted the set of indicators to 4 indicators:

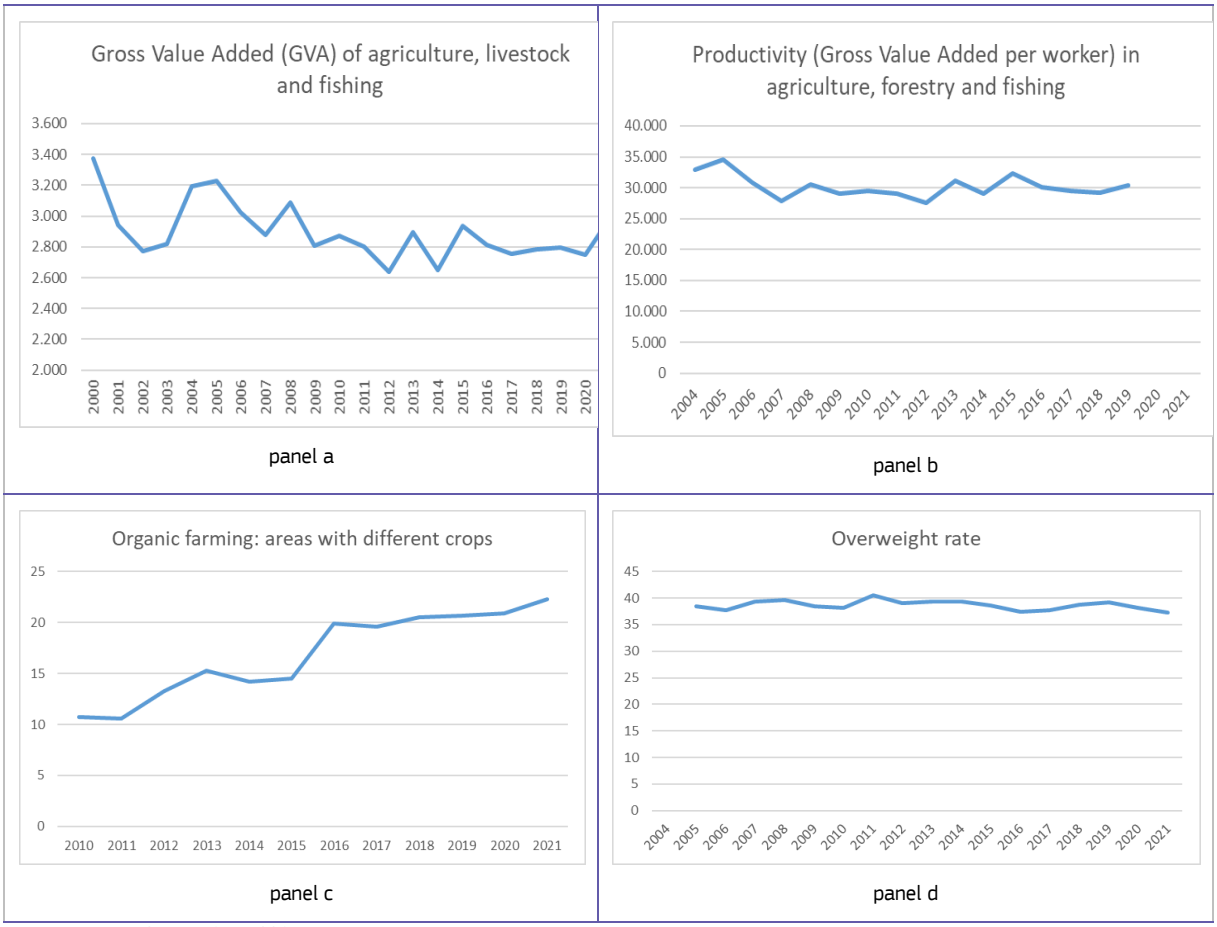
- Gross Value Added (GVA) of agriculture, livestock and fishing;
- "Organic farming: areas with different crops";
- "Productivity (Gross Value Added per worker) in agriculture, forestry and fishing";
- "Overweight rate";

As figure 10 (panel a) shows below, the GVA of agriculture index decreased across the last 20 years. The value added of agriculture in the region of Puglia shows an overall downward trend until 2014, when it reached its lowest point. Since then it appears to stabilise, remaining broadly constant until 2020.

Labour productivity in agriculture declined until 2007 (figure 10, panel b). It then remained fairly stable around the 30,000 threshold in the following years. Interestingly, the share of land under organic agriculture constantly grew as well. In 2019, organic crops covered 15.8% of the utilized agricultural area measured at national level, almost double than the EU average. In Puglia this indicator is even higher, and it achieves 20% (Figure 10 panel c). The growth of organic crops in Puglia, consistently rose in the last years (+2% in 2021). Data sheds a light on the local Governmental policies to support organic agriculture in the last 30 years, mainly using the FEASR funds: if the GVA dropped down because of structural shortfalls, well known for agriculture in Puglia, and labour productivity as well, the enduring growth in the organic food supply-chain made Puglia one of the largest organic food provider in EU, and even worldwide.

Finally, the "*Overweight rate*" index shows a quite stable trend although slightly decreasing in recent years (Figure 10, panel d), which reached 37.3% in 2021 compared to 39.2% in 2019 and 38.2% in 2020. Men were found to be more overweight than women. Excess weight increases with age (as early as the 45-54 age group, it affected almost 5 out of 10 people) and in the regions of Southern Italy (50.0%). Compared to 2020, the share of overweight people decreased for both men and women, with more significant levels among adults aged 50-64 years (-3%) and especially in the northern regions (from 43.7% to 41.1%), while in the Central and Southern regions the situation remained (as for Puglia region) more or less stable. It is apparent that sedentary behaviour is often associated with excess body weight. These risk factors, alone or in association, generally concern about 60% of the adult population, with a share of about 20% in which both forms of behaviour overlap. The protective role of educational qualifications was confirmed, with a greater focus on healthier behaviour among those with higher educational qualifications. For example, a higher proportion of overweight people was observed among those with a low educational qualification (54.6%), compared to those with a university degree or higher (33.7%). Similarly, a higher proportion of sedentary people was observed among those with a low educational qualification, compared to those with at least a university degree (Istat, 2021).

Figure 10. SDG-2 indicators statistical trends.



Source: Istat and OECD (panel b)

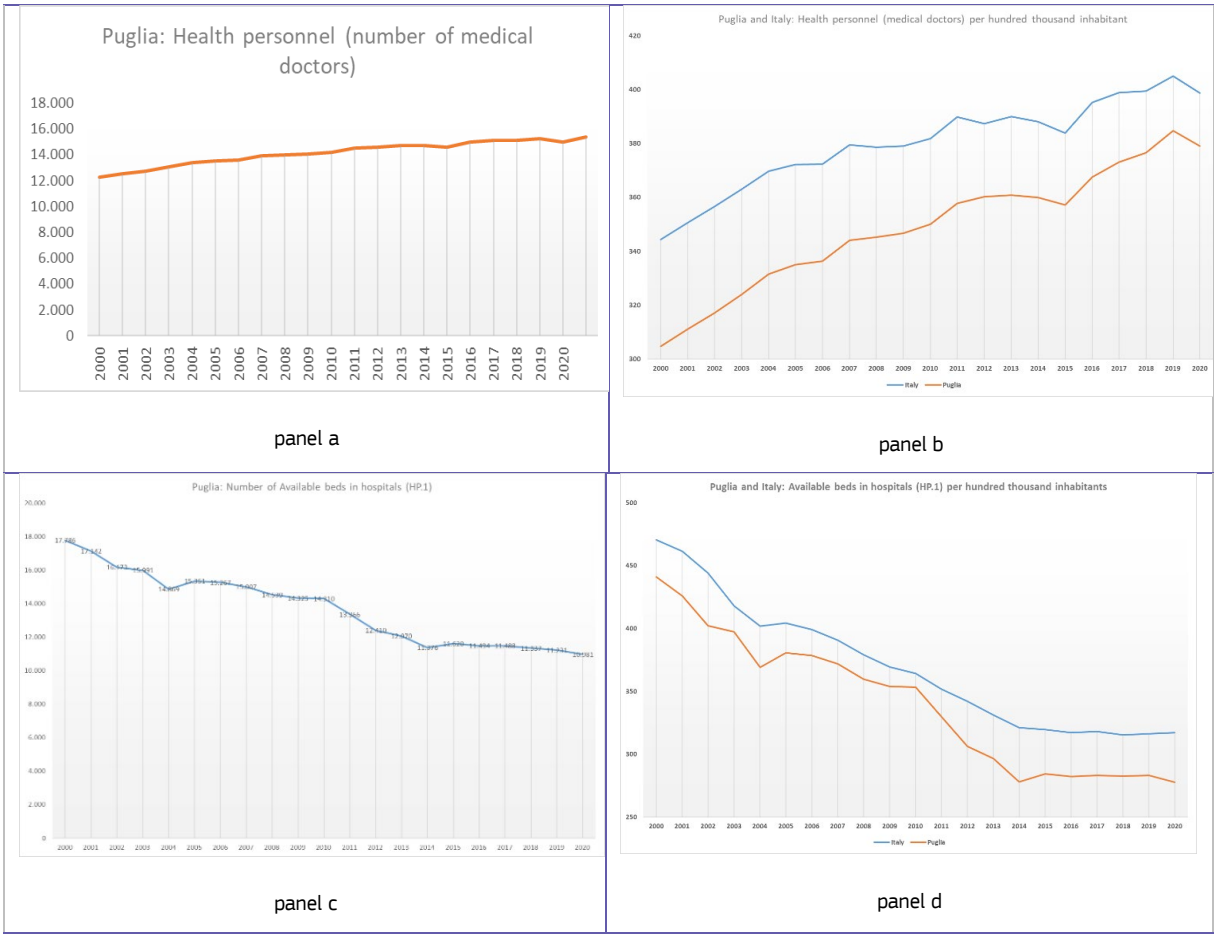
4.2.3 Goal 3 - Ensure healthy lives and promote well-being for all at all ages

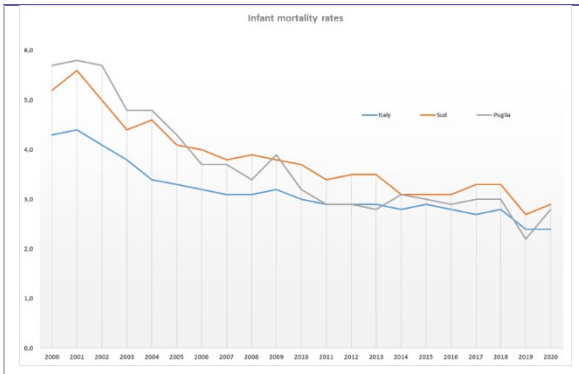
Data availability for Goal 3 restricted the set of indicators to 4 indicators:

- "Health personnel";
- "Hospital beds";
- "Infant mortality";
- "Deaths due to Covid-19".

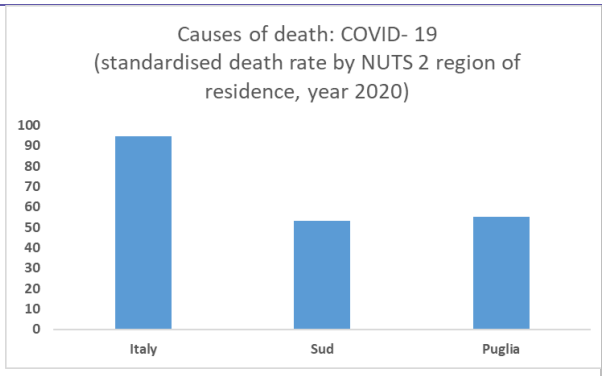
Everyone has the right to timely access to good preventive and therapeutic healthcare at an affordable cost. To guarantee this right, there is a need for an even distribution of structures and health workers across the territory and for effective disease prevention, control and monitoring policies, control and monitoring of diseases. A balanced distribution of health facilities and staff is necessary to guarantee this right. The coverage of essential health services is represented through the allocation on the territory of facilities and personnel that allow basic, medical, diagnostic, residential or semi-residential healthcare. Several subjects are involved: health care institutions, physicians, nursing staff, pharmacists and social-healthcare residential facilities.

Figure 11. SDG-3 indicators statistical trends.





panel e



panel f

Source: Eurostat

As it is possible to see from Figure 11 (panel a), people employed in healthcare constantly grew in the last 20 years although the number of hospital beds decreased (panel b), calling for in-depth analysis. In 2020 in the Puglia region about 10,000 hospital beds were available (189000 in Italy), corresponding to 277 beds for every 100,000 inhabitants (317 in Italy), confirming a downward trend started in the mid-1990s. In 2021, in Puglia, the number of specialist and general physicians is about 15.000 equal to a ratio of 380 physicians per hundred thousand inhabitants (390 in Italy.)

The advances in the medical and health field made in the last 20 years can be summarized through the trend on infant mortality. As figure 11 (panel e) shows, it has been significantly positive and has declined almost steadily in the last 20 years. The infant mortality rate in 2020 was 2.8 per 1,000 live births, up from the best-ever figure recorded in 2019 (2.2 per 1,000 live births).

It should be noted that, although starting from values above the Italian average and those of the other southern regions, the infant mortality rate has decreased to the point of reaching the Italian average figure in 2019 and being lower than that of the other southern regions.

Finally, the goodness of the sanitary measures taken, albeit within the constant economic limits that have characterized the Puglia Region's spending capacity over the last 20 years, can also be seen in the data on the number of deaths in the region during the Covid-19 pandemic. In 2020, the region was fortunately affected less by the number of Covid deaths than other Italian regions (Figure 11, panel f). Local measures to reduce the spread of the virus, such as social distancing and quarantines, helped to reduce the number of people infected and the number of fatalities.

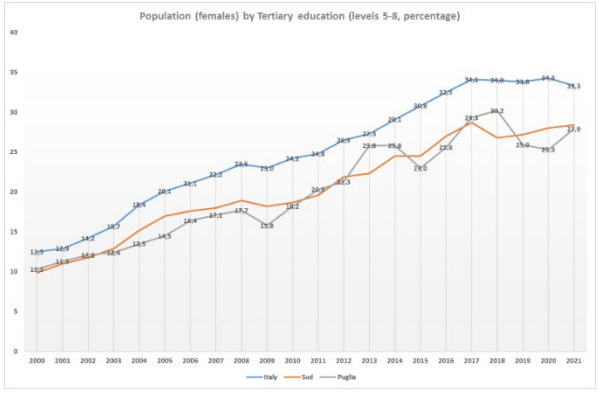
4.2.4 Goal 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Data availability for Goal 4 is completed and it regards the following 7 indicators:

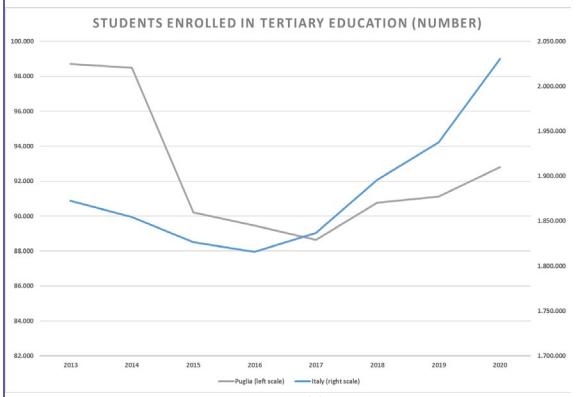
- "Women 30-34 years old with higher education level";
- "Students enrolled in tertiary education";
- "Participation in education";
- "Pupils enrolled in early childhood education";
- "Participation rates in selected education levels";
- "Distribution of pupils and students enrolled in general and vocational programmes";
- "Early leavers from education and training".

Goal 4 addresses the issue of the quality of education, which is important for improving the lives of people and for ensuring that development is inclusive and sustainable. The targets to be monitored cover several dimensions: access for all to all levels of education (primary, secondary and tertiary); quality of education; knowledge and skills for employment and sustainable development; elimination of gender disparities in education and equal access for the most vulnerable; and monitoring of school facilities to ensure they meet everyone's needs. Education, training and the level of skills acquired influence people's well-being. They open up avenues and opportunities that would otherwise be closed to them. In Italy (and in Puglia), the level of education and training that individuals are able to achieve is still strongly correlated with social background, gender, socio-economic context and the geographical area in which they live. Italy (and the region of Puglia) lags far behind the European averages and indicators of educational attainment and skill levels have suffered a setback in the last two years. The 2020 pandemic, with the consequent closure of schools and universities and the spread of distance and integrated learning, has exacerbated the difficulties.

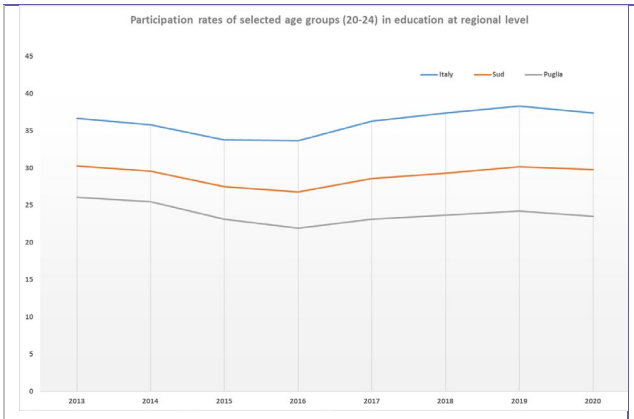
Figure 12. SDGs 4 indicators statistical trends.



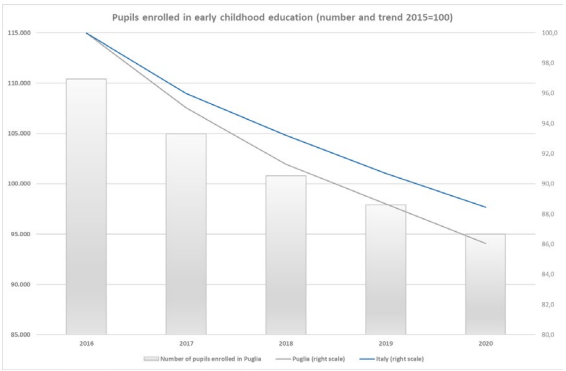
Panel a



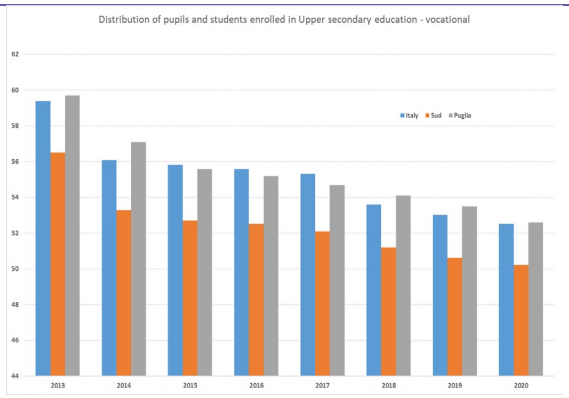
panel b



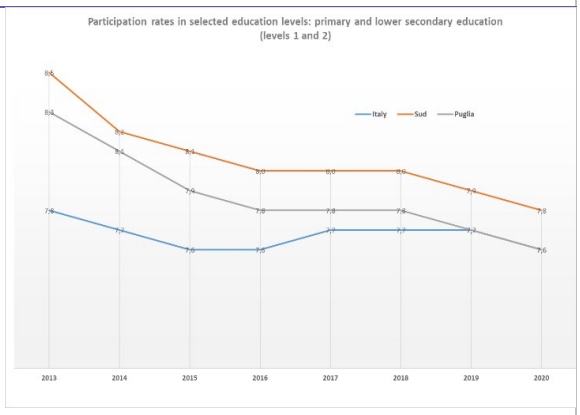
panel c



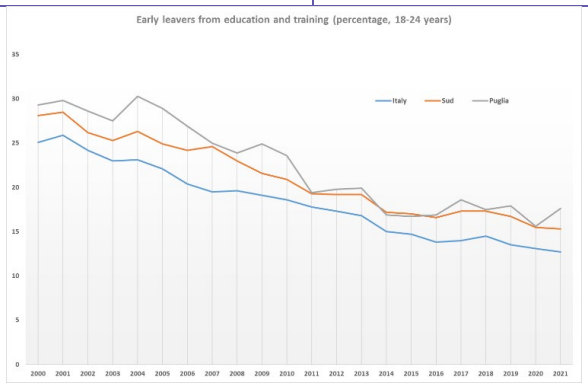
panel d



panel e



panel f



panel g

Source Istat

In Puglia, women aged between 30 and 34 years show a constantly rising trend in higher education (Figure 12 panel a). After peaking at 30% in 2018, only 4 percentage points from the Italian figure and above the average for the other southern regions, there was a decline during 2019 and 2020, only partially recovered in 2021. The gap with the Italian average figure has thus widened over the last three years. This result could also be due to the resumption of the migration phenomenon, which has mainly characterized young people with more advanced education (Istat 2022).

The number of students enrolled in tertiary education declined significantly until 2016, (from 98,000 enrolled to 88000). After 2016, it is possible to observe an increase in the number of students: in 2020, it reaches a peak of 98,000 students (Figure 12 panel b). The trend of students enrolled in tertiary education appears to be at odds with the data on participation in tertiary education, which appears to be slightly decreasing (Figure 13

panel c). One possible explanation for this lack of synchrony is that the proportion of those enrolled in tertiary education over 24 has risen sharply in recent years. This is a symptom of a process of continuous training of workers that also seems to have taken place in the Puglia Region.

The evidence shown by the last two indicators links quite well, with what also emerges from the other four for which it was possible to collect data. In fact, the demographic trends of the Puglia region explain the constant decline observed in the number of children enrolled in schools (Figure 12 panel d) and the participation rate (Figure 12, panel e). In Italy, school is compulsory up to age 16. The share of students enrolling in vocational programs is in constant decline (Figure 13, panel f), signals that there is little appeal of these educational institutions, which need extensive reform, and which are currently seen as a rather useless training "tool" to achieve good quality work and/or to move to a tertiary level of education. Equally alarming is the data that emerges from the early leaving from education and training indicator.

In Italy, in 2020 the share of people in the 18-24 age class who left the education and training system without having obtained a diploma or a qualification was estimated at 13.1%, equal to 543 thousand people, a marginal reduction compared to the previous year (Figure 12, panel g),.The level was still higher than the European target (10%), which has already been achieved by the EU27 (10.1%). Early school leaving involved more men (15.6%) than women (10.4%). Territorial gaps were very wide and persistent, despite the fact that in 2020 the difference between the North and the South and Islands decreased to 5.3 percentage points (thanks to the decrease recorded in the South and Islands), from 7.7 p.p. in 2019. In 2020, the dropout rate before completion of upper secondary education or vocational training was equal to 17.9% in the Islands, 15.5% in the South, 11.8% in the North-West, 9.9% in the Northeast and 11.5 % in the Centre. In Puglia, the share exceeded 15%, with a worrying leap in 2021.

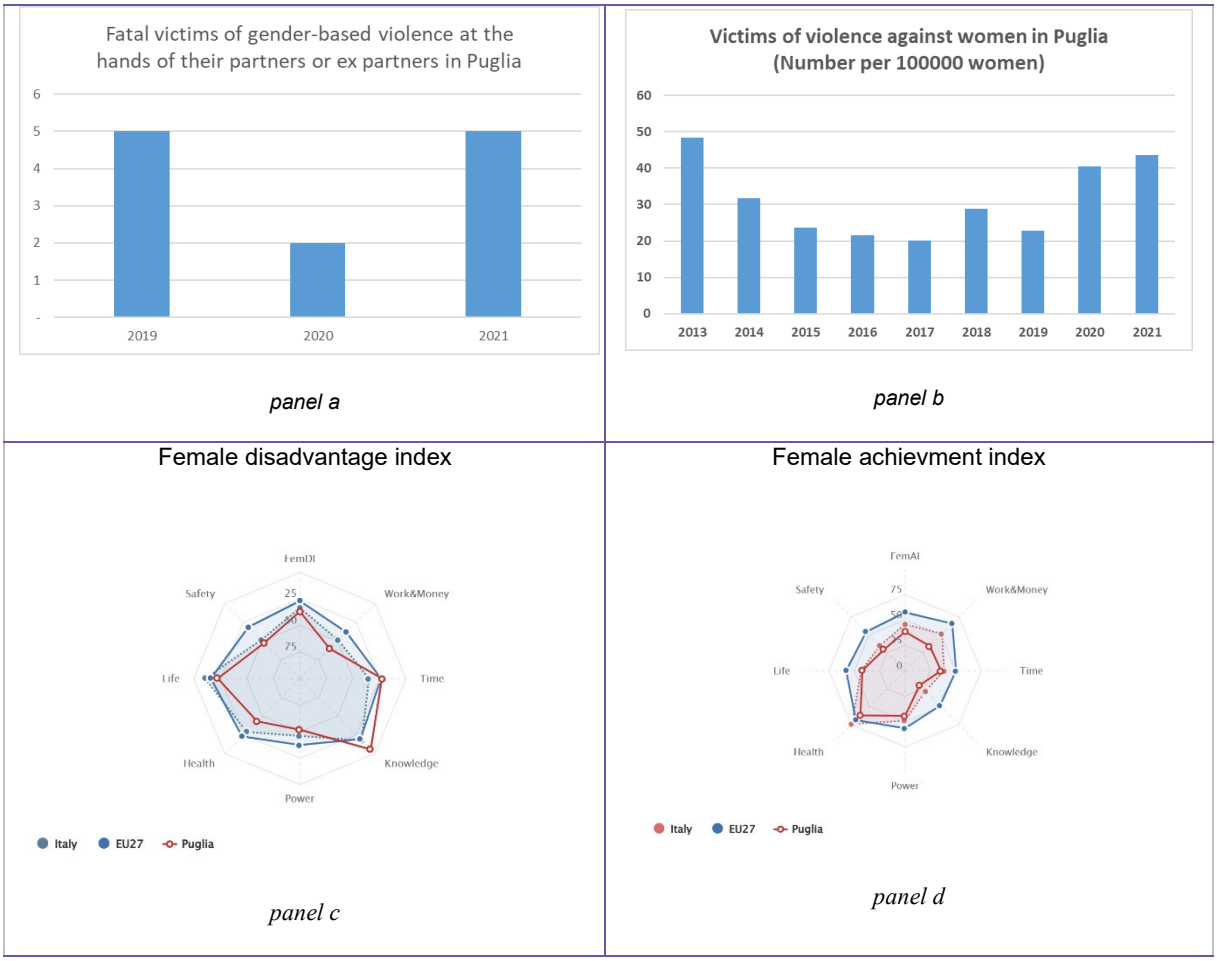
4.2.5 Goal 5 - Achieve gender equality and empower all women and girls

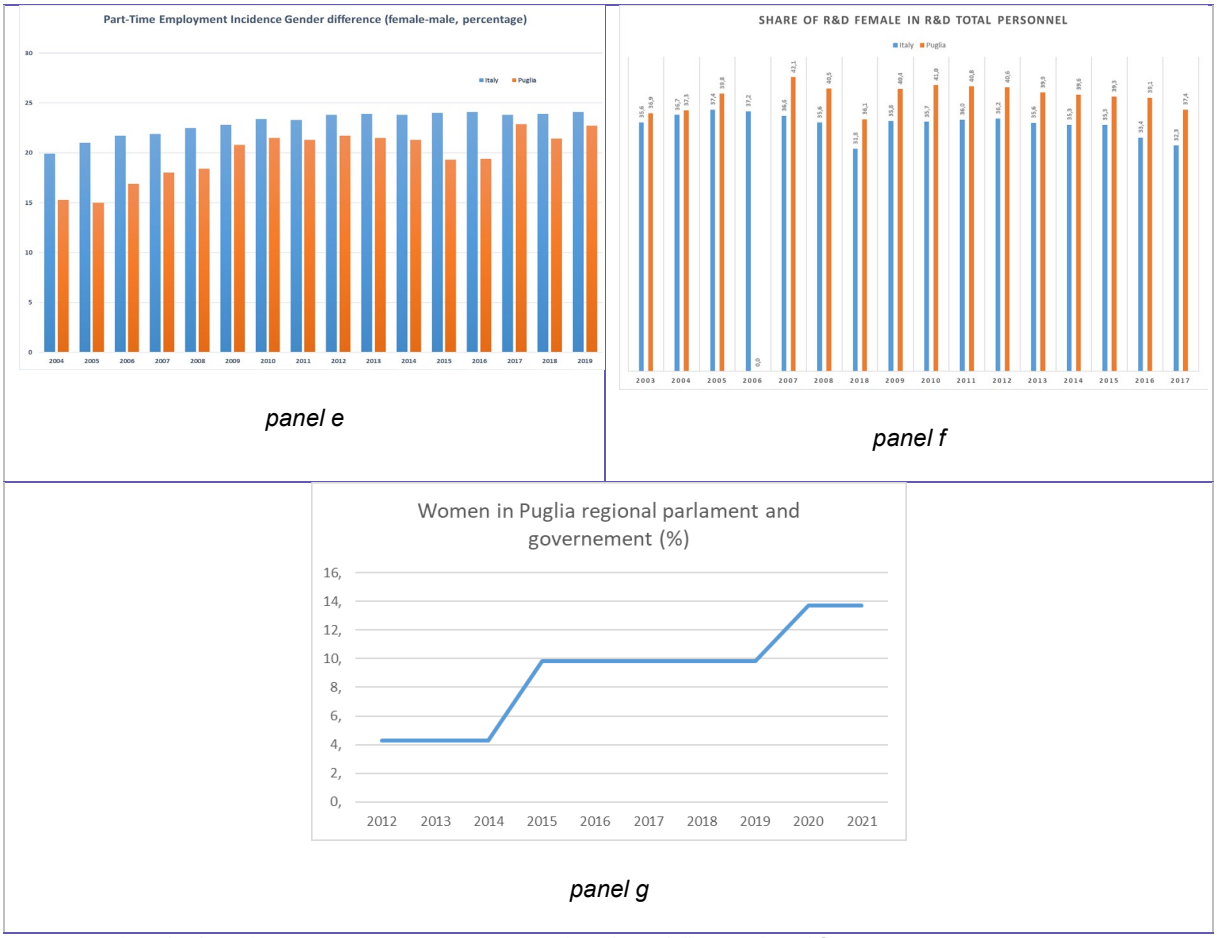
Data availability for Goal 5 is almost completed and it regards the following 6 indicators:

- "Fatal victims of gender-based violence at the hands of their partners or ex partners";
- "Victims of violence against women";
- "Female research and development personnel";
- "Women in parliament and government";
- "Female achievement/disadvantage index";
- "Gender gap in part-time employment incidence".

Despite the progress achieved in gender equality and women's empowerment, women and girls continue to deal with disparities in rights and access to economic, natural and technological resources, to face gender stereotypes and to suffer discrimination and violence. Goal 5 aims to remove any kind of discrimination and violence for women, both in the public and in the private sphere. It is important to ensure access to acknowledge and enhance unpaid housework and care work, to provide public services, infrastructure and social protection policies finally to promote shared responsibility within the household. This goal wants to ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life. Gender equality is not a fundamental human right only it is an essential condition for a prosperous, sustainable and peaceful world too. Gender differences and inequalities must therefore be contrasted in every field.

Figure 13. SDGs 5 indicators statistical trends.





panel e

panel f

panel g

Source: Istat (panel a, b, e, g), European Commission, DG REGIO (panel c and d), OECD (panel f)

Women were affected deeply by the pandemic. Italy included the guidelines of the new European strategy for gender equality into the National Recovery and Resilience Plan (NRRP). Gender equality is classified as a crosscutting goal to be achieved through the implementation of the Reforms and Missions of the NRRP. The evolution of Goal 5 indicators is an important tool for gender equality analysis.

Results for the Goal 5 reveal some shadow above the sustainable development in Puglia. While both the number of women employed in local government and the share of female employees in R&D rise encouragingly, three development indexes record worrying rising trends: "*Victims of violence against women*", "*Female disadvantage index*" (as described above), "Gender gap in part-time employment incidence".

Since the beginning of the pandemic in Europe, there has been an alarming increase in violence against women (Report on Gender Equality in the European Union, 2021). The phenomenon involved Italy too.

According to the United Nations, violence against women is defined as "*any act of gender-based violence that causes or is likely to cause physical, sexual or psychological harm to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or private life*" (Vienna, 1993). Measuring violence against women is difficult since it is a phenomenon mostly hidden. This violence is perpetrated very often by a family member and therefore is hard to talk about and to report. The woman feels lonely having to cope with abuses that, once disclosed, would change the life of her loved ones. The emotional and psychological reactions that develop because of episodic or continuous violence are very complex.

In 2020, more than 49 women per 100,000 inhabitants called the toll-free number 1522, because they were victims of violence. They were around 27 in 2019 (Istat 2021). The increase in calls to the toll-free number was widespread throughout the territory and recorded a higher intensity in Lazio, about 60 per 100,000 women (38 in 2019). As Figure 13 panel b shows, in Puglia, the number reached about 44 per 100,000 women with respect to the pre-pandemic period (22 per 100,000). The most common kind of violence is psychological, usually jointly reported with physical violence.

According to Istat, 315 homicides were committed in Italy in 2020, of which 111 were women (in 2018 there were 345 homicides of which 133 were women). About 84% of women (79.7% in 2019) were murdered at home. Of these, 55 women (49.5%) were murdered by their partner, 13 by their ex-partner (11.7%; the number was 7.5 in 2019) and 25 by another family member (22.5%). In the Puglia region, women murdered by their partner in Puglia have increased compared to 2019, reaching the sad result of 5 women murdered (Figure 13, panel a).

The incidence of part-time in female employment, compared to male workers, is increasing both in Puglia region and more generally in Italy. In Puglia, a difference level of 22.7% was reached in 2019, with a significant increase in recent years (Figure 13, panel e). This value, although lower than the national average, is even more worrying if we consider the lower percentage of employed women in Puglia. In addition, it is probably a symptom of the still strong custom in the Puglia region of delegating family and childcare tasks to the female gender.

Female disadvantage index shows how the female disadvantages are fairly similar between Italy and Puglia region, even if difference results appear in money&work, power, safety and knowledge (in this last case it is positive for Puglia region). Regarding the female achievements index the difference seems to be greater (Figure 13 panel d).

The indicator "*Share of female R&D personnel*" signals a significant movement away from the desired direction regarding the growth of female empowerment. In fact, both in Italy and in the Puglia region, a decreasing trend appears to be underway, with a reduction in the share of women on the total research and development personnel. In 2018, this share was 37%, ten percentage points less than the figure of ten years earlier (Figure 13, panel f). The difficult economic situation that has involved Puglia over the last 15 years may have prompted the "*more qualified*" female personnel but with fewer career prospects to emigrate to seek the appropriate professional satisfaction.

In 2018, Italy, with 35% of seats occupied by women, is in 8th place, recovering the disadvantage of 2008, when it was in 16th position. Over the period 2003-2018, the share of seats allocated to women in Italy has increased significantly. If, in fact, in 2003 our country had a much lower share than the EU28 average (10.2% compared to 20.5%), over the years Italy has recovered its disadvantage to reach and exceed the EU average (Istat 2021).

The presence of women in positions of political representation is still insufficient. The gender gap is still very wide, but Italy's profile is no worse than the average of the EU countries. In 2021, Italy's representation of women in the European Parliament (39.5%) remained in line with the average of the 27 countries, and that in the national Parliament (36.2%) remained higher (+3.7 percentage points); the share of women elected to municipal councils (31.7%) was slightly lower (-2.7 percentage points). In this latter regard, however, it should be noted that less than one Italian municipality in six has a female mayor, and that among the 133 largest municipal administrations (with at least 50,000 inhabitants) there are currently only five women in the same position (Istat 2021). The trends described by the data, as is well known, are also due to the measures taken over the years to mitigate the gender gap in political representation and top management. It is especially in regional politics that the presence of women still struggles to establish itself.

In 2020, nine out of twenty regions elected the new Regional Councils. Moreover, there is only one woman among the 20 Regional Governors currently in office. The percentage of women chairing councils rose by almost one percentage point to 22%. Females in the Centre (32.9%) compared to the North (23.2%) and the South and Islands (15.8%) recorded a larger presence. In Puglia, the number of women in local councils was 13.7% (see Figure 13, panel g).

4.2.6 Goal 6 - Ensure availability and sustainable management of water and sanitation for all

The statistical measures available for Goal 6 are only two and refer to target 6.3 (water quality). They are the following:

- "Water bodies that exceed a standardized quality rating";
- "Groundwater that exceeds a standardized quality rating".

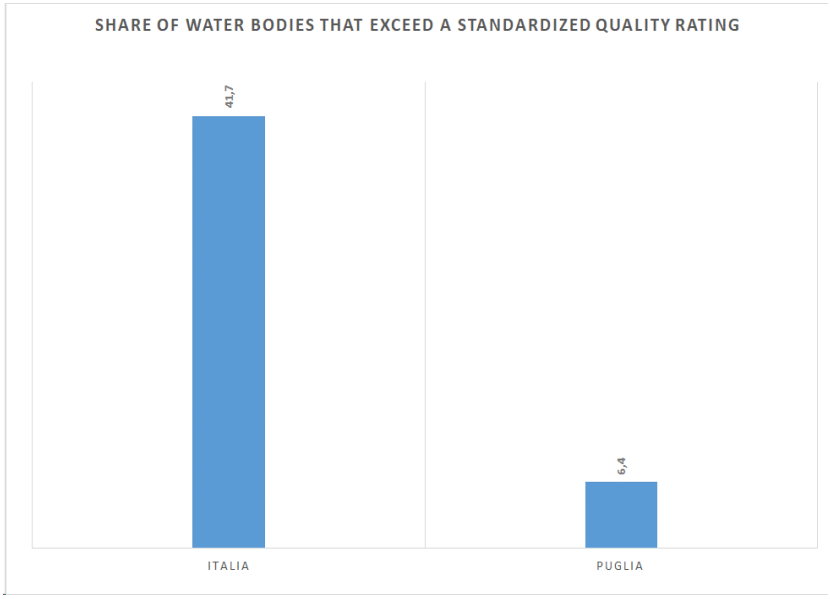
Goal 6 focuses on the availability of water, a vital and essential resource for all forms of life. Making water accessible and safe for people and ecosystems is essential for human and natural survival and health. Climate change and increasing demand intensify the water challenge. The availability of water and the forecasts for the future are far from being favourable.

Puglia is not excluded from this scenario, having already experienced severe water shortages in some areas. In addition, there are serious and persistent inefficiencies in the water network that are still a source of waste and huge losses of this precious commodity. The management of the entire water cycle must therefore be made more efficient by investing in the different types of activity, from abstraction to distribution and treatment of waste water. In order to ensure an adequate level of quality, the return of water to the environment must be as free of pollutants as possible.

Water bodies that exceed a standardized quality rating measured as the "Share (%) of water bodies that reached ecological quality standards (high or fair) over the entire surface water bodies (rivers and lakes)". The ecological state of inland surface waters, in accordance with Legislative Decree 152/2006, is an index that describes the quality of the structure and functioning of aquatic ecosystems. The legislation includes a selection of the Biological Quality Elements (EQB) to be monitored in the different water bodies based on the objectives and the assessment of the pressures and impacts. The EQB provided for surface waters are: macrobenthos, macrophytes and fish fauna. In addition, fitobenthos (diatoms) for rivers, and phytoplankton for lakes. In order to allow a better understanding of the status and management of water bodies, in addition to the EQB, other supporting elements are monitored: the quality index of the chemical-physical components of rivers (LIMeco) or lakes (LTLeco), specific pollutants not included in the priority list (Table 1 / B) and the hydromorphological elements.

The synthetic version of the indicator proposed here aims to highlight only the percentage of water bodies that have achieved the objective of ecological quality (high and good) on the total number of water bodies of surface waters (rivers and lakes). Source: National Institute for Environmental Research (ISPRA); the index answers a EU-directive; it is surveyed every 7 years (Figure 14).

Figure 14. "Share of water bodies that exceed a standardized quality rating" (SDG 6) - statistical trend.

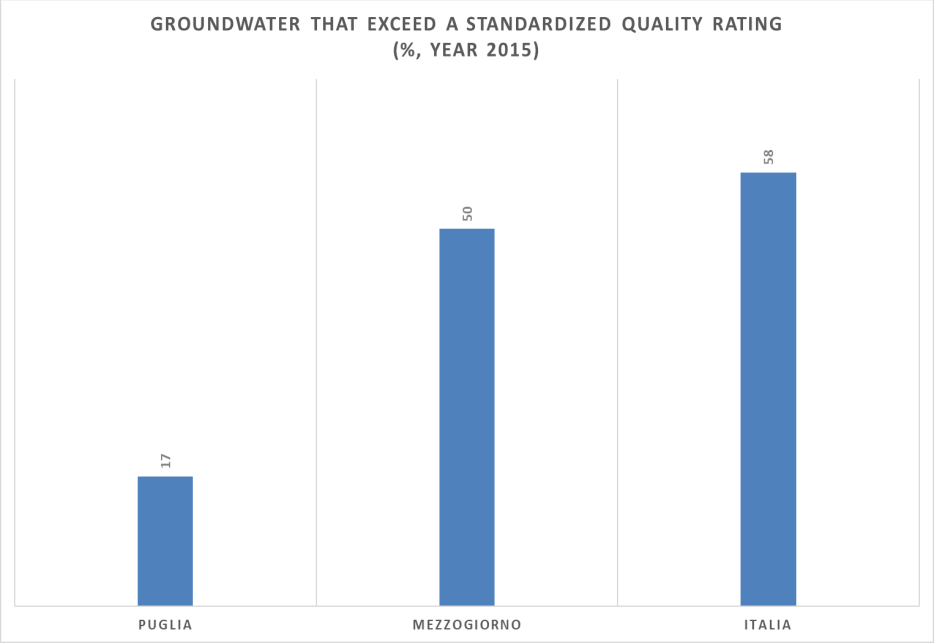


Source: National Institute for Environmental Research (ISPRA)

The "*Share (%) of groundwater that reached chemical quality standards (good) over the entire groundwater*" index is released by the National Institute for Environmental Research (ISPRA); the index answers a EU-directive; it is surveyed every 7 years. Groundwater provides a major source of drinking water for many EU citizens and provides the steady base flow of rivers and wetlands. Keeping groundwater free of pollution is vital for humans and river and wetland ecosystems. Once pollutants are in groundwater, recovery can take years or even many decades because of residence times and the slow degradation of pollutants. Puglia data seems not to be very positive compared with Italian and Mezzogiorno averages (Figure 15).

At the moment these indicators cannot give us information about the trend, but it is possible to note that data regarding Puglia are below the national average. These results show that the Puglia Region is particularly lagging behind in these areas. Given the growing risk of drought and the desertification of part of the territory, it is essential to find solutions quickly.

Figure 15. "Ground water that exceed a standardized quality rating" (SDG 6) – statistical trend.



Source: National Institute for Environmental Research (ISPRA)

4.2.7 Goal 7 - Ensure access to affordable, reliable, sustainable and modern energy for all

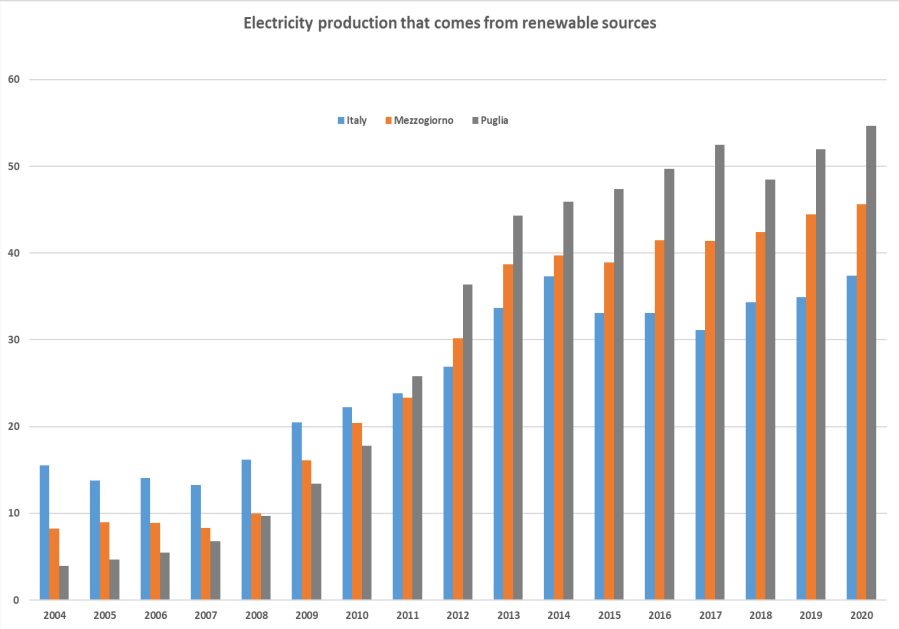
The statistical measures available for Goal 7 are the following two:

- "Energy intensity";
- "Electricity production that comes from renewable sources".

Both the indexes reveal positive issues: the share of electricity from renewable sources in Puglia encouragingly grows and the energy intensity in the last years constantly dropped revealing the effectiveness of the energy management local policies.

National and international energy policies have been active for years to expand the renewable energy sources, with the aim of decarbonising the economy and guaranteeing climate change commitments. In 2019, one year before the deadline of the 2020 targets set by the EU Climate-Energy Package, Italy was among the fourteen Member States exceeding the target assigned at national level. In Italy, the overall share of energy from renewable sources on the gross final consumption was equal to 18.2%, a percentage slightly lower than the average of the EU27 (19.7%). Italy was for the sixth consecutive year above the percentage of 17% set as national target. Over the last twenty years, the share of renewables increased (Figure 16), due to RES incentive policies, but also to the contraction of overall energy consumption. However, in order to achieve the ambitious goals defined a further boost to production from renewable sources is required. To realize the "Green revolution and ecological transition", the National Recovery and Resilience Plan (NRRP) finances large investments in the energy field, focusing, among other components, on a further expansion of RES. Puglia is actually a strong player in the energetic transition toward sustainable and renewable energy sources: Figure 16 shows the huge investments in wind farms and solar farms that pushed the amount of electricity power from renewable resources up over 50%.

Figure 16. "Electricity production that comes from renewable sources" - statistical trend.

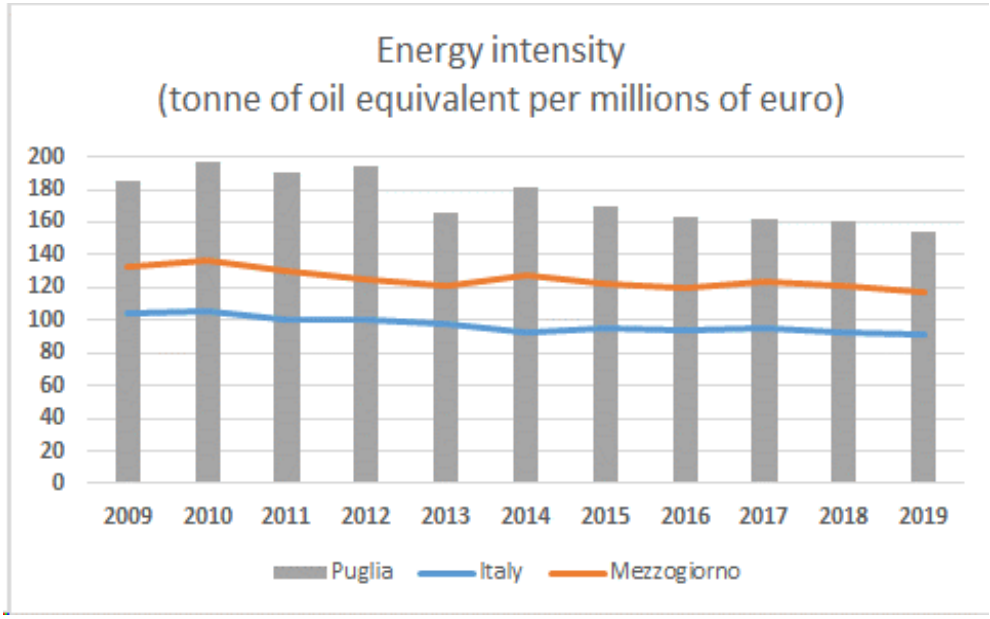


Source Istat on Terna data

In 2019 Italy reached the fourth position in the EU ranking of energy intensity (ratio of gross available energy to gross domestic product), with 91.6 tonnes of oil equivalent consumed per million euro (TOE/M€), lower than the 112.8 EU27 average. 2019 confirmed the process of reduction of Italian energy intensity (Figure 17), which marked a further contraction of 1.3%, reaching an overall negative balance compared to the last decade of 11.8%, with an average annual variation rate equal to -1.2%. Puglia moves along the same path reaching less than 150 tonnes of oil equivalent consumed per million euros (TOE/M€), although still higher than the national average.

Despite the joint impact of GDP on the trend of the indicator, the reduction in energy intensity was largely due to the measures in favour of energy efficiency, which, between 2011 and 2019, saved energy for 12 Mtep/year, equal to 77% of the 2020 target set by the National Action Plan for Energy Efficiency 2017. A further acceleration to energy efficiency is expected, in the coming years, as a result of the investment plan made available by the NRRP, largely due to the renovation of the public and private building stock.

Figure 17. "Energy intensity (SDG 7) – statistical trend.



Source: Istat- Enea

4.2.8 Goal 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

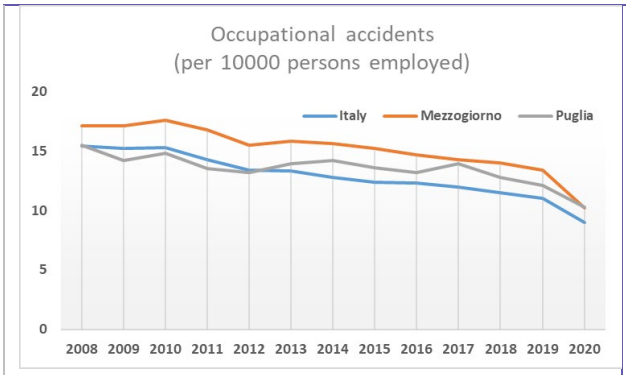
Data availability for Goal 8 is completed and it regards the following 10 indicators:

- "Occupational accidents".
- "Economic activity".
- "Unemployment".
- "Firm creation".
- "Employment".
- "GDP at current market prices".
- "GVA at basic prices".
- "Long-term unemployment (12 months and more)".
- "Compensation of employees".
- "Young people neither in employment nor in education and training".

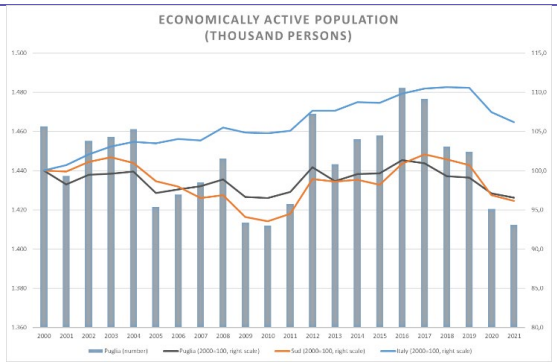
Goal 8 focuses on the promotion of a new model of economic development that combines economic growth with environmental protection and ensures inclusion and equity in the distribution of economic resources and working conditions. The monitoring of economic growth refers to the performance of economies and their production capacity, to be supported and strengthened by stimulating diversification, technological progress and innovation. This means promoting a development model based on drivers that can increase the potential for growth, with a balanced leveraging of qualitative factors, not just quantitative ones, in order to generate inclusive and sustainable effects. The aspect of labour is addressed with reference to the goal of ensuring full employment and decent work for all, including the categories at risk of exclusion (young people, women, persons with disabilities, migrants) and fairness in compensation, improving safety conditions in the workplace and eliminating all forms of labour exploitation.

Data and trends for Goal 8 are listed in the following figure.

Figure 18. SDGs 8 indicators statistical trends.



panel a



panel b

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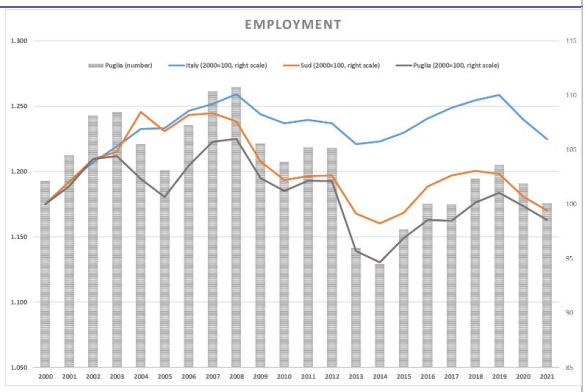
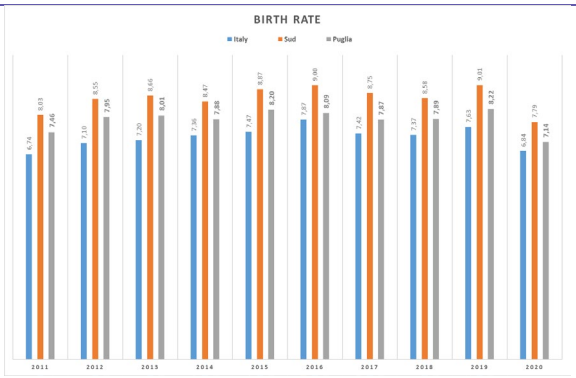
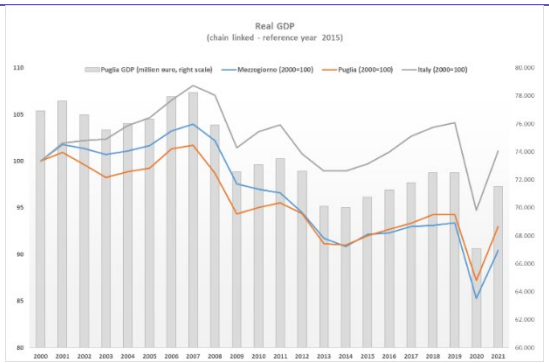


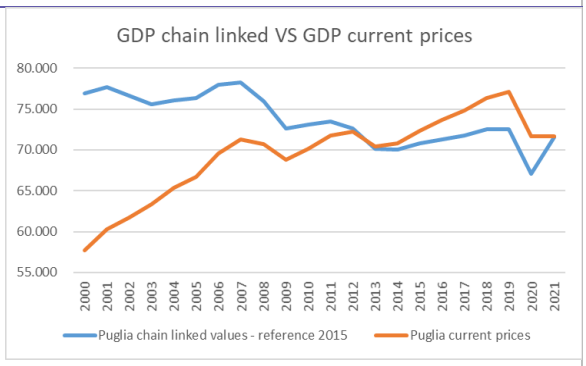
panel d



panel e

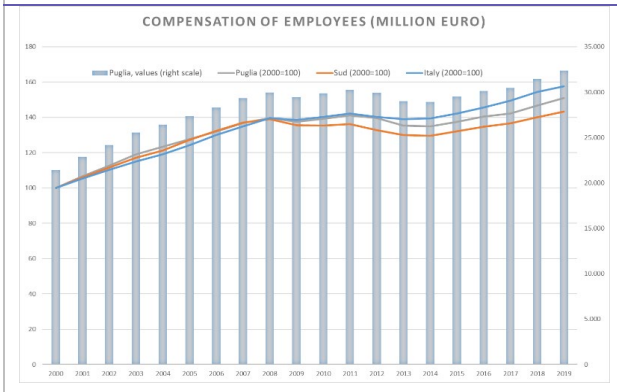
panel f



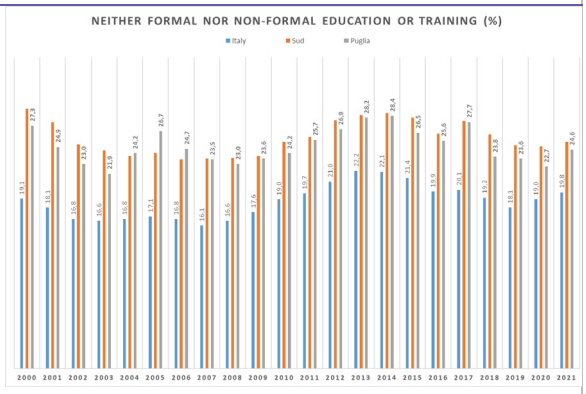


panel h

panel g



panel i



panel l

Source: Eurostat and Istat-Inail (panel a)

The whole picture shows a negative scenario for this goal. During 2020 in Italy GDP fell dramatically (-8.9%) due to the impact of the mobility restrictions and the closures of economic activities to mitigate the Covid-19 pandemic. The Puglia region, starting from lower GDP levels, experienced a similar fall compared to the Italian figure (Figure 18 panel g). And even the robust recovery recorded in 2021 does not seem to have been able to bring it back to pre-Covid levels. However, the Puglia region seems to have shown signs of greater dynamism over the last ten years than the other economically less developed regions in Southern Italy.

The economic crisis originated by the pandemic affected the labour market and interrupted the phase of employment growth recorded. Nonetheless, the local labour market is stuck: both the economic crisis in 2011-2012 affected the number of unemployed workers (see Figure 18, panel c), which increased to a peak of 21.2% in 2014 and then slow down until 2020. However, it is interesting to note that in the last five years there was an important recovery in terms of a reduction in the unemployment rate, which is lower than the average of the other regions of Southern Italy. In Italy, in 2020, the unemployment rate decreased from 10,0 to 9.2% (-0,8 p.p.), differently from the EU27 average (+0,3). Italian unemployment rate is higher than ten years ago (8,4%; + 0,8 points), despite the progressive reduction started in 2015. The improvement in the unemployment rate in 2020 reflected the difficulties in job search due to the restrictions to production and mobility, which increased inactivity. In 2020, data confirmed the traditional territorial gaps, by gender, age and educational level and highlighted greater difficulties in Southern Italy, especially in Calabria (20,1%), Campania (18,0%) and Sicilia (17,9%), for women, foreigners and for the lower educated and younger population groups.

As the Figure 18, panel d, shows, the employment rate does not differ showing a fluctuating trend: after suffering the crisis in 2008-2009 and in 2011-2012, the number of employees rose from 2015 and then again dropped in 2021. The overall resilience of employment compared to the large losses of production activity was due to permanent employees supporting policies (in particular, redundancy fund and layoff suspension). Besides the impact on self-employed and fixed-term jobs, the most relevant impact of the health emergency led to a generalized reduction in hours worked. The decline in the employment rate recorded in Italy in 2020 interrupted a growing trend observed since 2014 (which had allowed our country to recover, in 2019, the pre-crisis levels), hitting population selectively. The most vulnerable categories were deeply penalized, even considering the different participation of such categories in self-employment and fixed-term work and in production sectors most affected by closures. The employment rate of the 20-64 age class fell more sharply for women, dropping from 53.8% in 2019 to 52.7% (- 1.1 percentage point), than for men (from 73.4% to 72.6%; -0.8 p.p.), with a consequent increase in gender gap (-19.9 p.p. for women), which had instead improved in the last three years (Istat 2022).

The long-term unemployment index has moved in line with this, peaking in 2014 (see Figure 18, panel f) and then remaining essentially stable above 60% in recent years, with a brief rise in 2021 following the Covid 19 crisis. On the other hand, the graph of the compensation of employees index shows a constant positive slope, which is slightly stable in the period between 2009 and 2014 and is on a sustained upward trend in the following years (see Figure 18, panel i). It is interesting to note that this trend is similar to that observed in Italy as a whole and in the other regions of southern Italy, but it is more positive when compared with the regions of the latter area.

As can be seen from Figure 19 panel e, similar to the latter indicator, the birth rate of regional enterprises also showed a positive trend. It was 7.45 % in 2011 and rises to 8.22 % in 2019. Then, probably due to the Covid-19 pandemic, it drops by more than one percentage point in 2020. The higher birth rate of enterprises in Apulia, and even more so in the regions of southern Italy, compared to the Italian figure also implies a lower capacity of the enterprises themselves to survive for a longer time and therefore a higher mortality rate.

The proportion of those neither studying nor working (NEET) in Puglia was 27.3 per cent in 2000, a full 8 points higher than the Italian average and lower than that of other southern Italian regions (see Figure 18, panel l). This rate declined until 2003 (to 21.9%) and then increased until 2014, peaking at 28.4%, a level similar to that of other southern Italian regions. In the following years it fell to 22.7 per cent in 2020, showing even better dynamics than other Italian regions. As a result of the Covid-19 pandemic, this indicator is once again on the rise, with a jump of around two percentage points.

In the forthcoming years, improvements are expected thanks to the implementation of the National Recovery and Resilience Plan (NRRP). The Mission Inclusion and Cohesion envisages relevant reforms and investments to support employment through the reinforcing of training, the contrast to undeclared work and the reduction of inequalities for women, young people and the South in accordance with the transversal objectives of NRRP.

In Puglia, in 2020, the number of occupational fatal injuries or injuries leading to permanent disability was equal to 10,3 per 10,000 employees, decreasing by 15% compared to previous year, in continuity with the positive trend recorded in the last decade (-3,3% annual average growth), also determined by the progressive change of our economy towards sectors with less risky working conditions (Figure 18, panel a). The accident rate was higher in the South and Islands (10,6). The incidence of fatal accidents and permanent disabilities employed increased with age. It was 6,0 for 15-34-year-old workers and 27,7 for the over 64 year old workers. The trends in the accident rate are however affected by sectoral characteristics of the local economies, as well as by the different participation rate by gender and by age in the economic sectors that present worse working conditions.

4.2.9 Goal 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Data availability for Goal 9 is completed and it regards the following 6 indicators:

- "GVA of the industry with respect to the GVA of the total sectors (current price)";
- "Gross Domestic Expenditure on R&D";
- "R&D personnel and researchers";
- "Employment in high-technology manufacturing as a percentage of total";
- "Patent applications to the EPO";
- "Share of manufacturing value added of small-scale manufacturing".

Data and trends for Goal 9 are listed in the following figure 19.

Figure 19. SDGs 9 indicators statistical trends.

panel a

panel b

panel c

panel d

Source: Eurostat

The industrial sector in Puglia reduced its incidence on the total added value of the regional economy, especially during the first decade of the 2000s (from 16% to 12,5%), similar to what happened in Italy. In the second decade, on the other hand, this share has remained substantially stable, while in Italy it has grown slightly (Figure 19, panel a). In 2019, the incidence of the industrial sector in Puglia region reached 13.7 per cent. This is six points lower than the national average. At the same time, a growth in R&D expenditure as a percentage of GDP and a similar expansion in the number of personnel and researchers employed in R&D can be observed in recent years. However, R&D intensity remained below the Italian average, equal to 1.51%. In 2019, R&D intensity accounted for 0.8% of GDP and increased to 0.84% in 2020. Business was the institutional sector with

the highest research intensity, followed by universities and by the public sector. R&D intensity showed a deep regional gap. Piemonte and Emilia-Romagna were the most virtuous cases with a R&D intensity above 2%; conversely, Southern regions showed a much lower R&D intensity.

At the same time, R&D expenditure as a percentage of GDP has increased in recent years, but the trend has been non-linear and has mainly widened the gap with the Italian average (Figure 19, panel b). The R&D intensity has always been significantly lower than the Italian average (1.51 per cent compared to 0.8 per cent in Apulia). The business enterprise sector is the institutional sector with the highest R&D intensity, followed by the higher education sector and the public sector. R&D intensity shows deep regional disparities. Piedmont and Emilia-Romagna were the best performers, with R&D intensities above 2%, while the southern regions had much lower R&D intensities.

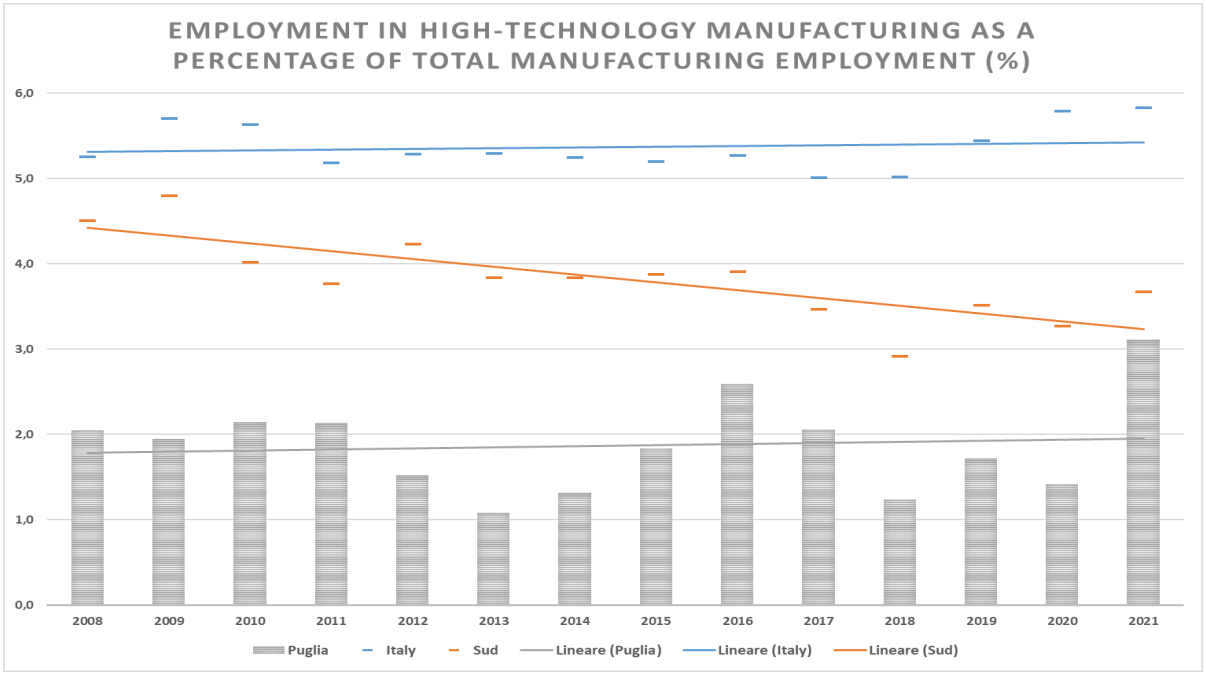
In the context of an increasingly knowledge-based economy, ensuring sustainable and inclusive economic growth requires the availability of human capital that has the level of education, skills and competences required by knowledge-intensive occupations. It is important to have human capital with the appropriate level of education, skills and abilities The number of researchers is an indicator of the input of human capital with a high level of qualification, while at the same time it provides a measure of the demand for highly qualified human resources.

The number of researchers has increased in recent years. However, the gap between Puglia and the rest of Italy remains large (see Figure 19, panel c). The share of Apulian researchers in the total number of Italian researchers, after declining until 2013, has returned in recent years to close to the 2007 level (over 3.5%).

The number of patents published by Puglia's inhabitants also increased up to 2011 (Figure 19, panel d). However, if this figure is related to the population, it can be seen that the number of patents per million inhabitants is actually lower than the national average. The presence of five universities (and in particular one of the four polytechnics in Italy) could be a factor in the increase of this indicator as well as the others above.

The Puglia region is also noted for an interesting trend in employment in the most technologically advanced sectors. This trend is positive in contrast to the other regions of Southern Italy, an indication of peculiarities and targeted investments that make the region attractive (Figure 20). In 2021, thanks to both the economic recovery that pushed Puglia to grow at an average rate higher than the national records, to new investments boosted by the National Recovery and Resilience Plan, and to a beneficial positioning of the Apulian industrial sectors, there has been a doubling in the number of employees in the technological sector. This data undoubtedly indicates an important positive element for the future development of the Region.

Figure 20. "Employment in high technology manufacturing ad percentage of total manufacturing" (SDG 9) - statistical trend.



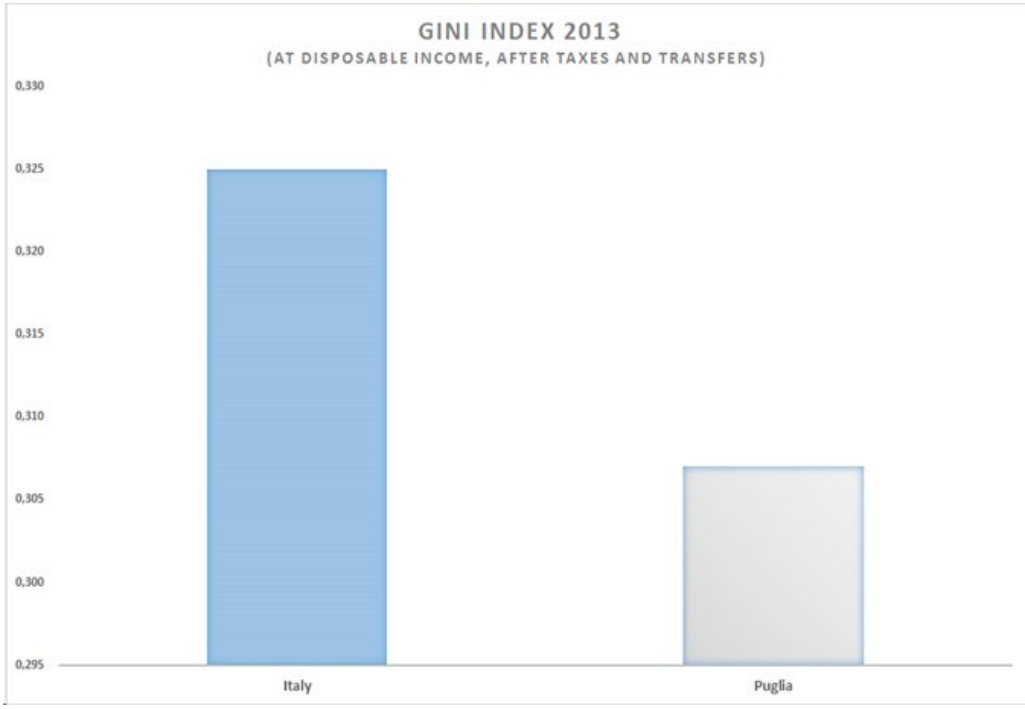
Source: Eurostat

4.2.10 Goal 10 – Reduce inequality within and among Countries

Data and trends available for the Goal 10 are summed up into only one index: the "Gini index of disposable income".

This indicator is a measure of statistical dispersion intended to represent the income inequality. The Gini index measures the inequality among the values of a frequency distribution, such as levels of income. A Gini coefficient of 0 reflects perfect equality, where all income or wealth values are the same, while a Gini coefficient of 1 (or 100%) reflects maximal inequality among values.

Figure 21. "Gini Index" (SDG 10) – statistical trend.

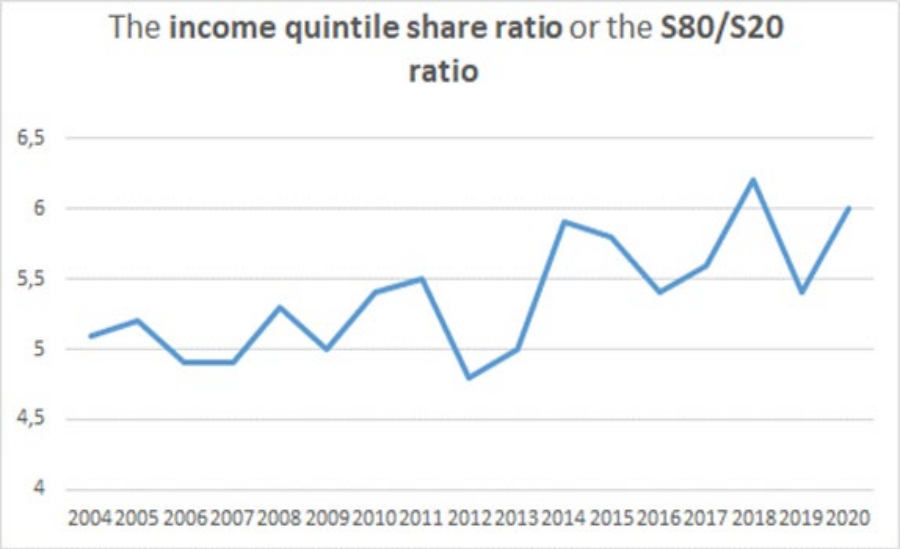


Source: OECD

The data are limited to a single year, and this makes it difficult to carry out any kind of analysis. The only possible observation is the fact that the value of this indicator for Italy is higher than the value for Puglia, which is an indication of greater income inequality in Italy than in Puglia (Figure 21). This result therefore shows greater income disparities in Italy than Puglia. In what follows, we will advance the hypothesis of replacing this indicator to observe the level of inequality within the region with the income inequality indicator. This indicator is a measure of the inequality of income distribution. It is calculated as the ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% of the population with the lowest income (the bottom quintile). The data source is the EU-SILC survey and thus it is official statistics, with a sufficiently long historical series and an annual frequency (as shown in the Figure 22).

In Puglia, from the beginning of the economic crisis in 2008 until the end of 2018, the income gap between the poorest and the richest classes increased. Per capita income of the 20% of the population with the lowest income decreased larger than the one of the total population. The ratio between the amount of equivalent disposable income of the highest fifth percentile and that of the lowest fifth percentile of the population reached a value of 6,3 in 2018. Although data on the impact of the pandemic on inequality are not yet available, the indicator provides a preliminary estimate of the measures to support households and businesses. Income support measures allowed to significantly contain the gap of income inequality that should reach 6,1 in 2020.

Figure 22. "Income quintile share ratio" – statistical trend.



Source: Istat

4.2.11 Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable

Data and trends for Goal 11 are listed in the following figure 23; the Goal comprises 7 indicators. Data show regular trends for 3 of them ("*Stock of vehicles (passengers cars)*", "*Number of victims in road accidents*" and "*PM2.5 emissions*"). The other 5 indicators of Goal 11, on the other hand, show less regularity.

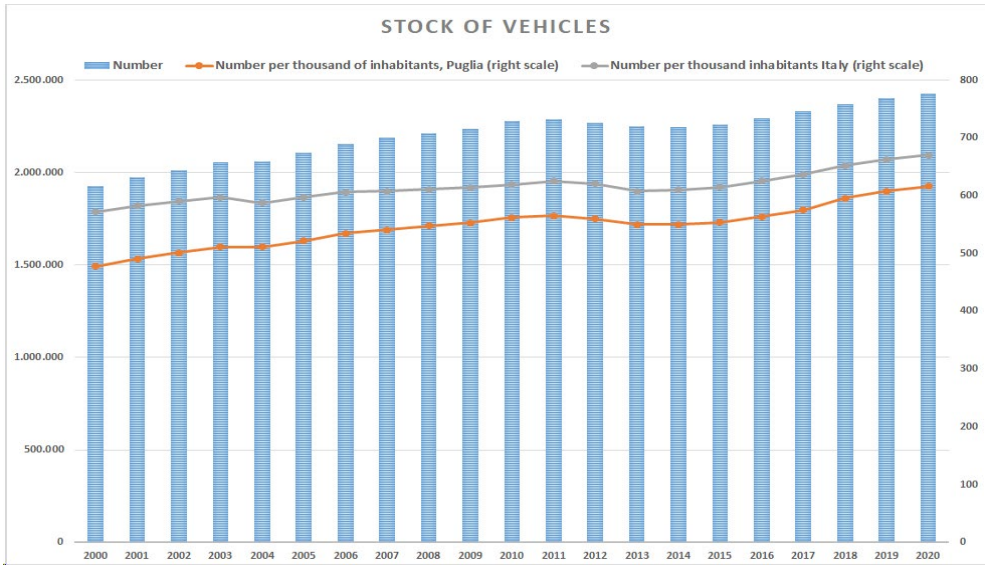
Figure 23. SDGs 11 indicators statistical trends.

SI	Indicator Name	Statiscal trend
11	Households expenses dedicated to housing costs	
11	Daily accessibility	
11	Stock of vehicles (passenger cars)	
11	Land use	
11	PM2.5 Emissions	
11	Household and commercial waste generation per inhabitant	
11	Victims in road accidents	

Source: Istat

Sustainable mobility is a central issue for urban regeneration. The measures to mitigate the Covid-19 pandemic have strongly and directly affected the mobility of the population. In this scenario, 2020 data indicate an increase in the number of vehicles constantly rose in Puglia, but surprisingly, both the number of victims in road accidents and the PM2.5 emissions (usually positively correlated to vehicles) dropped in the same time range. Since the trend is similar to the national records, these results together may suggest a constant substitution of the old stocks with newer and more performant stocks of vehicles. The trend in the number of vehicles does not differ from the national trend, however the number of vehicles per thousands of inhabitants is substantially lower (Figures 24). Puglia has slightly lower records compared to the national average. Overall, the data about the stock of vehicles suggest a need for specific policies supporting public transport.

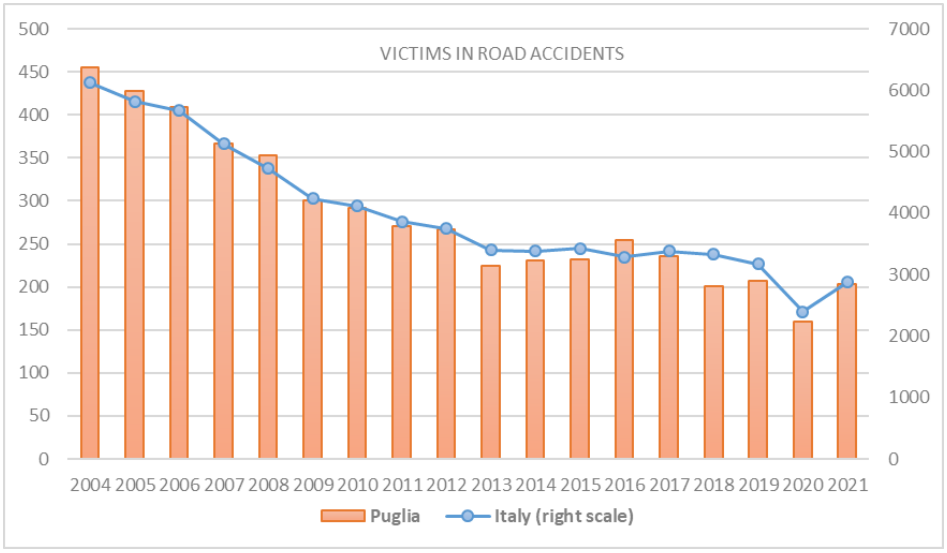
Figure 24. "Stock of vehicles (passengers' cars)" SDG 11 – statistical trend.



Source: Istat.

The recent trend in the number of victims by car accidents (Figure 25) may be also explained with the pandemic. The pandemic itself and the measures to contain probably influenced the trend in road traffic accidents and mobility in 2021. In the first half of 2021, the trend appears to have changed from the usual seasonal pattern. Compared with 2020, the number of accidents and injuries decreases in January and February and increases substantially in March-June 2021, returning to levels close to the pre-pandemic period in the second half of the year. In total, in 2021, there were 151875 road accidents in Italy (+28,4% over 2020) with 2875 fatalities within 30 days of the event (+20.0%) and 204728 people injured (+28,6%); values, however, still falling compared to 2019 (accidents: -11,8%, fatalities: -9.4% and injuries: -15,2%).

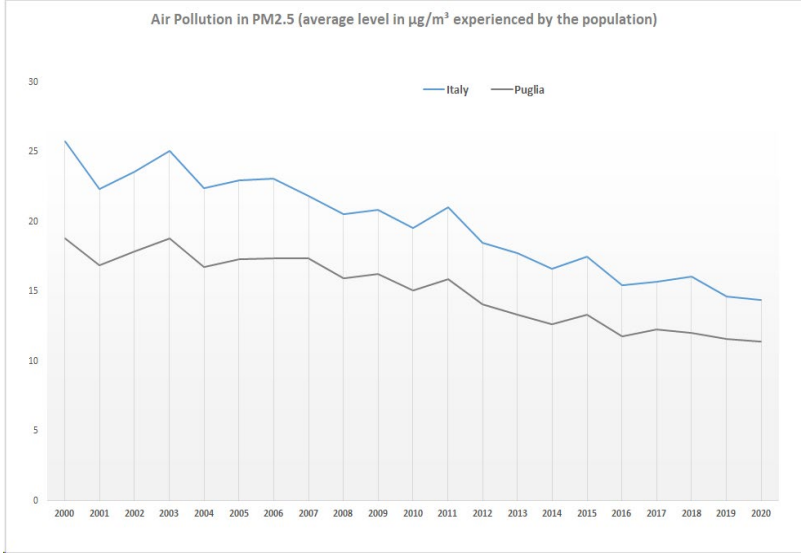
Figure 25. "Number of victims in road accidents" (SDG 11) – statistical trend.



Source: Istat.

Over the past 20 years, data on PM2.5 emissions show a steady and progressive reduction (Figure 26). This reflects the greater attention paid to this type of atmospheric pollution and the introduction of significant technical improvements, particularly in relation to cars. Puglia has always had a lower level than the national average, although from a difference of more than 7 points at the beginning of the century, this gap has narrowed over time, probably as a result of the policies implemented throughout the country.

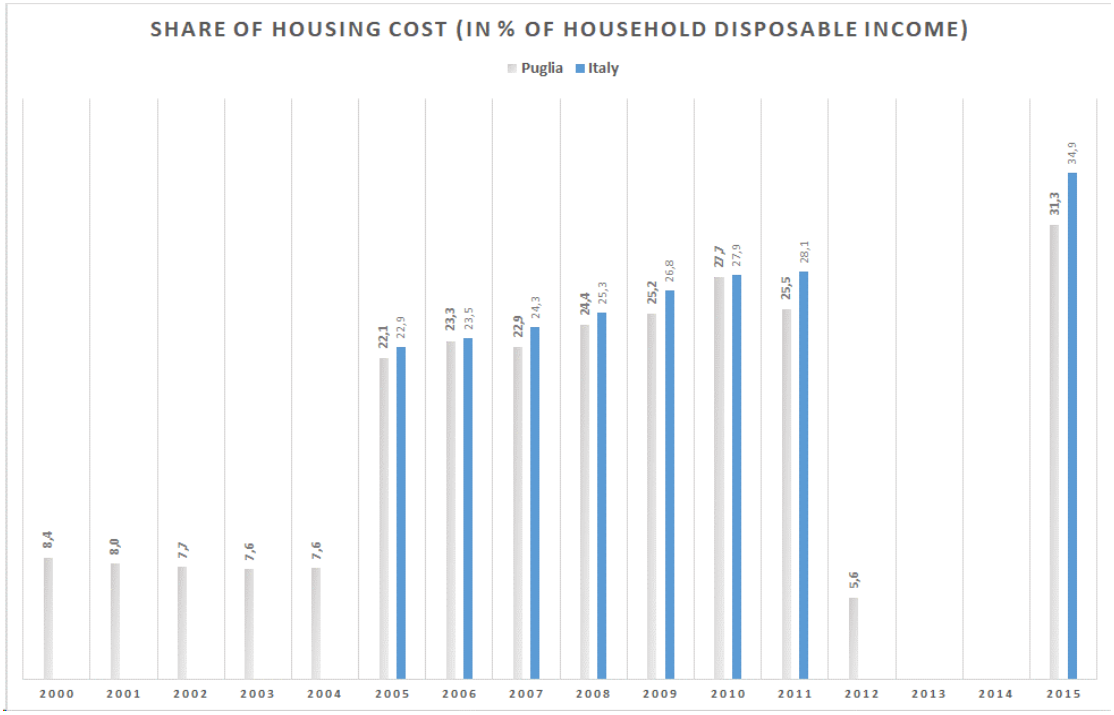
Figure 26. "PM2.5 emissions" (SDG 11) – statistical trend.



Source: Istat.

Moving forward to the subsequent indexes, we can observe that after a period of stability on low levels, the household expenses for housing costs rose consistently in 2004, dropped again to the initial levels in 2012, and rose again in 2015 (the last available data; Figure 27). Although national data are less complete than local, the trend looks similar, with the local levels quite close to the national average until 2010, and consistently lower from 2010 to 2015. Economic dynamics play a decisive role in modifying housing costs, but maybe local taxation and energy bills may affect the records as well. The role of taxation is too complex for a quick review; nonetheless, it is worth to focus here on both resilience and sustainability: lower taxes and energy bills help families to be more resilient, on the other hand when these costs are higher people tend to reduce their environmental footprint.

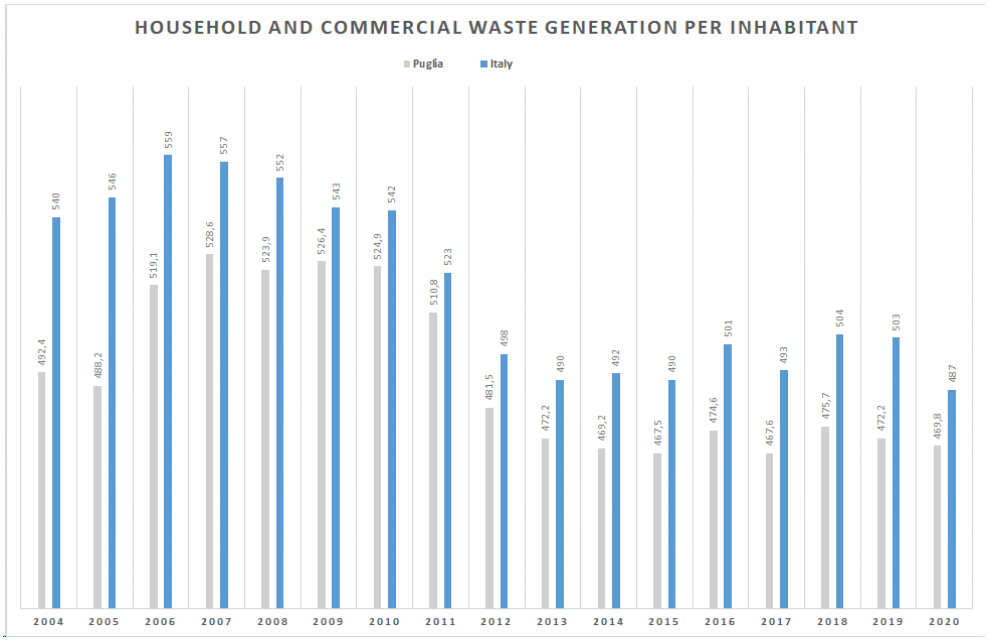
Figure 27. "Share of housing cost" (SDG 11) – statistical trend.



Source: Istat.

Household and commercial waste production has constantly lowered in the last years, as opposed to a peak around 10 years ago, suggesting that the local waste management policies are paying-off. The local trend does not substantially differ from the national trend but, interestingly, the per capita waste production is really lower than the national average (Figure 28) with the latter getting closer to the former only in recent years.

Figure 28. "Households and commercial waste generation per inhabitant" (SDG 11) - statistical trend.

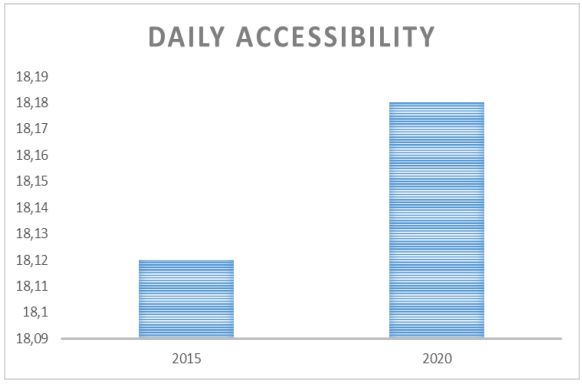


Source: Istat.

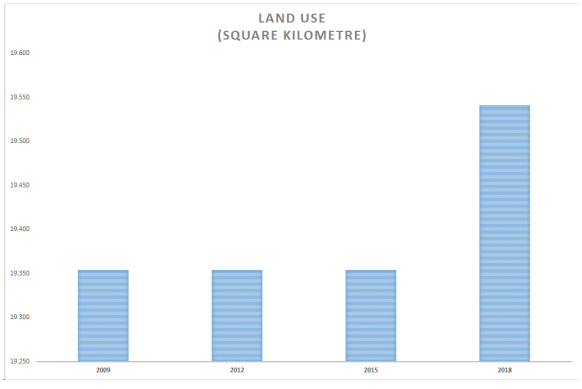
Other relevant indicators to explore inclusive, safe, resilient and sustainable cities and human settlements, concern the territory overall: daily accessibility and land use. The accessibility of the whole territory in Puglia more than doubled since 2015 (although data stops at 2019; figure 29, panel a): improving territorial accessibility eases daily life and makes it safer (eg. easing to reach public health facilities), and help both the population and productive fabric to react to shocks, thus improving resilience. The level of daily accessibility of the Puglia region seems to improve between 2015 and 2020, although not significantly.

Land use was quite stable in the last 13 years but suddenly rose in 2018 (last data available; Figure 29, panel b): since land use is a sustainable development indicator with sensitive effects on the global sustainability profile, results call for specific local policies. The recent significant growth of the tourism sector and the recent economic stimulus measures aimed at the construction sector may have further supported the growth of this indicator, which therefore needs to be monitored more closely.

Figure 29. "Daily accessibility" (panel a) and "Land use" (panel b), SDGs 11- indicators statistical trends.



Panel a



Panel b

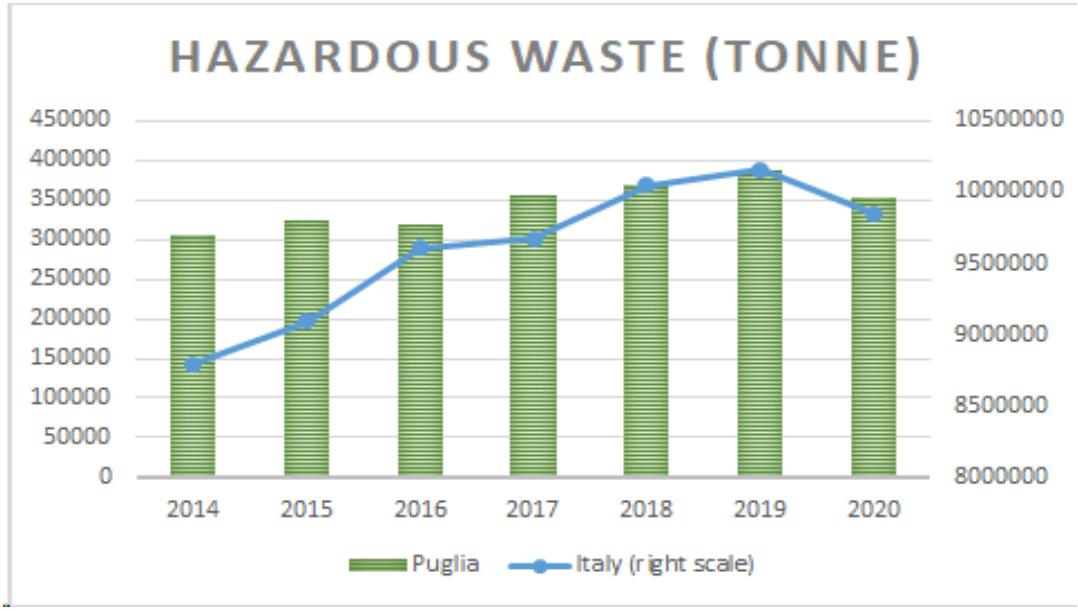
Source: JRC.

4.2.12 Goal 12 - Ensure sustainable consumption and production patterns

Following the principle of 'doing more and better with less', Goal 12 provides a framework for integrating the three pillars of sustainability: environmental, social and economic. Progress towards Goal 12 is therefore highly relevant to the achievement of the other Sustainable Development Goals: on hunger and health, on reducing inequality, on sustainable water and energy management, on promoting long-lasting, inclusive and sustainable patterns of economic growth, and on combating climate change.

Data and trends for Goal 12 refer to only one indicator: the "hazardous waste" index (Figure 30).

Figure 30: "Hazardous waste" (SDG 12) - statistical trend.



Source: Ispra.

Hazardous waste may pose an elevated risk to human health and to the environment if not managed and disposed of safely. The indicator snapshots the goal at large scale. Trend in hazardous waste production (Figure 30), reasonably related to production patterns, has a highly positive slope that breaks only for the Covid-19 pandemic. The phenomenon should alert both national and local policy makers. Nonetheless, the local trend is less steep than the national trend. In terms of waste quantities, Puglia weigths 3.7% of the national record.

4.2.13 Goal 13 - Take urgent action to combat climate change and its impacts

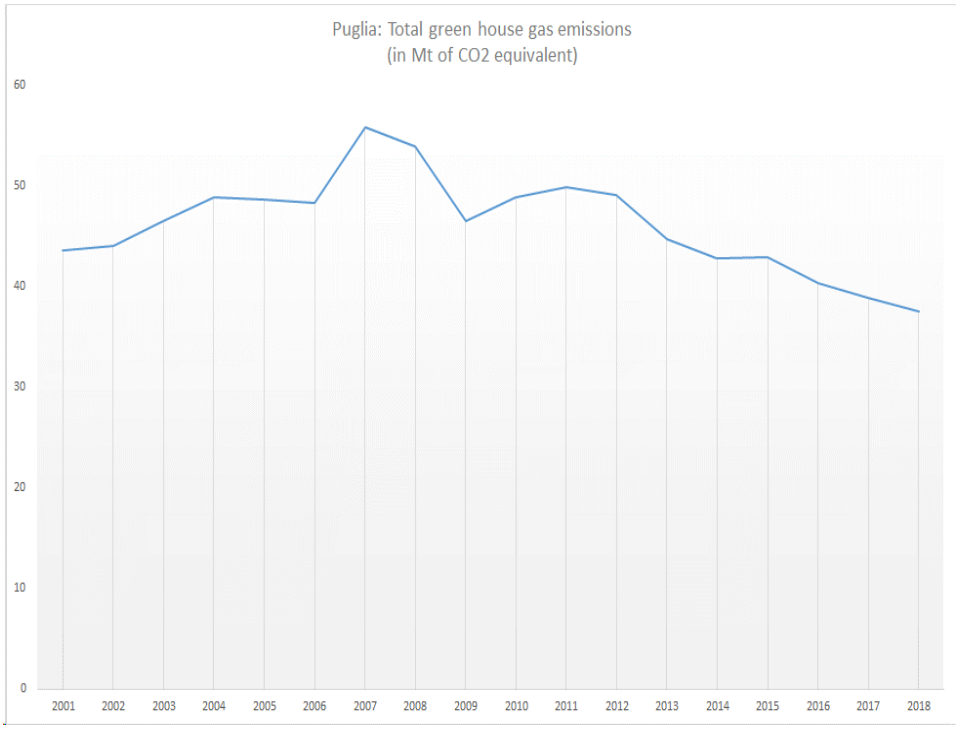
Data availability for Goal 13 is completed and it regards the following 4 indicators:

- "PM10 Emissions";
- "CO2 Emissions";
- "Greenhouse Gas Emissions";
- "Cooling and heating degree days".

Overall, the first 3 indicators together show a positive scenario for Goal 13 since all the main air pollutants recorded low emission levels or decreasing trends: greenhouse gas (GHG), PM10, CO2. Conversely, the heating days increased (figure xxx), but this cannot be addressed to local policies, rather to global climate issues.

In Puglia GHG emissions decreased since 2001, reaching 39.0 Mt of CO2 equivalent in 2019 (Figure 31). Nonetheless, in 2007 the GHG reached a peak emission: +31% compared to 2001. It is difficult to explain the phenomenon here, but it is worth recalling how it follows the trends explained for car stocks in Goal 2, as well as the decreasing local heavy industry production (on above the others, the steel production).

Figure 31. "Total greenhouse gas emissions" (SDG 13) - statistical trend.

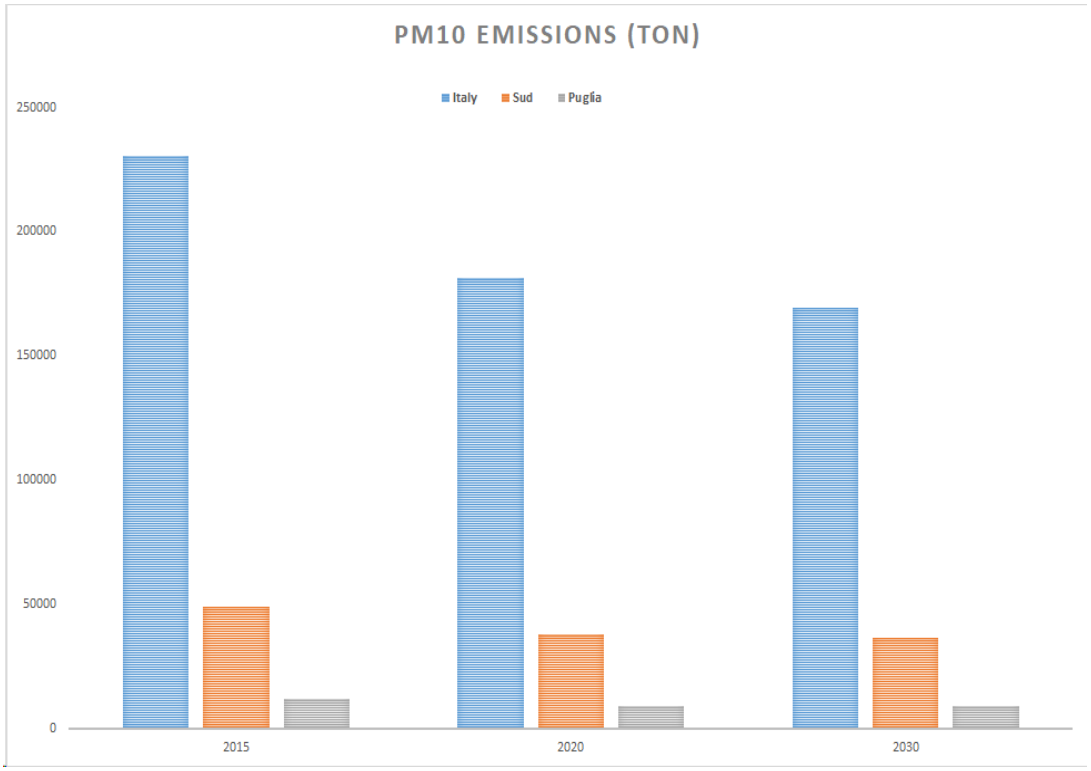


Source: OECD.

PM10 is an air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 micrometer (about 1/7 the diameter of a single human hair). Their small size allows them to make their way to the air passages deep within the lungs where they may be deposited and result in adverse health effects. Sources of PM10 emissions include fuel combustion from electricity utilities, industrial activities, and transport.

The PM10 emissions in Puglia follow the same decreasing trend recorded at national level and among all the Southern Italian regions (Figure 32). Puglia emits almost 25% of the emissions in Southern Italy (5 regions).

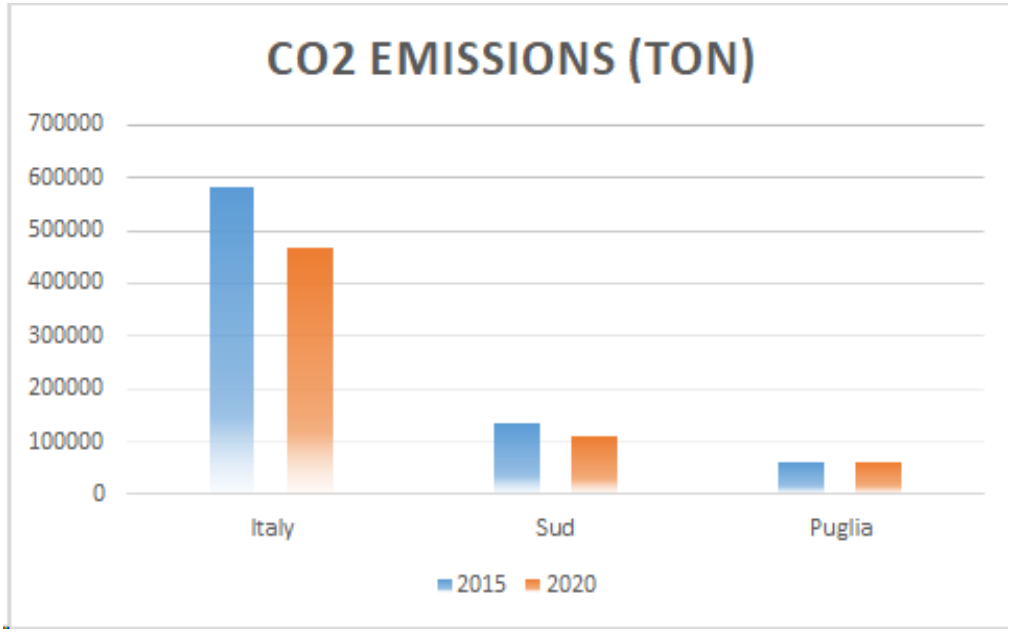
Figure 32. "PM10 emissions" SDG 13 - statistical trend.



Source: Istat

The trend in CO2 emissions (Figure 33) is quite similar to PM10's trends. In the last 5 years (latest data: 2020) the trend is negative. Nonetheless, Puglia CO2 weights more than PM10 over the average recorded for Southern Italy and at national level.

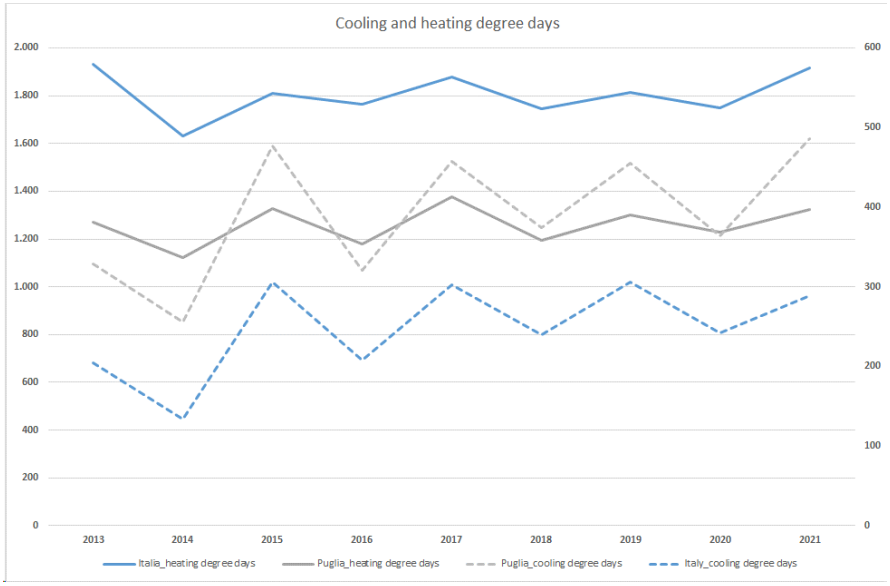
Figure 33. "CO2 emissions" (SDG 13) - statistical trend.



Source: OECD

The cooling and heating degree (Figure 34) show similar trends between local and national data. This should not surprise since data follow general climate trends and issues. As stated above, the heating days have increased in the last few years. The cooling degree days show a more swinging trend than heating degree days and, surprisingly considering the geographic location of Puglia (South), compared to the national average the region benefits from lower heating days and higher cooling days.

Figure 34. "Cooling and heating degree days" (SDG 13) – statistical trend.



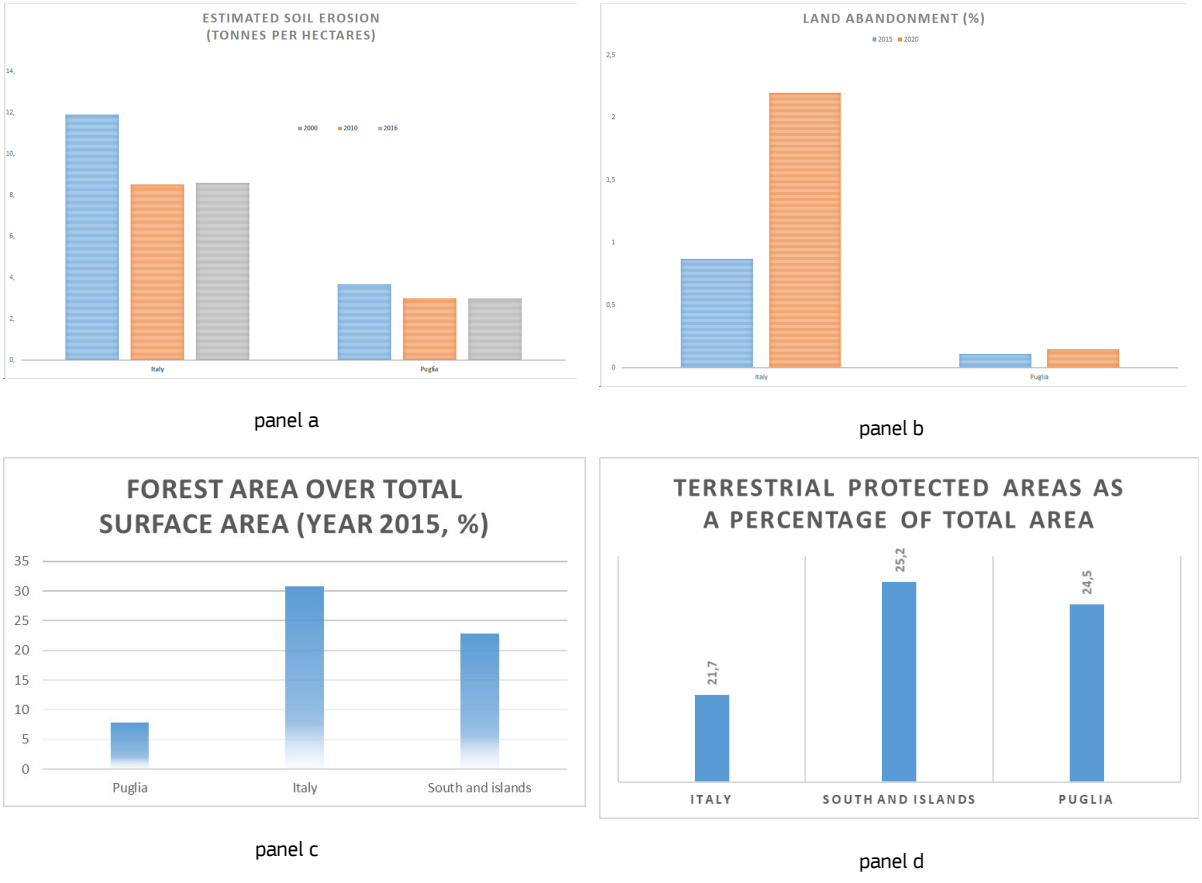
Source: Eurostat

4.2.14 Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and reverse land degradation and halt biodiversity loss

Data and trends for Goal 15 are completed and regard the following indicators:

- "Estimated soil erosion";
- "Land Abandonment";
- "Forest area over total surface area";
- "Terrestrial protected areas as a percentage of total area".

Figure 35. SDG 15 indicators statistical trend.



panel a

panel b

panel c

panel d

Source: Eurostat, panel a and b; ISPRA panel c and d

The share of local protected areas is stable (Figure 35, panel d) and almost evenly distributed across the Country with some exceptions. Puglia is slightly over the national average and the other Southern regions. The registration of new protected areas is a long bureaucratic process that takes years before reaching the end, making it difficult to trace a trend in a time frame shorter than 50 years.

Conversely, the estimated soil erosion index shows local policies had a positive impact (figure 35, panel a). Soil has a very slow rate of formation and any soil loss above 1 tonne per hectare per year can be considered irreversible over a period of 50-100 years. Soil erosion is one of the eight threats listed in the European Commission's Thematic Strategy on Soil. In the Region of Puglia this phenomenon seems to be less pronounced than the Italian average, as shown in Figure 35 (panel a). This indicator must be carefully monitored in view of the risk of desertification in part of Puglia.

Today, Italy is one of the most forested countries in Europe, with 11.4 million hectares covering 32% of its land area. In the region of Puglia, the percentage of the area covered by forest is much lower, at just over 5 % (Figure 35, panel c). Every year, Italian forests remove about 46.2 million tonnes of carbon dioxide from the atmosphere. This corresponds to 12.6 million tonnes of accumulated carbon. Italian forests store 1.24 billion tonnes of organic carbon, equivalent to 4.5 billion tonnes of carbon dioxide.

The expansion of forest areas brings considerable benefits, but is not in itself proof of ecosystem health and only partially depends on the effectiveness of management and protection policies. In Italy, forest expansion is also due to the abandonment of traditional agricultural and forestry practices, combined with the abandonment of inland areas. This has led to the spontaneous renaturation of large areas, with results that are not always positive from an ecological point of view. The ecological transition plan in the European Commission's Next Generation EU could have forests as one of its strengths, starting with a public-private-community-citizen alliance.

The growth of forest areas has significant benefits, primarily for carbon sequestration, although it does not grant the good health of woodland ecosystems, and is only partially related to the management and protection policies. In Italy, forest growth is related to the abandonment of traditional agricultural and forestry practices caused by the depopulation of inland areas and left vast land areas to spontaneous renaturation (not necessarily positive for the environment). Moreover, the low exploitation of forest resources transfers abroad a large part of the environmental pressure generated by our economic system.

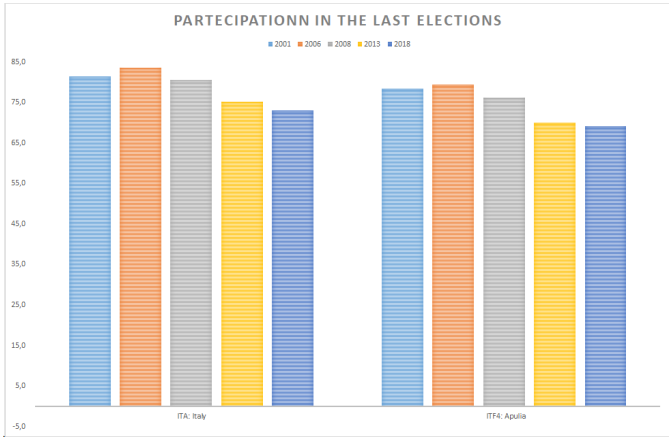
The only negative record belongs to the land abandonment that constantly rose (figure 36, panel b). Nonetheless, these figures hide complex dynamics depending on issues like land fragmentation mostly due to inheritance laws, which cannot be ruled locally. Land degradation, intended as loss of ecological functionality, is monitored through the dynamics of soil consumption, which Italy has committed to reduce to zero by 2030 through the National Strategy for Sustainable Development (2017). The soil is "*consumed*" when occupied by urbanization, and made impervious to water by artificial coverings (soil sealing). Also an excessive fragmentation of open spaces is a factor of degradation, since the barriers made by buildings and infrastructures break the spatial continuity of ecosystems. In this case, unoccupied spaces not large enough are turned into ecologically inert and unproductive land. Moreover, in a fragile territory like Italy's, soil consumption is also a relevant factor of hydrogeological risk and landscape degradation.

4.2.15 Goal 16 - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

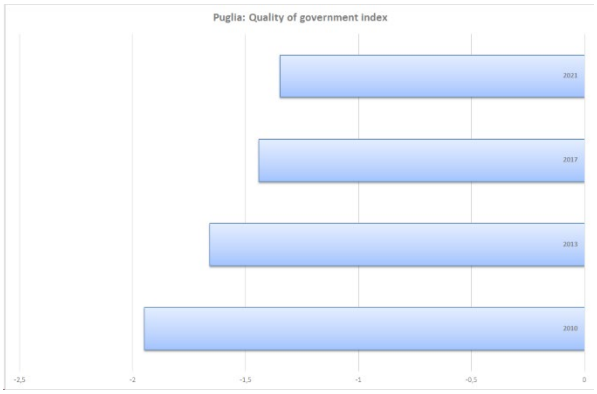
Data and trends for the Goal 16 grouped 3 indicators are the following:

- "Participation in the last elections".
- "Quality of Government Index".
- "Extract from QGI an indicator on corruption".

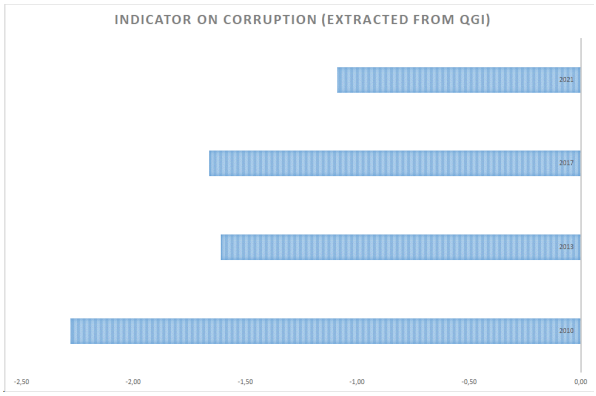
Figure 36. SDG 16 indicators statistical trend.



panel a



panel b



panel c

Source: Istat (panel A); University Gothenburg (panel c and b)

The participation rate in the last elections highlighted by the Figure 36 panel a, and it indicates a decreasing trend in the number of participants, similar to that recorded in the rest of Italy. This trend seems to suggest a lowering interest in politics, lack of confidence and growing sense of uselessness in participation in elections. However, the lack of confidence in policy seems to be not explained by the data emerging from the other two indicators. In detail, the Quality of Government reports an improvement over the last few years in the quality of public action, which, although starting from negative and extremely low levels, seems to get closer to the Italian average (Figure 36 panel b). The existence of institutions capable of guaranteeing the quality of their actions is certainly one of the fundamental elements for achieving the objectives of sustainable development, it could almost be considered a "conditio sine qua non".

The indicator on corruption moved accordingly; it also improved steadily over the last few years (Figure 36 panel c). Although the positive trend in the "*Quality of Government*" index and in the "Corruption" indicator, the poor results in terms of participation in the last elections suggest the need for a deeper analysis.

4.2.16 Goal 17 - Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Finally, data and trends for the Goal 17 are summed up to 3 indicators listed in Figure 37.

- "Imports from developing countries".
- "Individuals who used the internet for interaction with public authorities".
- "PCT co-patent applications that are done with foreign regions".

Figure 37. SDG 17 indicators statistical trend.

Source: Istat

As Figure 37, panel a, shows the imports coming from developing countries increased in the last twenty years (declining only after the introduction of the euro, during the economic crisis of 2008-2009 and in the years 2011-2013). The Puglia Region, also because of its geographical position in the middle of the Mediterranean Sea, has increased trade with the Developing Countries especially with North Africa and the Balkans, but above all it has increased its positioning in the global value chains. Whereas in the last decade the increase in imports gave rise to fears of a loss of market shares and competitiveness of local products and domestic businesses,

today these figures are no longer necessarily negative, but rather they represent the chance to access more competitive inputs in terms of cost that can then be reworked or reprocessed to be then resold with greater added value.

The number of individuals who used the web to access and to interact with public authorities grew as well. As shown in Figure 37 (panel b), the process of digitization of public administrations grew during the social restrictions imposed by Covid-19. In 2020 and 2021, the percentage of people who used the web to access or interact with public authorities increased by almost 10% compared to 2019. The spread of broadband in Puglia and the increased digital knowledge among the population are two further factors.

These two results suggest rising investments in local policies for open government. Graphing the trend of the index for "PCT co-patent applications that are done with foreign regions" reveals that policies supporting openness still have to explore more complex dynamics. The presence in the Puglia Region of major multinational companies with national or foreign control and the presence of 5 universities, including a polytechnic, make it even easier to develop and collaborate between different territories in the development of patents (Figure 37, panel c).

5. IDENTIFICATION OF SDGS AND SDGS TARGETS THAT REQUIRE CUSTOMIZED APPROACH

The 18 indicators with no data available are listed below in Table 8.

As mentioned above, there are 18 indicators for which no data could be found, broken down as follows: 3 indicators relate to goal 14; respectively 2 for each goal, relate to goals 1, 6, 7, 11, 12; finally, the remaining 5 relate to goals 3, 5, 10, 16 and 17.

Table 8. JRC indicators with no available data.

Goal	Indicator Name	Type	Coverage	JRC Source	SDG Target(s)
1	Affected people due to disasters	Experimental		Case study	1.5 (exposure to vulnerability)
1	Material and social deprivation	Official	EU-27 plus others	European Union Statistics on Income and Living Conditions (EU-SILC)	1.1 (extreme poverty)
3	Self reported unmet needs for medical examination	Official	EU-27 plus others	European Union Statistics on Income and Living Conditions (EU-SILC)	3.c (health financing and recruitment)
5	Inactive population rate due to caregiving responsibilities	Official	Andalusia	Institute of Statistics and Cartography	5.4 (unpaid work)
6	Population served by safely managed drinking water supply services	Official	Flanders	Flanders Environment Agency	6.1 (universal access to water)
6	Population connected to wastewater with at least secondary treatment	Official	Navarra	NILSA (Navarra de Infraestucturas Locales)	6.3 (water quality)
7	Electricity production that comes from nuclear power	Experimental	OECD countries and other European countries	Organisation for Economic Cooperation and Development (OECD)	7.2 (share of renewable energy)
7	People affected by energy poverty	Official	Spain	Ministry for the Ecological Transition and the Demographic Challenge	7.1 (access to energy)
10	Unemployment of people with disabilities	Official	Spain	INE (National Statistics Institute)	10.2 (inclusion irrespective of status)
11	Transport performance	Experimental		Own elaboration (regional government)	11.2 (access to transport systems)
11	Difference between built-up area growth rate and population growth rate	Experimental	OECD countries and other European countries	Organisation for Economic Cooperation and Development (OECD)	11.3 (sustainable urbanization)
12	Carbon footprint	Official	Flanders	Statistics Flanders	12.2 (management of natural resources)
12	Food waste	Official		Department of Environment of the Regional Government	12.3 (reduce food waste)

14	Estuarine with high/very high water quality	Official	Basque county	URA (Basque Water Agency)	14.1 (reduce marine pollution)
14	Protected coastal area as a percentage of total coastal area	Experimental	OECD countries and other European countries	Organisation for Economic Cooperation and Development (OECD)	14.5 (coastal and marine areas)
14	Coastal areas with good/very good water quality	Official	Basque county	URA (Basque Water Agency)	14.5 (coastal and marine areas)
16	Transparency index	Experimental		Transparency International	16.6 (effective institutions)
17	Official Development Assistance	Official		Own elaboration (regional government)	17.2 (development assistance commitments)

Source own elaboration

The main reasons for which it was not possible to collect data are listed and examined below:

1.Data are available only at large level of territorial aggregation (i.e., NUTS1) due to the sampling schemes; Trying to solve for this data gap, we proposed query the data managers and providers for less aggregated data by means of specific estimates, for example:

(a) "*Unemployment of people with disabilities*". The Labour Force Survey (Istat), from which the information for this indicator is taken, has too few responses on this specific item to be able to process this indicator at regional level, so the request to data providers was not successful.

(b) "*People affected by energy poverty*". The data provider (Istat) explained that data at lower aggregation is time consuming mainly because of checking and auditing. This indicator may be provided in the near future.

(c) "*Severe Material and social deprivation*". This indicator could be elaborated by EU-SILC survey data. The process to get the data is feasible but highly time-consuming; collaboration with the National Statistical Institute (Istat) could provide data at NUTS2 aggregation level, leveraging a common interest for this topic.

(d) "*Self reported unmet need for medical examination*". The data provider (Istat) explained that Italian regional data are available but it is necessary to compare the different items considered to identify the correct definition used by Eurostat at nuts1 level.

(e) "*Inactive population rate due to caregiving responsibilities*". Querying data providers was unsuccessful because the labour force survey contains too few answers linked to this specific item to elaborate this indicator at a regional level.

2.The phenomenon the index points out does not apply to local specificities; This applies to the following indicators:

(a) "*Electricity production that comes from nuclear power*" (SDG 7);

(b) "*Estuarine with high water quality*" (SDG 14).

In Italy there are no nuclear power plants and in the Puglia region there are no rivers and estuarine for which it is possible to measure the phenomenon. For these reasons, these indicators are not suitable to measure SDGs in the Puglia region.

3.The indicator is not fully defined or explained within the JRC dataset (case study or experimental statistics); specifically, it applies to the following indexes:

(a) "*Affected people due to disasters*" (SDG 1)

(b) "*Transport performance*" (SDG 11);

(c) "*Carbon Footprint*" (SDG 12).

(d) "*Food waste*" (SGD 12);

(e) "*Transparency index*" (SDG 16);

(f) "*Official Development Assistance*" (SDG 17);

In order to find specific solutions and better define the definitions of the phenomenon under analysis, round table discussions with experts in the field were initiated.

4.The indicator needs further investigation with domain experts in order to understand if it actually fits the JRC goal. It applies mainly to those indicators grouped in the SDG 6 and 14:

(a) "*Population served by safely managed drinking water supply services*" (SGD 6);

(b) "*Population connected to wastewater with at least secondary treatment*" (SDG 6);

(c) "*Difference between built-up area growth rate and population growth rate*" (SDG 11);

(d) "*Protected coastal area as a percentage of total coastal area*" (SDG 14);

(e) "*Coastal areas with good/very good water quality*" (SDG 14).

Round tables with domain experts and data providers were launched to check if these indicators actually match the JRC indicators.

The following methodology has been used to try to replace 18 indicators with others that are broadly similar, covering the same target identified in the JRC dataset:

— First, we checked for indicators included in the National Strategy that could be adequate for the Regional Strategy, and among these which were sufficiently similar to ensure the observability of the phenomenon and the target. This operation, which could be defined as substitution and convergence, allows to cover the missing target, replacing the indicator, and to converge towards official indicators, updated and identified by commissions of national experts on which there was also convergence of the Puglia Region. Indeed, the regional strategy must include the identified national context indicators. For 15 out of 18 indicators, a suitable replacement could be found.

— If the phenomenon under observation could not be adequately covered by the indicators from the National Strategy then, thanks to the information gathered from thematic tables and field experts, alternative proposals were identified. This operation could be defined as: research & propose. For 2 out of 18 indicators a suitable alternative could be found: "Net entry rate in the labour market for people with disabilities" (SGD 10) and "Food Waste" (SDG 12). The discussions with the regional experts did not lead to the identification of alternatives for only one of the indicators: "Official Development Assistance". Neither did the national and regional strategies suggest an alternative indicator.

6. PROPOSAL OF ADDITIONAL INDICATORS

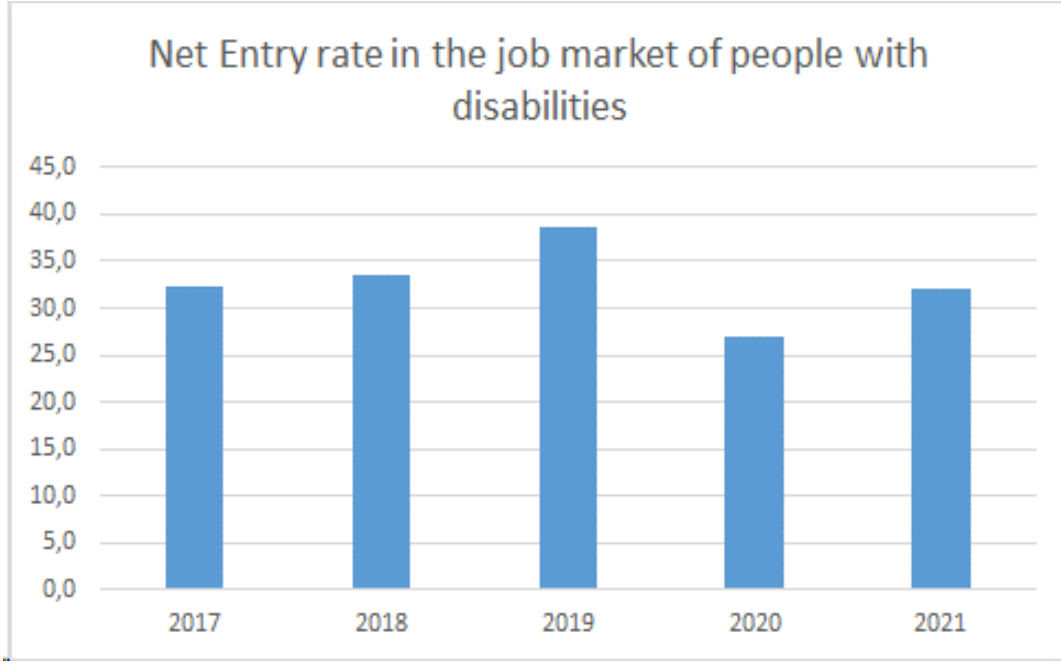
The main reasons why it was not possible to collect data on 18 indicators were discussed in the previous section. Having made this necessary premise, individual points are now discussed

This lack of information was addressed by setting up technical and thematic tables with experts both from the Puglia Region and from outside the region's administrative offices. The objective of these round tables, four of which were held with environmental, energy, economic and food policy experts, was to identify at least one indicator capable of measuring the target identified by the JRC, and that, at the same time, could be extended to all the other Italian regions, and that could possibly be derived from an official statistical source.

Trying to solve data gap due to availability only at large level of territorial aggregation (NUTS1), point 1 of the previous paragraph, the following additional indicators are proposed:

— The first one is the "*Net entry rate in the job market of people with disabilities*" (SDG 10) as a substitute of the "*Unemployment of people with disabilities*". Exploration of the availability of data on people with disabilities with the officials of the regions authorised to obtain information on the administrative data collected by the region and transmitted to the Ministry of the Interior. These data provide information on the number of activated and terminated contracts per time period of people with disabilities. The indicator proposed is calculated as the number of new job contracts of people with disabilities on the sum of the new contracts and the new terminations. The source of the data is the Puglia region and the availability of the time series is 2019-2021. It could be a useful alternative indicator for the target of this SDG. As can be seen in Figure 38, there was an overall increase in the trend of the indicator until 2019. This is a symptom of the increasing entry movements of disabled people into the labour market. The crisis caused by Covid-19 led to a sharp fall in this indicator, not so much due to an increase in the number of contracts terminated by disabled people, but due to a reduction in the number of new contracts to which they were directed, probably as a result of the freeze in the economy due to the closure and the measures adopted. In 2021, however, there was a rapid recovery. This brought the net employment rate of disabled people back to the level of the previous three years.

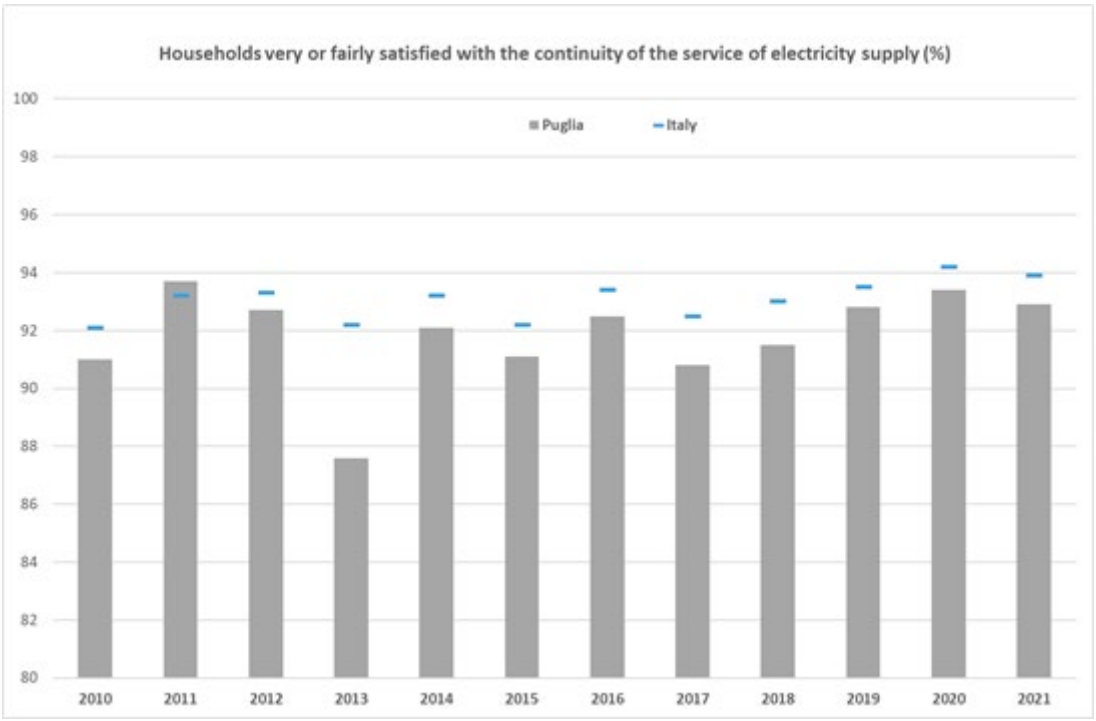
Figure 38. "Net entry rate in the job market of people with disabilities (SDG 10) - statistical trend.



Source: own elaboration on Puglia Region data

— "*Consumers' satisfaction about the Electricity providers' services*" (SDG 7) could be a substitute for "People affected by energy poverty". The indicator proposed is available from the National Statistical institute (Istat) from a national survey in yearly time-series from 2010: "*Survey on Aspects of daily life*". The indicator target is the same as SDG's goal, and it is inserted in the National Strategy. Figure 39 indicates a high level of satisfaction among households in the level of continuity of electricity supply. It shows an excellent starting point. However, this percentage in the Puglia Region is always lower than the national average, with a constant gap over time. Over the last 10 years it is possible to report an overall positive trend for this indicator, which seems to signal a growing level of satisfaction.

Figure 39. "Consumers' satisfaction about the Electricity providers' services" (SDG 7) - statistical trend.



Source: Istat

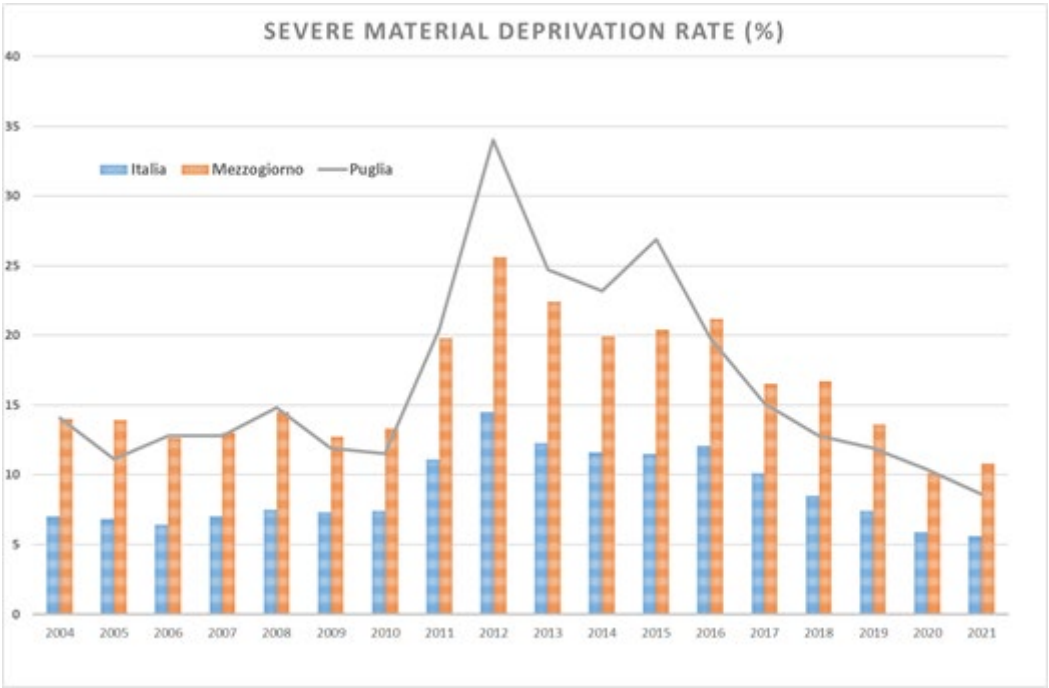
— "*Severe material deprivation rate*" (SDG 1). This indicator is available from the EU-SILC survey and could fit the same SDG's target identified from the "Severe material and social deprivation". It is import to clarify that these two indicators are completely different because they use different types of items. The indicator ("Severe Material and Social deprivation") proposed by the JRC covers 13 deprivation items at both household and individual level. The alternative indicator covers 9 household-level deprivations. There are therefore two different and non-overlapping measures. But they share the same objective and the same data source. In fact, this indicator means the inability to afford some items that are considered by most people to be desirable or even necessary for a decent life. It distinguishes between people who cannot afford a particular good or service and those who do not have that good or service for some other reason, e.g. because they do not want or need it. It was one of the components that defined the "at-risk-of-poverty-or-social-exclusion rate (AROPE)" according to the Europe 2020 strategy. The indicator adopted by the Social protection committee measures the percentage of the population that cannot afford at least three of the following nine items:

- to pay their rent, mortgage or utility bills;
- to keep their home adequately warm;
- to face unexpected expenses;
- to eat meat or proteins regularly;
- to go on holiday;

- a television set;
- washing machine;
- a car;
- a telephone.

The "*Severe material deprivation rate*" indicator is yearly surveyed, relies on a quite long time-series, and it is provided by an official data source. Data are available for all European regions. The rate of severe material deprivation, which was substantially stable between 2004 and 2008 (see Figure 40), jumped particularly sharply after the 2008-2009 crisis, reaching a peak in 2012 at 35% of people, almost 10 percentage points higher than the average figure for the Mezzogiorno geographical breakdown and 20 points higher than the Italian figure. Subsequently, this percentage began to fall steadily, and in particular, since 2015 it has been below the average figure for the breakdown, also approaching the national average level. Even the pandemic crisis does not seem to have affected the declining trend of this indicator, a sign that the economic measures implemented to support households have worked quite well.

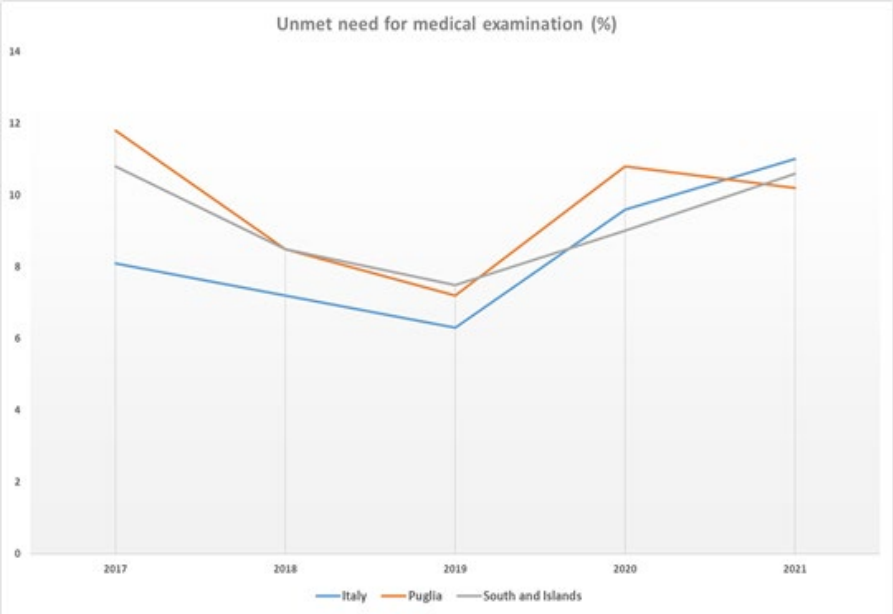
Figure 40. "Severe material deprivation rate" (SDG 1) - statistical trend.



Source: Istat

— "*Unmet need for medical examination*" (SDG 3); this indicator appears quite similar to "*Self reported unmet need for medical examination*". It is yearly available from the National Statistical Institute (Istat - *Survey on Aspects of daily life*), as compared to the EU-SILC dataset suggested by the JRC. The "*Unmet need for medical examination*" indicator is calculated as share (%) of the population reporting, in the last 12 months, unmet needs for medical care (specialist examination or diagnostic examination) due to one of the following reasons: she/he could not pay for it, it was too expensive; inconvenience (distant structure, lack of transportation, inconvenient hours); long waiting list. Time-series are available from 2017 to 2021. This indicator would seem to have been strongly affected by the pandemic crisis, as you can see from Figure 41. In fact, even though Puglia started from a higher figure, not only than the national average, but also than the geographical distribution, in the three-year period 2017-2019 this percentage dropped significantly, to below 8%. With the advent of the Covid pandemic in 2020, there was a sharp increase, due to the restrictive measures affecting the entire Country. In 2021, the Puglia region's figure seems to be better than the breakdown but also better than the national figures.

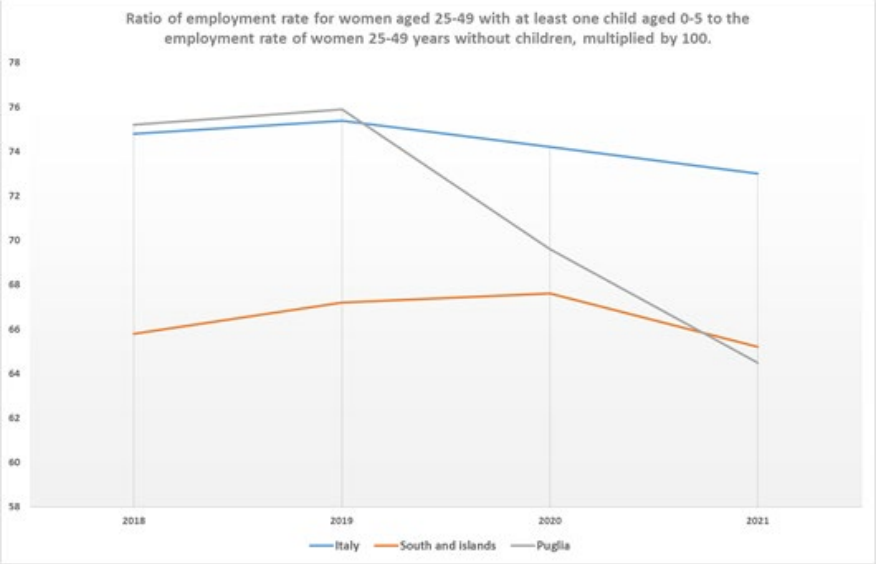
Figure 41. "Unmet need for medical examination" (SDG 3) – statistical trend.



Source: Istat

— "Ratio of employment rate for women aged 25-49 with at least one child aged 0-5 to the employment rate of women 25-49 years without children, multiplied by 100" (SDG 5.4). This indicator could be useful to fit the proportion of time spent on unpaid domestic and care work. For this reason, it could substitute the indicator "Inactive population rate due to caregiving responsibilities". In the context of couples with young children, the difficulties of reconciling family needs and work schedules are generally greater for women. The lack of adequate social services may also lead them to choose to leave work when a child is born. The indicator suggested is an official statistic, from the ISTAT labour force survey and data are available from 2018 to 2021 for all Italian regions. It is also one of the national indicators for the sustainable strategy. This indicator showed that until 2019, there was no particular difference between the employment rate for women aged 25-49 with at least one child aged 0-5 to the employment rate of women 25-49 years without children in Puglia compared to the rest of Italy (Figure 42). The Covid crisis, on the other hand, has affected Puglia differently from the rest of Italy: due to the pandemic, there was a significant reduction in this indicator, a symptom that women had to take more care of the family during the pandemic period to the detriment of work.

Figure 42. "Ratio of employment rate for women aged 25-49 with at least one child aged 0-5 to the employment rate of women 25-49 years without children, multiplied by 100" (SDG 5) – statistical trend.

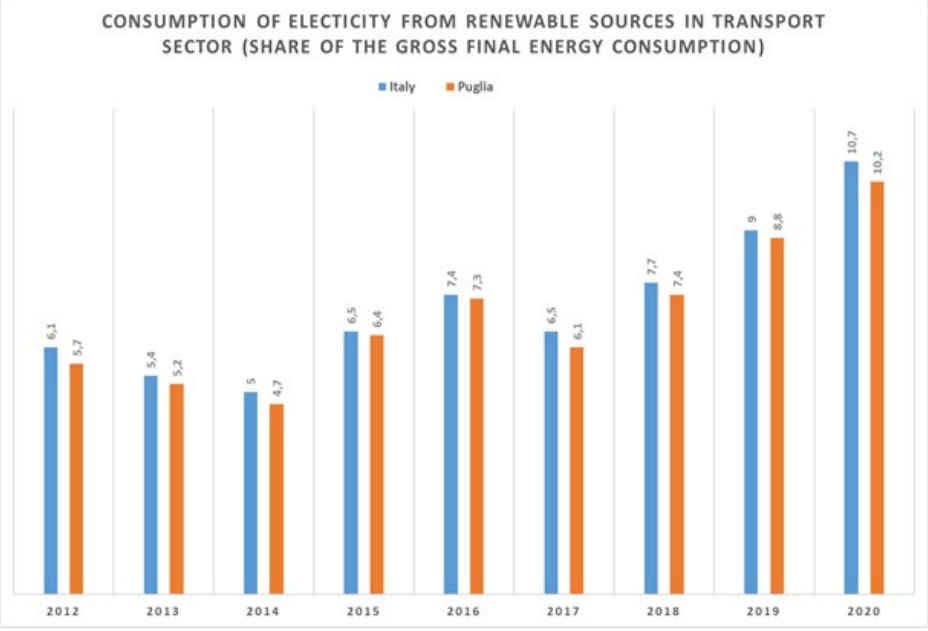


Source: labour force survey, Istat

Trying to solve data gap due to the fact that the phenomenon the indicators points out does not apply to local specificities (point 2 of the previous paragraph), the following indicators are proposed:

— *"Consumption of electricity from renewable resources for transports (share of the final gross energy consumption)*" (SDG7). Considering the local specificities in Puglia, this indicator fits better the corresponding JRC goal for "Electricity production that comes from nuclear power". The source is "GSE S.p.A. - Gestore dei Servizi Energetici" (Nation Provider for Energy Services); official statistics time-series: 2012-2020; available for every region in Italy. As can be seen from Figure 43, this indicator was declining until 2014, then increased in the following years, reaching a peak of 10.2% in 2020. The positive dynamic of the Puglia region seems to be perfectly in line with that of Italy.

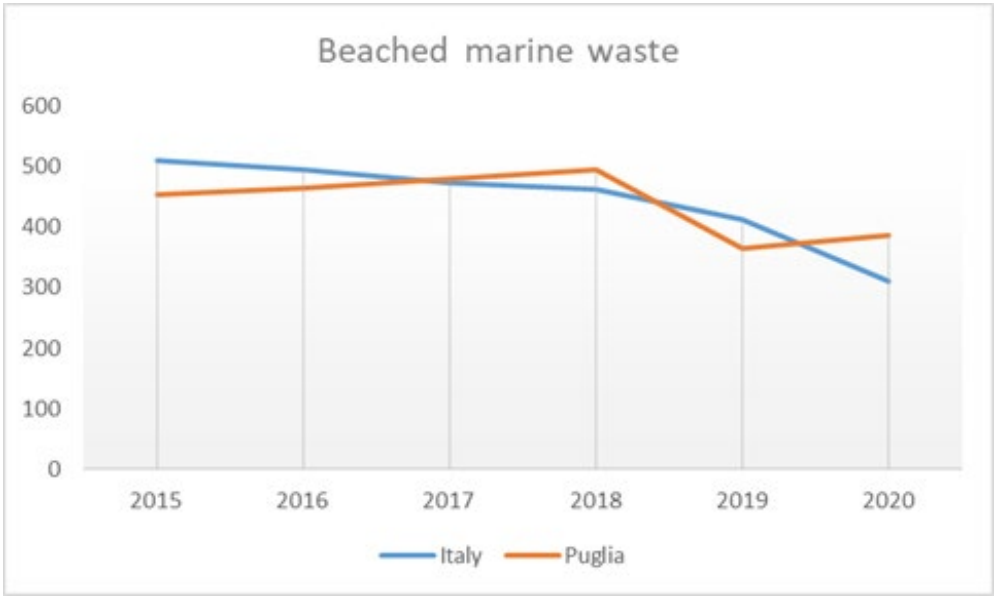
Figure 43. "Consumption of electricity from renewable resources for transports" (SDG 7) - statistical trend.



Source: Istat

— "*Beached marine waste*" (SDG 14) (or "Marine Litter Waste"); this indicator is the alternative for the "*Estuarine with high/very high water quality*" index and it targets locally the same SDGs target. The "*Beached marine waste*" indicator is calculated as the number of items (disposable plastics, waste related to fishing and aquaculture, plastic bags and waste related to smoking, etc.) per 100 meters of coastline. Source: National Institute for Environmental Research (ISPRA) - Marine strategy survey; time series 2015-2020; official statistics, available for all Italian regions. The Apulian figures (Figure 44) in 2015 were lower than the Italian one, but unlike the latter, between 2015 and 2018 it recorded an opposite trend. As a matter of fact, while in Italy there was a constant reduction in beached marine waste, in Apulia there was an increase until 2018, the year after which it fortunately succeeded in reducing this phenomenon, also as a result of a more careful anti-pollution control policy and a greater information and awareness campaign. This indicator could be very useful for monitoring some of the policies implemented by the Region of Puglia regarding the Blue Economy and sustainable tourism. The protection of marine habitats and the reduction of marine litter play an important role in the policy to protect the seas, as set out in the European Marine Strategy (MSFD2), but also in the National Recovery and Resilience Plan (PNRR). In the PNRR, Italy has allocated 400 million euros for the protection of the seafloor.

Figure 44. "Beached marine waste" (SDG 14) – statistical trend.

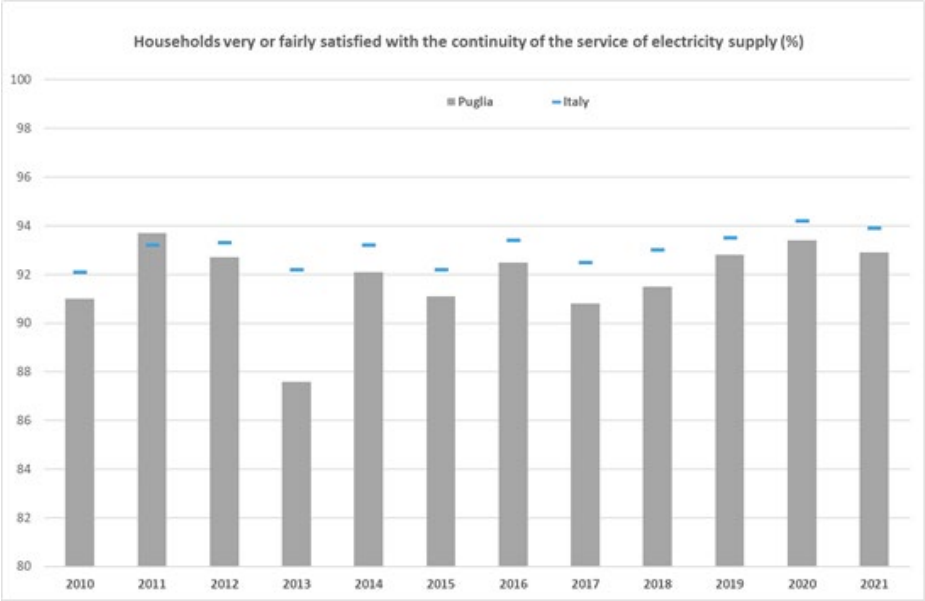


Source: ISPRA

Regarding indicators not fully defined or explained within the JRC dataset ("Affected people due to disasters"; "Food waste"; "Transparency index"; "Official Development Assistance"; "Transport performance"; "Carbon Footprint") at the moment, these indicators are identified as alternative or proxy:

— "*Population exposed to water floods*'' or "*Population exposed to landfilled*" (SDG 1). Considering both the specific SDG's target (1.5, "exposure to vulnerability"), the specific hydrogeological nature of Puglia, and the ongoing global climate changes, these indicators could fit better the target 1.5 in Puglia and so could be a useful substitute of the affected people due to disasters. Data are available from the National Institute for Environmental Research (ISPRA) for all Italian regions; time-series surveyed on a 3-year base. The percentage of the population at hydrogeological risk seems to be rather low in the Puglia region, especially when compared to the national figure, but this number seems to have been growing in recent years and is therefore worthy of attention (Figure 45).

Figure 45. "Population exposed to water floods" (SDG 1) - statistical trend.

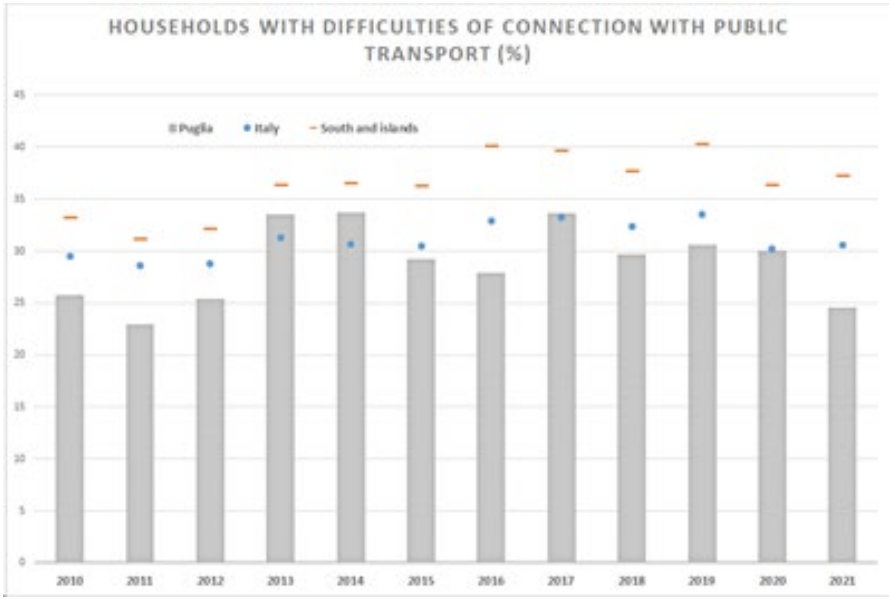


Source: Istat

— Regarding "*Transport performance*" (SDG 11), the local specificities, the SDG, and its relative target, can be addressed by the following three indicators:

- *"Households declaring difficulties of connection with public transport means (per 100 households)*". The source of this indicator is the National Statistical Institute (Istat), Survey on urban environmental data; data are official, available for all Italian regions and the time-series yearly surveyed from 2010 to 2021 (as shown in Figure 46).

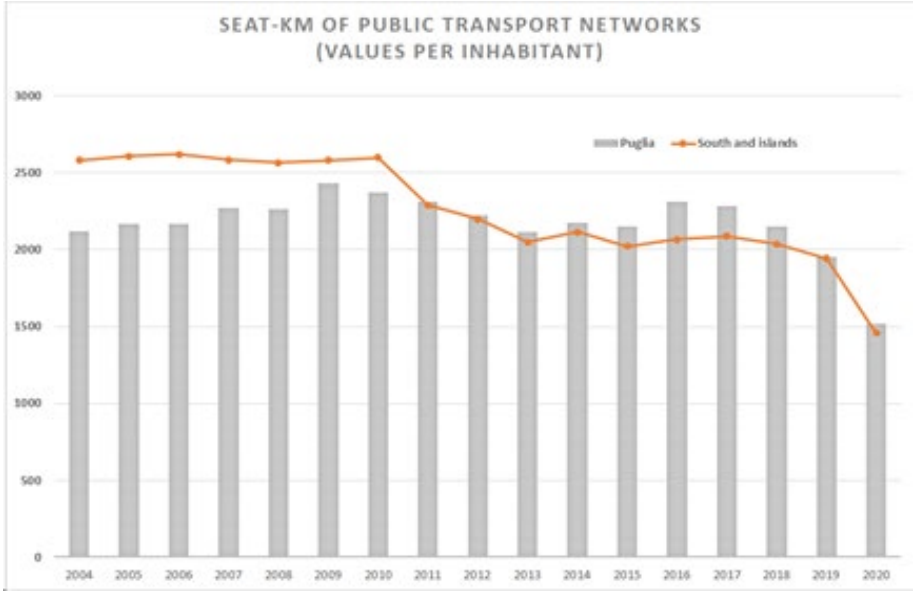
Figure 46. "Households declaring difficulties of connection with public transport means (per 100 households) – statistical trend.



Source: Istat

● *"Seats/ km offered by the local public transport service" (Figure 47)*; The source of this indicator is the National Statistical Institute (Istat), Survey on urban environmental data; data are official, available for all Italian regions and the time-series yearly surveyed from 2004 to 2020 (as shown in Figure 47).

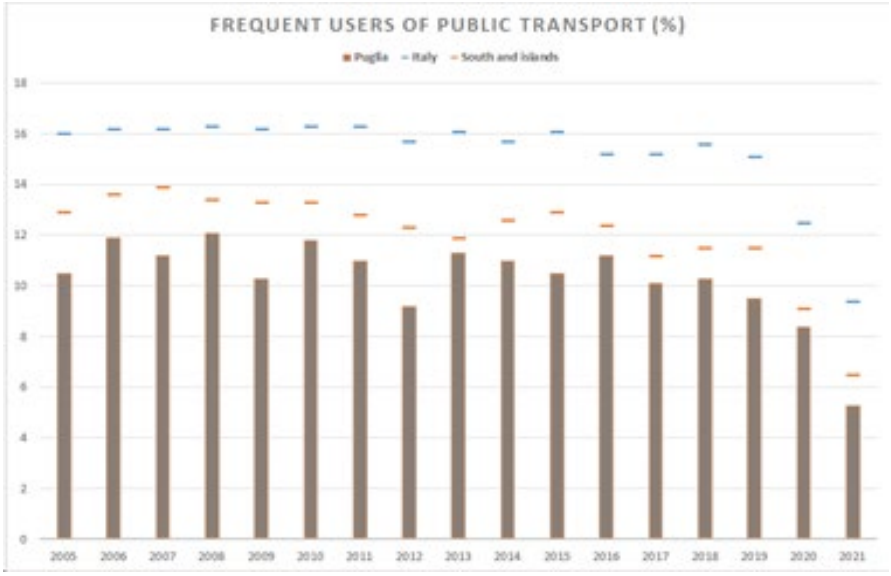
Figure 47. "Seats/km offered by the local public transport service" – statistical trend.



Source: Istat

● *Frequent users of the public transport service, calculated as percentage of population aged 14 and over who use public transport several times a week (bus, trolley bus, tram within their own municipality; bus or coach connecting different municipalities; train).* The source of this indicator is the National Statistical Institute (Istat), Survey on Aspects of daily life; data are official, available for all Italian regions and the time-series yearly surveyed from 2005 to 2021 (as shown in Figure 48).

Figure 48. "Frequent users of the public transport service, calculated as percentage of population aged 14 and over who use public transport several times a week" – statistical trend.

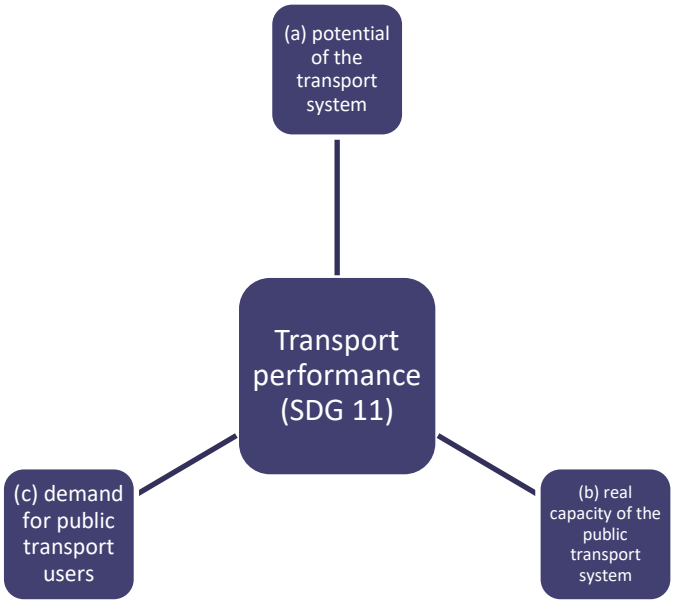


Source: Istat

These 3 indicators deserve to be read together as they could express the 3 different dimensions of a cube: on the one hand the potential of the transport system given the ability of households to be well connected to it (a). This indicator shows how households in Puglia region are on the whole potentially better connected to the public transport system than the average Italian figure. On the other hand, the real capacity of the public transport system (seats/km offered by local public transport service) indicates a lack of public investment, which has seen a diminution in recent years (also due to the Covid-19 pandemic), even if this reduction seems to have been less severe than in the other regions of southern Italy (b); and, finally, the demand for public transport users (c) which has also fallen in recent years, probably due to the poor quality of the service and as a result of the Covid-19 restrictive measures that have encouraged the use of private means of transport. This last figure indicates a much lower demand than the national average.

These 3 elements could be combined to form a multidimensional synthetic index (Figure 49). For reasons of space and time, only the indicator "seats/km of public transport" is included in the list of additional indicators, while the other two indicators are listed as additional indicators for the possible future construction of the synthetic index.

Figure 49. A proposal of "Transport performance" indicator.



Source: own elaboration

— "*Food waste*" (SDG 12). This indicator is the author's own elaboration. The elaboration of this indicator is based on the information obtained during the round table and the meeting with associations and civil society on the food policy. No official regional data source is available at the moment, even if there is a great interest on the topic. Food waste measurement has a key role to play: it could help farmers, companies and consumers to save money; it measures the environmental impact of food production, transport, processing and consumption. Given its important environmental and socio-economic impacts, food waste prevention and the need to adopt a more sustainable production and consumption model is a priority area in the EU's Circular Economy Action Plan. Starting from the food waste data published from Eurostat in October 2022 for all NUTS0 level (EU member states) (https://ec.europa.eu/eurostat/databrowser/view/SBS_R_NUTS06_R2__custom_5801470/default/table), 2020 was the first reporting year of the EU-wide monitoring of food waste levels according to Commission delegated decision (EU) 2019/1597. Information and data are based on the Waste Framework Directive (2008/98/EC) that establishes an annual reporting obligation on measurements of the levels of food waste, on Commission delegated decision (EU) 2019/1597, that defines the common methodology and minimum quality requirements for the uniform measurement of levels of food waste.

According to Eurostat:

$$\begin{aligned} Food\ Waste_{italy} = {} & Food\_Waste\_Primary\ Production_{ita} + Food\_Waste\_Processing\ and\ Manufacturing_{ita} \\ & + Food\_Waste\_Retail\ and\ other\ distibution\ of\ food_{ita} \\ & + Fodd\_Waste\_Restaurants\ and\ food\ services_{ita} + Food\_Waste\_Households_{ita} \end{aligned}$$

Food waste can be defined as explained above: the index sums up the contribution of the entire food supply chain up to the final consumer. Each step can be tracked locally. Therefore, where national data are available, a feasible solution for the local measurement of the index is to set the share of the regional contribution to food waste proportionally to the weight of the local food supply chain(s). This is done by assuming that Italian households and Italian companies produce food waste in the same way (on average), wherever they are located, and by assuming that the only significant difference is related to the dimension (large or small company).

In this way we can obtain:

$$\begin{aligned} Food\ Waste_j = {} & F\_Waste\_Primary\ Production_j + F\_Waste\_Processing\ and\ Manufacturing_j \\ & + F\_Waste\_Retail\ and\ other\ distibution\ of\ food_j \\ & + F\_Waste\_Restaurants\ and\ food\ services_j + F\_Waste\_Households_j \end{aligned}$$

where *j* indicates an Italian region and where

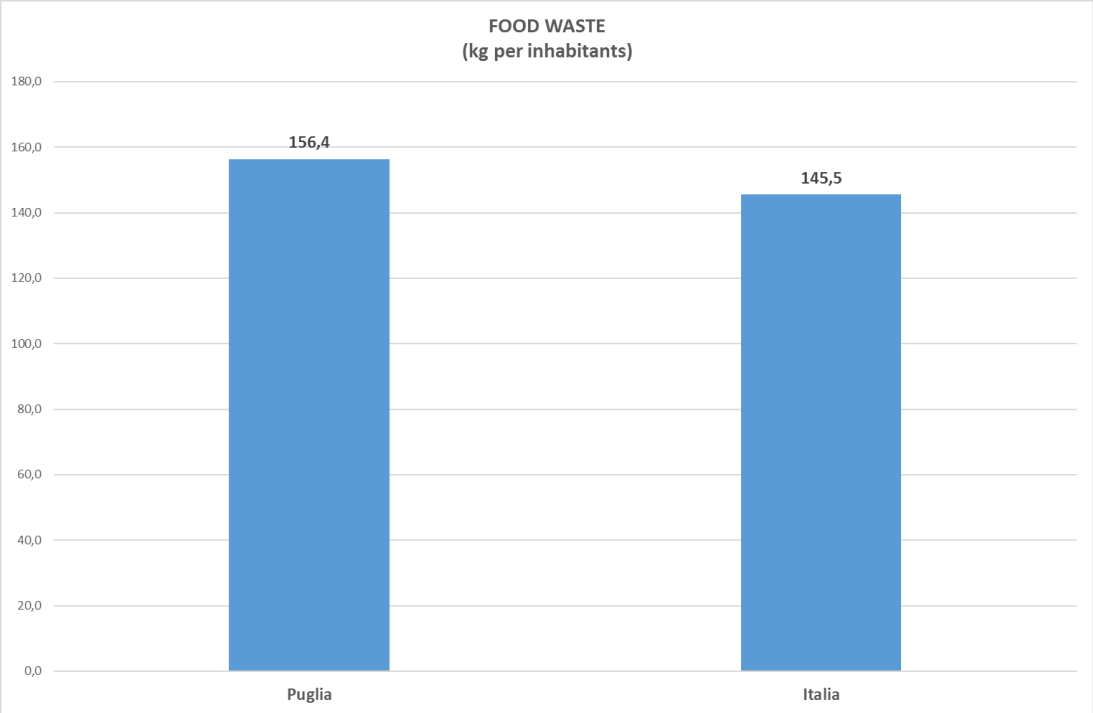
$$F\_Waste\_Prim\ Production_j = F\_Waste\_Primary\ Production_{ita} * \frac{n.\ of\ person\ employed\ in\ prim.production_{\ j}}{n.\ of\ person\ employed\ in\ prim.production_{ita}}$$

The same operation is realized for all other sectors contributing to food waste chain.

In this way, it is possible to obtain a proxy of this indicator for all Italian regions using the weight of each single regional sector contributing to food waste chain: Primary production of food - agriculture, fishing and aquaculture; Manufacture of food products and beverages; Retail and other distribution of food; Restaurants and food services, Households.

For each sector, we use the following regional weights: number of persons employed, number of households, number of firms. Data on these sectors are available for all European regions. The result can be seen in the following Figure 50.

Figure 50. "Food waste" (SDG 12) – statistical trend.



Source: own elaboration on Eurostat and Istat data

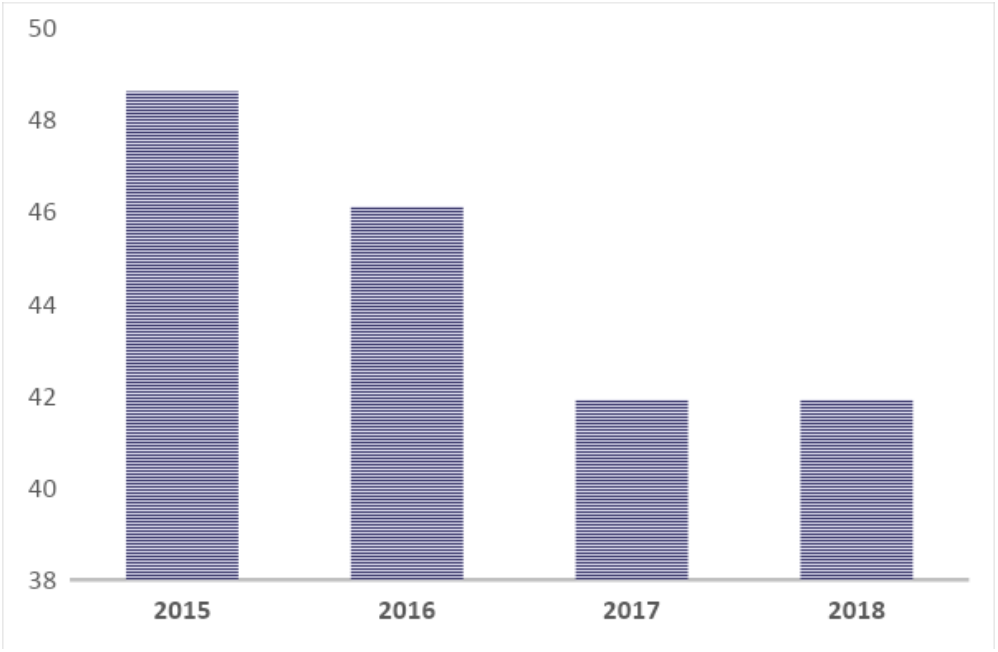
The presence in Puglia of a rather important agrifood and primary sector in terms of economic weight means that the Puglia region's food waste figure is higher than the average Italian figure. In the Puglia region, food waste is estimated at 156 kg per inhabitant in 2020, against a figure of 146 kg per inhabitant for Italy. The data call for specific local policies, although results may change, improving surveying in the next few years.

— As an alternative to carbon footprint (SDG 12, target 12.2), following the indications coming from the Italian National strategy on SDG it is possible to suggest the following indicator: "*Domestic material consumption*". It measures the quantity of raw materials, other than water and air, used every year by the socio-economic system and released into the environment (incorporated into emissions or effluents) or accumulated in new anthropogenic stocks (both capital goods and other durable goods and waste). Denominator: average annual population (Reg. UE N. 549/2013). Source: National Statistical Institute (Istat) – Materials' flows accounts; time-series from 2015 to 2018; annual frequency (Figure 51).

Puglia recorded progress overtime in limiting material consumption, thanks to the strong impetus given by European policies for promoting Sustainable Consumption and Production models aimed at turning the European Union into a resource-efficient economy. The advancements partly linked to structural changes of production of European economies and to business cycle trends, showed signs of a progressive decoupling between the development of economic activity and pressures on the environment. Over the last ten years, the ratio between Domestic material consumption (DMC) and GDP – an indicator of efficiency in the use of material resources – has decreased by 33,3%, compared to the EU27 average change of 17% (from 0,58 to 0,48 tonnes per 1000 euro). In 2019, Italy was among the most virtuous Member States, placing in the fourth position in the decreasing DMC/GDP ranking (with a value that amounted to 59% of the EU27 average) and in the first position in the material consumption per capita ranking (57%).

There are important regional disparities of material consumption, due to sectoral characterisation and to the heterogeneity of production processes. In 2017, DMC recorded lower intensities in the Centre (6,9 tonnes per inhabitant and 0,23 per 1000 euro) than in the North (respectively 8,7 and 0,25). South and Islands placed in an intermediate position in terms of DMC per inhabitant (7,6 tonnes per capita) and reached a high intensity in terms to GDP (0,42 per 1000 €), in particular in Sardegna (0,78), Molise (0,75), Puglia (0,58) and Basilicata (0,53).

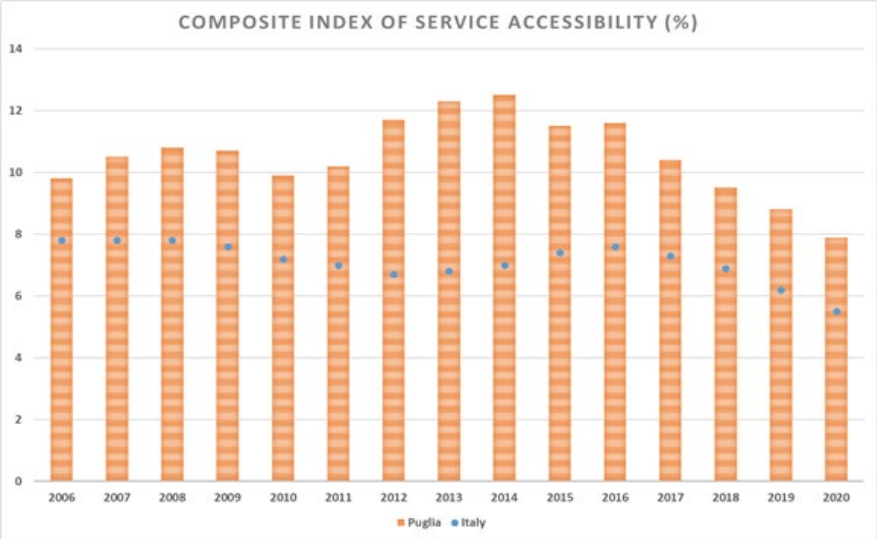
Figure 51. Puglia "domestic material consumption (million tonnes)" SDG 12 – statistical trend.



Source: Istat

— The use of the "*Composite index of service accessibility*" (SDG 16.6) from the National Statistical Institute (Istat) is suggested as an alternative identified for the "*Transparency index*". It is calculated as the percentage of households who find it very difficult to reach some basic services (pharmacy, emergency room, post office, police, municipal offices, nursery, primary and secondary school, market and supermarket). The indicator is an official statistics data, available for all Italian regions, with a three-year average, and has a time-series available: 2006-2020. Over the past 15 years, the percentage of Puglia region households experiencing difficulties in accessing certain services has decreased overall, from close to 10 per cent to less than 8 per cent in 2020. This positive dynamic, however, seems to be the result of two different trends. In the first period from 2006 to 2014, there was an increase in this indicator, probably also as a result of the great economic crisis and the period of austerity, that entailed quite significant cuts in investments and public administrations. From 2014 onwards, on the other hand, there has been a gradual reduction that has brought the average figure for Puglia closer to the Italian average (Figure 52).

Figure 52. "Composite index of service accessibility" (SDG 16) - statistical trend.

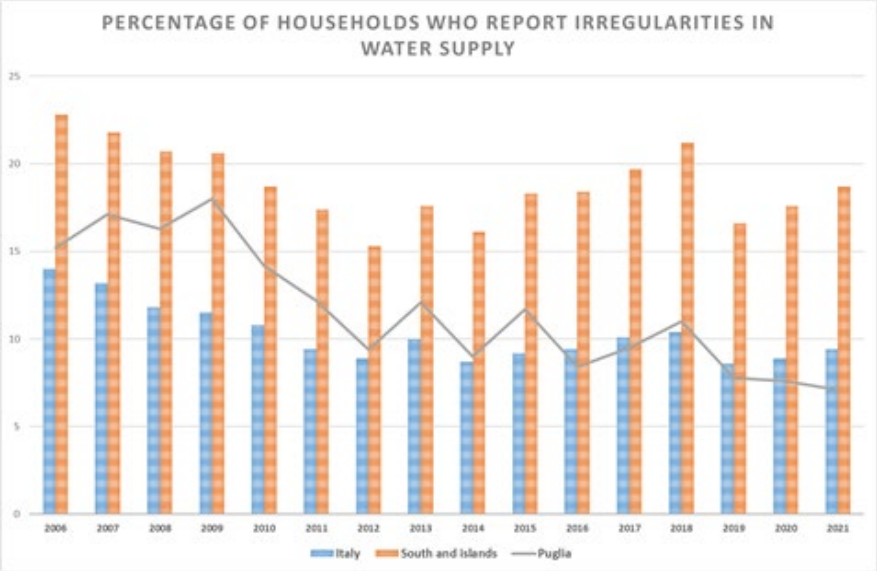


Source: Istat

Regarding the indicators that need further investigation with domain experts in order to understand if it actually fits the JRC goal, at the moment, the following alternatives have been selected:

— "*Percentage of households who report irregularities in water supply*" (SDG 6), as a feasible option for "*Population served by safely managed drinking water supply services*". Source Istat, Survey on Aspects of daily life, time series 2010-2021; data available for all Italian regions; official data. The percentage of the population in the Puglia region reporting irregularities in water supply has been steadily decreasing over the last 15 years, unlike in other regions of southern Italy (Figure 53). The policies implemented and the presence of a leading actor such as the Acquedotto Pugliese would seem to have facilitated this progressive improvement. In 2021, the percentage of households in Puglia reporting irregularities in water supply was lower than the Italian average for the second year running.

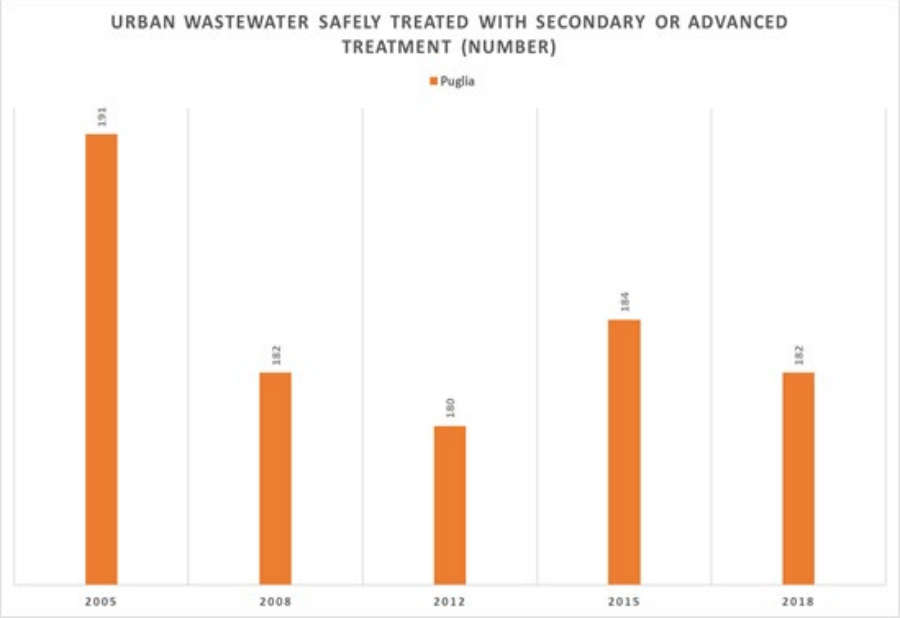
Figure 53. "Percentage of households who report irregularities in water supply" (SDG 6) – statistical trend.



Source: Istat

— "*Urban water treatment plants in operation by type of secondary/advanced treatment*" (SDG 6) as alternative to "Population connected to wastewater with at least secondary treatment". According to the information coming from this indicator, waste water from urban sources or elsewhere is treated by a process generally involving biological treatment with a secondary settlement or other process, resulting in a removal of organic material that reduces the biochemical oxygen demand (BOD) by at least 70% and the chemical oxygen demand (COD) by at least 75%. The indicator *"Urban water treatment plants in operation by type of secondary/advanced treatment"* is calculated as the number of urban wastewater treatment plants with secondary or advanced treatment for 1000 inhabitants. Data are available from 2008-2020 (Figure 54); surveyed every 2 years; Urban water census (Istat).

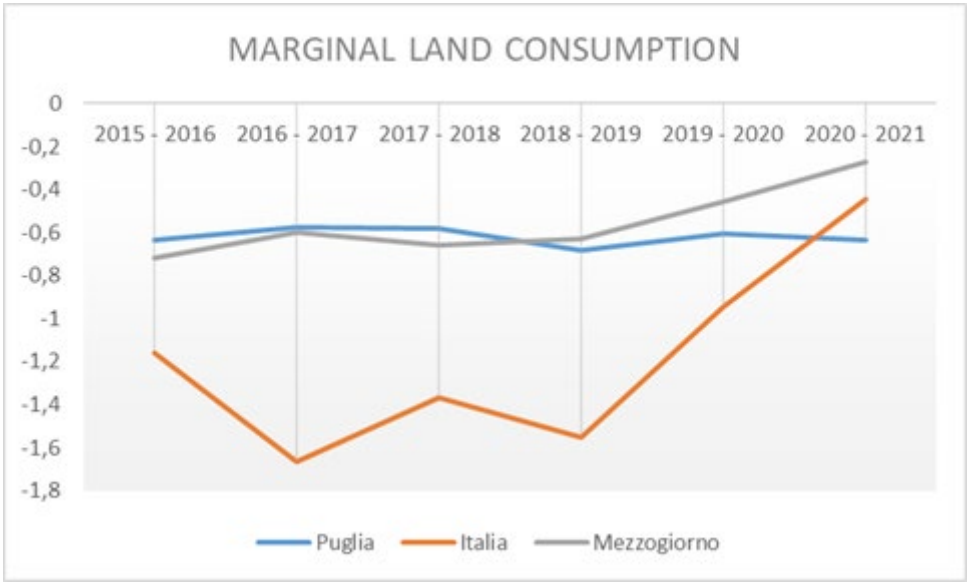
Figure 54. "Urban water treatment plants in operation by type of secondary/advanced treatment" (SDG 6) – statistical trend.



Source: Istat

— "*Marginal land consumption (SDG 11)*" (calculated as the ratio of new land consumption to new residents between one year and the following), could be an alternative to "*Difference between built-up area growth rate and population growth rate*". It matches the 11.3.1 indicator proposed by the United Nations and it relates the rate of change of land consumption with the rate of population change over the reference period. For values of the indicator between 0 and 1 the rate of change of land consumption is less than the rate of change of population, if the indicator is 0 the consumption does not vary, if it is greater than 1 the rate of change of land consumption is greater than the rate of change of population, if it is infinite the population does not change, but the consumed does. The objective of the indicator is to assess the sustainability of consumption on the basis of population growth (Figure 55). Source: National Institute for Environmental Research (ISPRA); time-series yearly surveyed from 2019 to 2021.

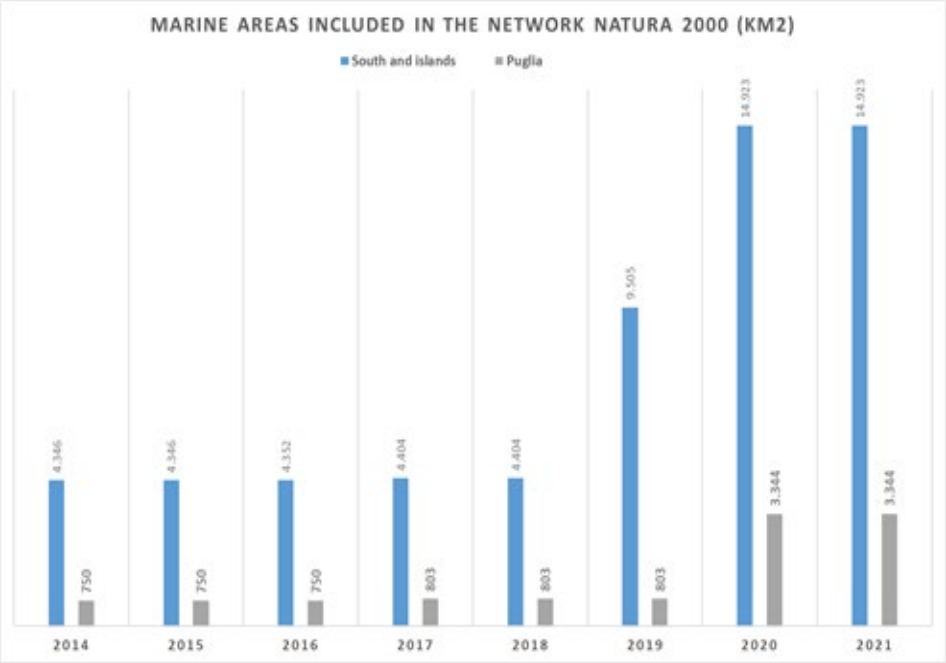
Figure 55. "Marginal land consumption" (SDG 11) – statistical trend.



Source: ISPRA

— "*Protected Marine Areas*" (SDG 14) is proposed as an alternative indicator for the *"Protected coastal area as a percentage of total coastal area"*. The index sums up the Italian coastal areas under environmental protection. Precisely, the index measures the marine areas under environmental protection (AMP), by the Italian Law (Laws nr. 979/1982 and nr. 394/1991) and all the protected areas officially listed in a national governmental record (EUAP). Anyway the AMP areas under international interest called "*Marine Mammals' Sanctuary*" is not included. After a period of substantial stability, the number of km2 of marine protected area has increased significantly over the last three years. The relative weight of Puglia's protected marine area compared to the Italian figure has doubled (Figure 56). This is a symptom of an increasing interest in what in Puglia region is considered a primary asset, a source of economic growth and wellbeing, above all within the regional investment plan of the Blue Economy.

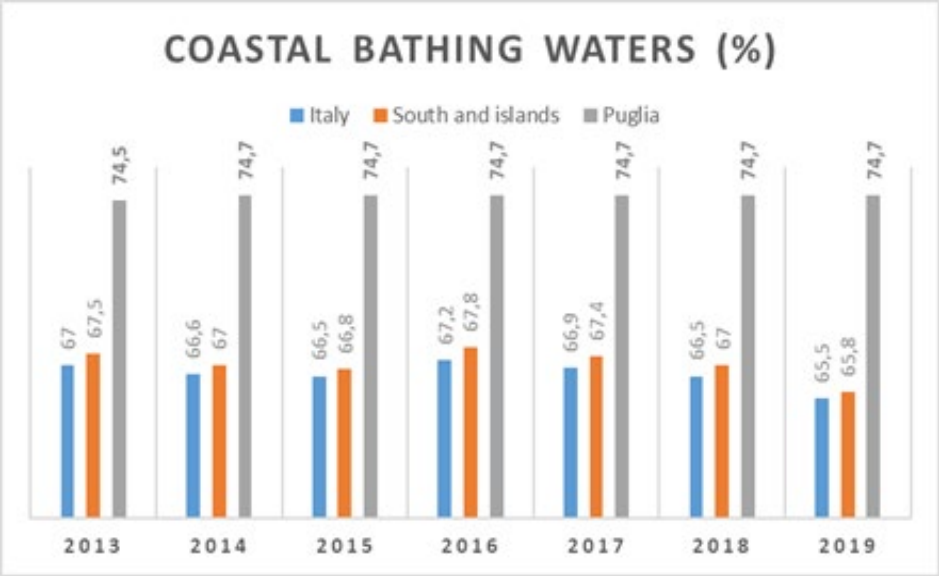
Figure 56. "Protected Marine Areas" (SDG 14) - statistical trend.



Source: Istat

— "*Coastal bathing waters*" (SDG 14) is proposed as an alternative to *"Coastal areas with good/very good water quality"*. It is calculated as the percentage of authorized coastal bathing waters on the total of the coastal line in accordance with the regulations in force. The source is Istat on data from Ministry of Health; time-series yearly surveyed from 2012 to 2019. The Bathing Water Directive defines bathing waters as "areas in which the competent authorities provide for an adequate number of people to bathe and where there are no permanent prohibitions" (Directive 2006/7/EC). The subsequent Implementation Decree of 30 March 2010 classifies water quality as "excellent", "good", "sufficient" and "poor", depending on the presence of microbiological parameters (intestinal enterococci and escherichia coli). There are also other factors of health concern that may lead to preventive measures in the case of the presence of values considered to be a health risk. Puglia's bathing surface area is close to 75%, with a stable share over time. This figure is higher not only than the Italian average but also that of southern Italian regions, another symptom of the importance the Puglia Region attaches to protecting its sea as a primary resource and a key element for economic development (Figure 57). This indicator is an important tool for defining a unified and integrated medium and long-term strategy for safeguarding, improving and developing a sustainable marine economy in Puglia, as envisaged in the regional Blue economy strategy.

Figure 57. "Coastal bathing waters" (SDG 14) – statistical trend.



Source: Istat

Among the 18 indicators for which it has not been possible to collect data and for which alternatives have been proposed, only in one case has it not been possible to find a workable alternative that could cover the same objective: the indicator "Official Development Assistance" (ODA). Discussions with regional experts did not lead to the identification of adequate alternatives. In this case, neither national nor regional strategies suggest an alternative indicator.

7. ADDITIONAL INDICATORS IDENTIFIED BASED ON RELEVANT THEMES AND AREAS SPECIFIC TO THE PUGLIA REGION

A number of topics specific to the Puglia Region have been included in the set of indicators provided by the JRC: on the one hand, from the observation of some geographical, economic, cultural and social peculiarities of Puglia, but above all from the VLR published by the Region, which tried to translate some regional investments and political choices into indicators with a view to sustainable development.

In addition to the gender agenda mentioned above, Puglia has recently invested heavily in hydrogen, the blue economy, but also in culture and sustainable tourism. Thematic meetings with regional experts identified some indicators that could help in the strategy. The local peculiarities in Puglia call for further indicators that contribute to complete the scenario and to better address the SDGs targets.

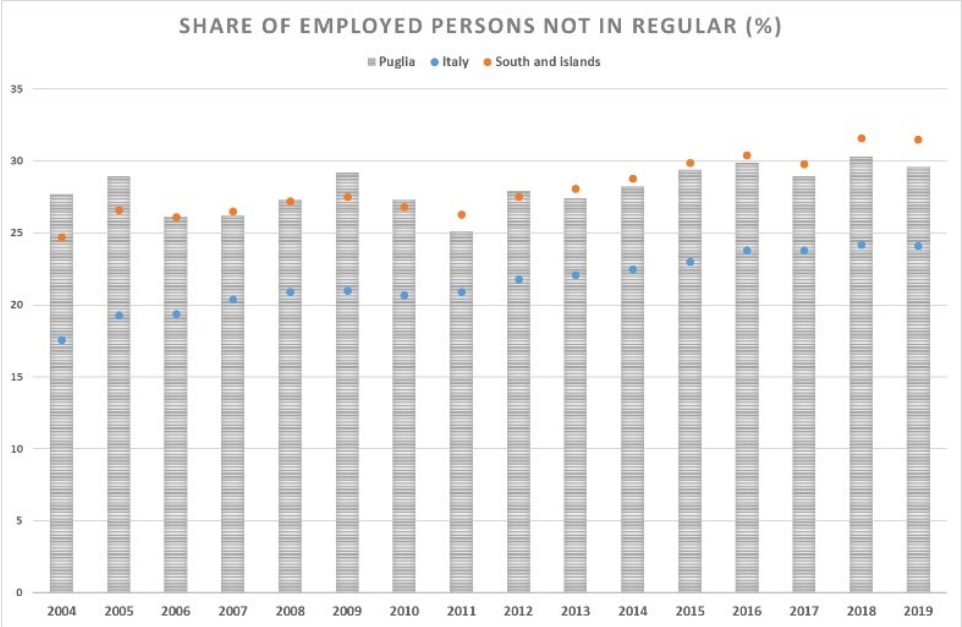
These issues were identified through the national framework provided by the Sustainable Development Strategy (see Box 1) and made available through the work of national experts, and then further defined and analysed at local level (within the Regional Sustainable Development Strategy), resulting in 13 additional indicators described below. The proposed indicators therefore sought to draw from within this framework, if the measurability of the phenomenon for all Italian regions was guaranteed at the same time, the use of the phenomenon through official data and under European regulation, and with a good frequency of updating.

These aspects in fact make it possible to hypothesize a future use of these indicators also for other European regions.

For instance, despite a particularly advanced regulatory context and the sustained investments, in fact, the Puglia Region is still characterized by particularly critical levels of employment rate which needs to be improved. It is therefore considered appropriate to supplement Goal 8 with some indicators relating to the following targets: a) 8.3 - "*Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services*"; b) 8.4 - "*Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead*".

— For the target 8.3 it is possible to suggest the following index: *"Share of employed persons not in regular occupation*", calculated as people employed who do not comply with work, fiscal and pension laws on total people employed. The source is National Statistical Institute (Istat); time-series is available from 2004 to 2019; annual frequency. Figure 58 shows data on the "Share of employed persons not in regular occupation" (SDG 8). The share *of* employed persons not in regular occupation has increased over the last 10 years. It is interesting to note, however, that it is higher than the national average, but lower than the other Mezzogiorno regions. In particular, if we look at the trend in relation to these regions, it is possible to observe a more favourable trend for the region of Puglia.

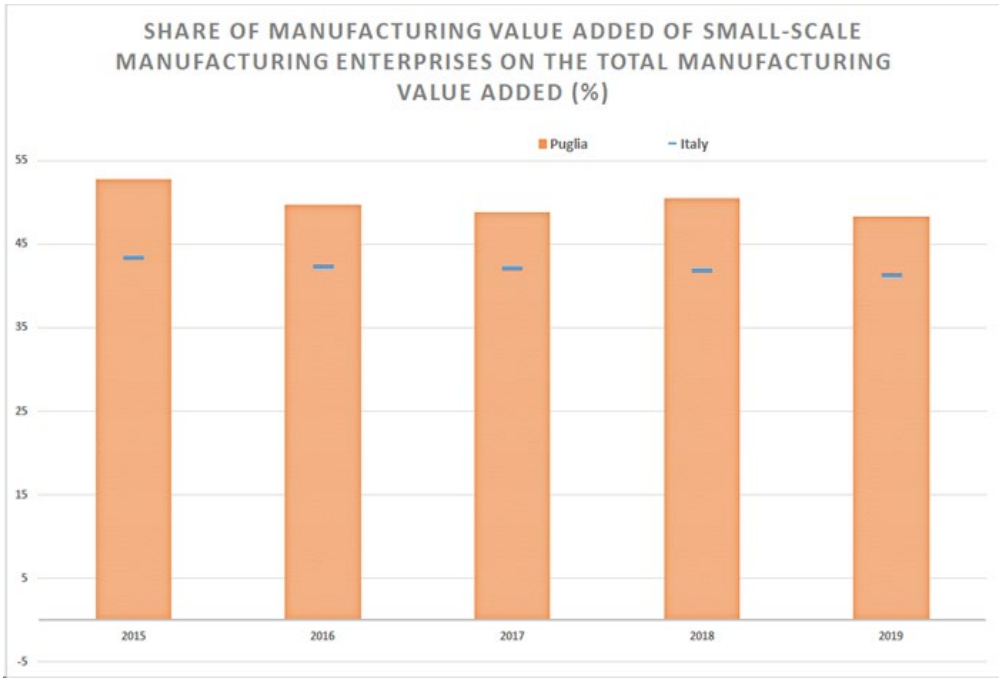
Figure 58. "Share of employed persons not in regular occupation" (SDG 8.3) – statistical trend.



Source: Istat

— For the target 9.3 "Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets", we suggest the following index: "*Share of manufacturing value added of small-scale manufacturing enterprises on the total manufacturing value added*". It is calculated as the percentage of the value added of manufacturing enterprises with less than 50 persons employed out of the total value added of the manufacturing sector. The source is National Statistical Institute (Istat) - Territorial FRAME Information system; time-series from 2015 to 2019 (Figure 59); annual frequency.

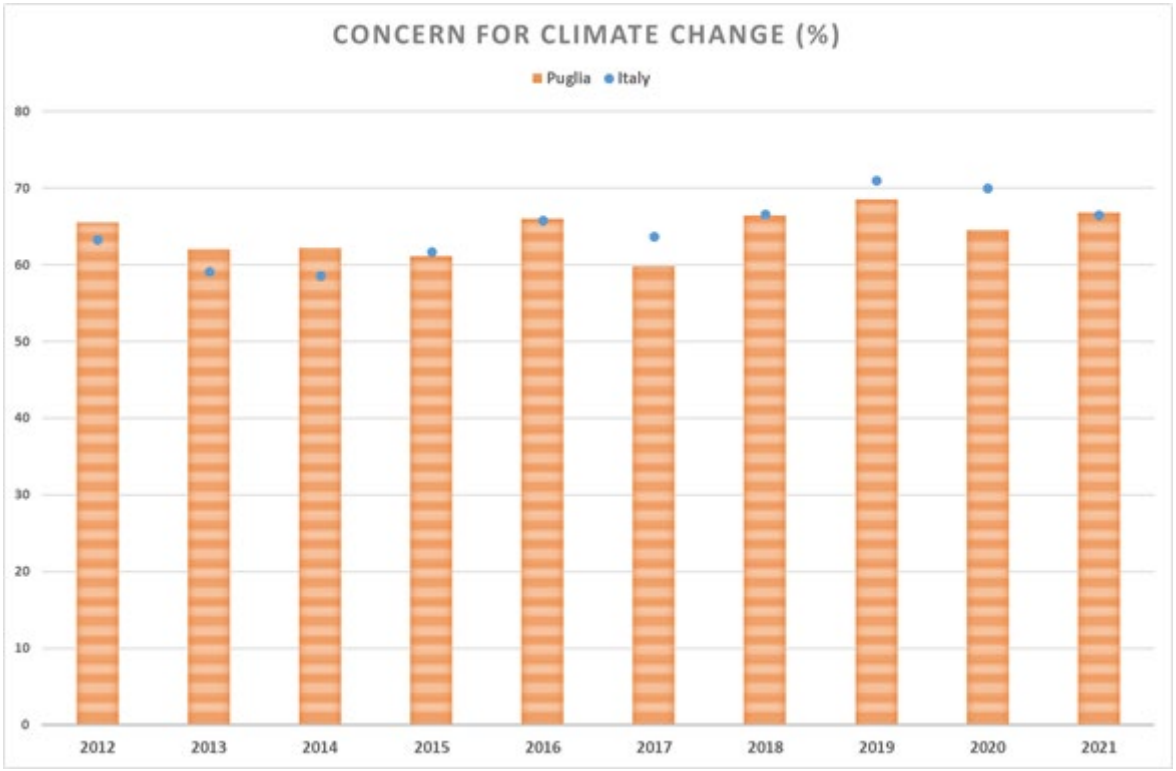
Figure 59. "Share of manufacturing value added of small-scale manufacturing enterprises on the total manufacturing value added" (SDG 8) – statistical trend.



Source: Istat

— For the target 13.3 “Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning”, we suggest the following indicators: “*Concern for climate change*”, calculated as Percentage of people aged 14 and over who believe that climate change, greenhouse effect and ozone hole are among the five most important environmental problems. The source is: National Statistical Institute (Istat) - Survey on Aspects of daily life; time-series from 2012 to 2021 as shown in the Figure 60.

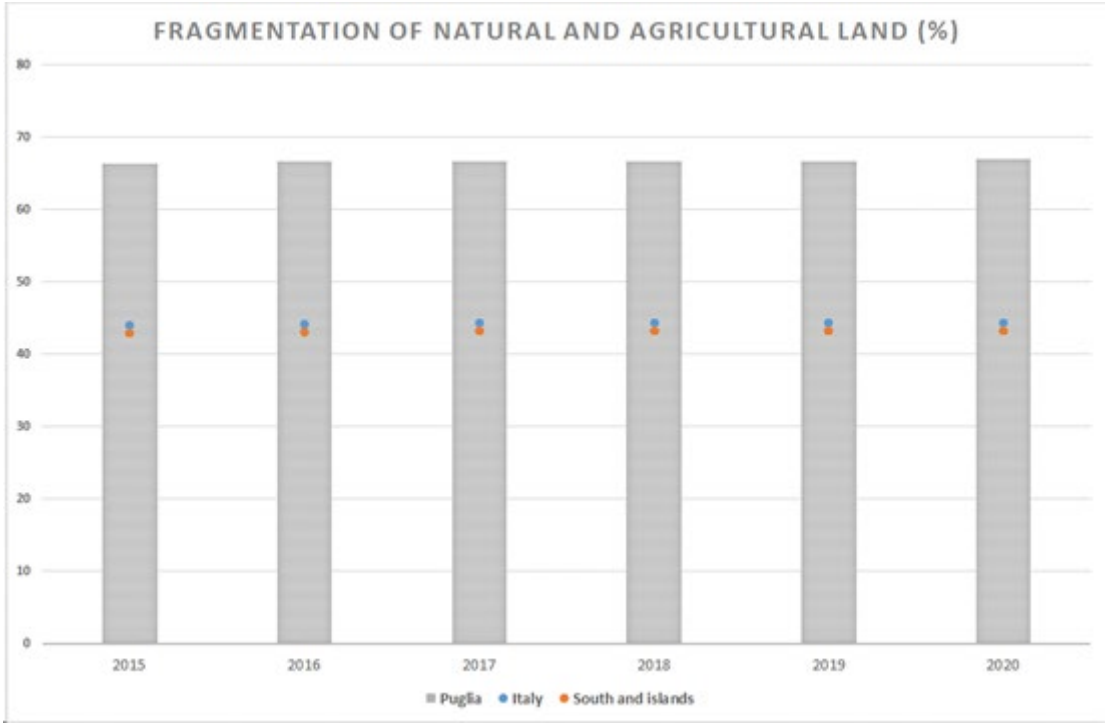
Figure 60. “Concern for climate change” (SDG 13) – statistical trend.



Source: Istat

— Provided the Puglia is at risk of desertification, for the target 15.3 “By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world”, the following indicator could be applied: “*Fragmentation of natural and agricultural land*”. It is calculated as the share of natural and agricultural land with high/very high fragmentation. Land fragmentation is the process of reducing the continuity of ecosystems, habitats and landscape units as a result of phenomena such as urban expansion and infrastructure network development. The indicator represents the density of the territorial patches (n° of meshes per 1,000 km2) calculated according to the Effective mesh-size method (Jaeger, 2000). The source is ISPRA, survey Soil consumption, territorial dynamics and ecosystem services. Data available from 2015 to 2021 for all Italian regions (Figure 61).

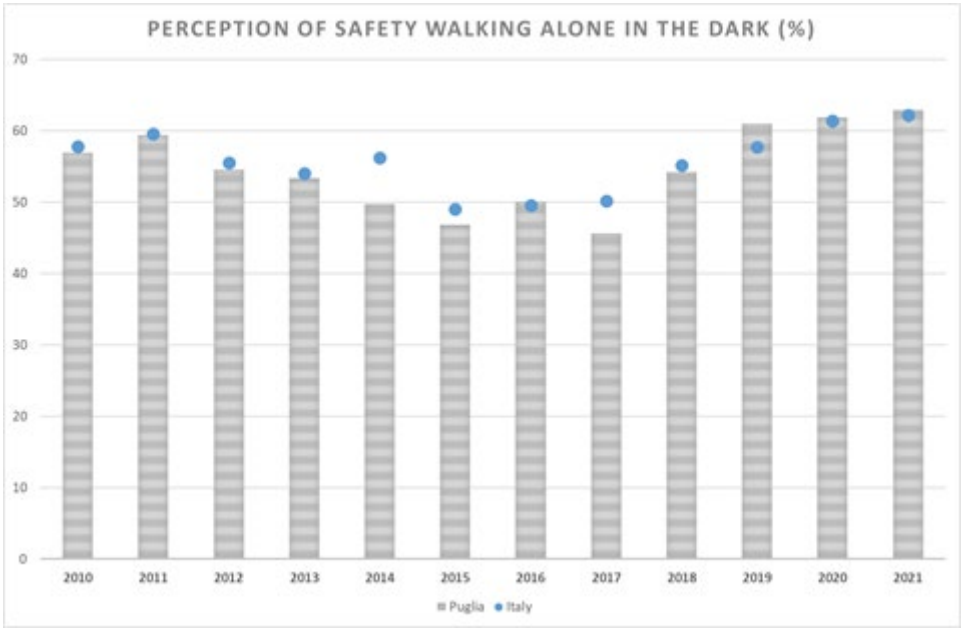
Figure 61. "Fragmentation of natural and agricultural land" (SDG 15) – statistical trend.



Source: ISPRA

— For the target 16.1 "Significantly reduce all forms of violence and related death rates everywhere", the following indicator could be useful: "*Perception of safety walking alone in the dark*". It is calculated as the percentage of people aged 14 and over feeling very or quite safe walking alone when it is dark in the area where they live. National Statistical Institute (Istat) - Survey on Aspects of daily life, 2010-2021 (Figure 62).

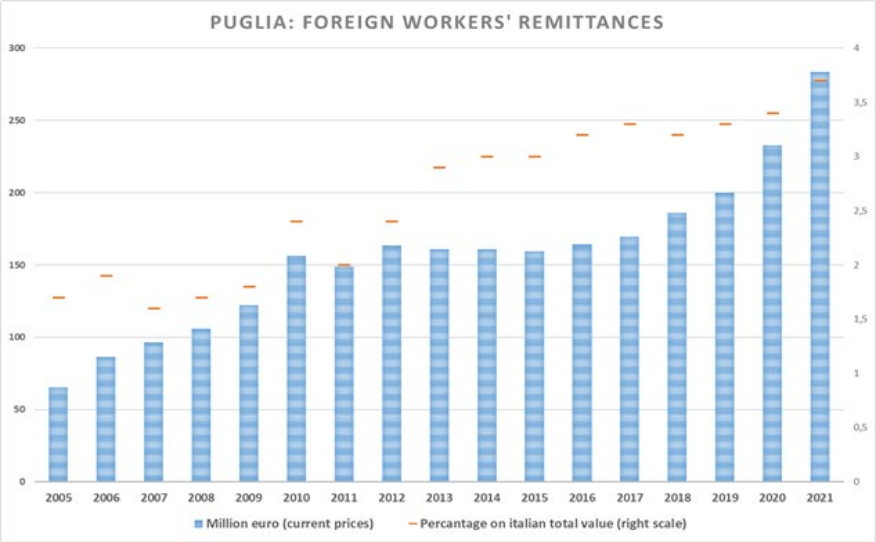
Figure 62. "Perception of safety walking alone in the dark" (SDG 16) – statistical trend.



Source: Istat

— For the target 17.3 "Mobilize additional financial resources for developing countries from multiple sources", could be useful to insert the following indicator: "*Foreign workers' remittances by region of residence of the payer and by foreign State of residence of the recipient*" (Millions of Euro, current values). Source: National Statistical Institute (Istat) based on data from the Bank of Italy; time series 2005-2021 (Figure 63). In 2021, remittances abroad in Puglia exceed 280 million for the first time, with a relevant increase compared to 2020. More than half (55.7%) of foreign remittances come from the four regions with the largest number of migrants: Lombardy (22.7%), Latium (14.6%), Emilia-Romagna (10.2%) and Veneto (8.2%). Puglia share is 3.7% Remittances are sent to a wide range of wide range of countries. The top three destination countries are Bangladesh (14.6%), Pakistan (8.5%) and the Philippines (7.6%).

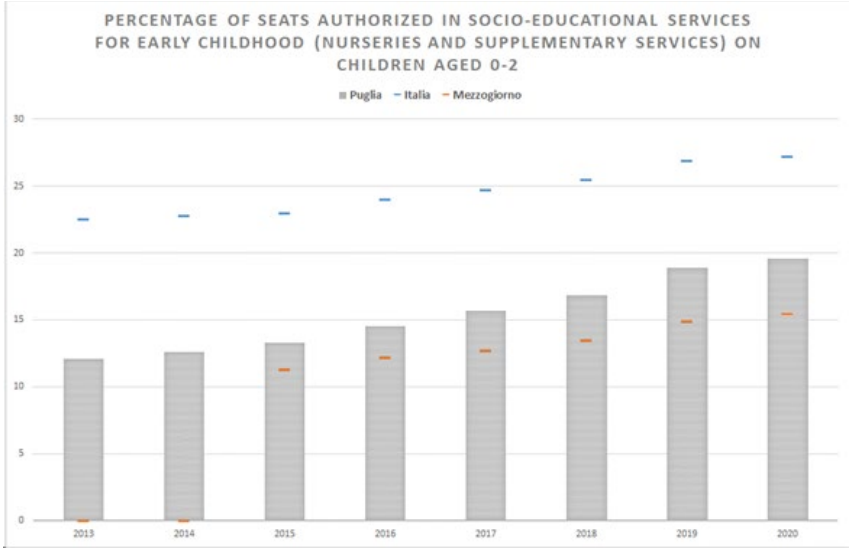
Figure 63. "Foreign workers' remittances by region of residence of the payer and by foreign State of residence of the recipient" (SDG 17) – statistical trend.



Source: Istat

— *"Percentage of seats authorized in socio-educational services for early childhood (nurseries and supplementary services) on children aged 0-2"* (SGD 4.2). The source is Istat, Survey on nurseries and supplementary services for early childhood, with annual frequency. This percentage has increased over the last 15 years. It is interesting to note, that it is lower than the national average, but higher than the other Mezzogiorno regions. In particular, if we look at the trend in relation to these regions, it is possible to observe a more favourable trend for the region of Puglia (Figure 64).

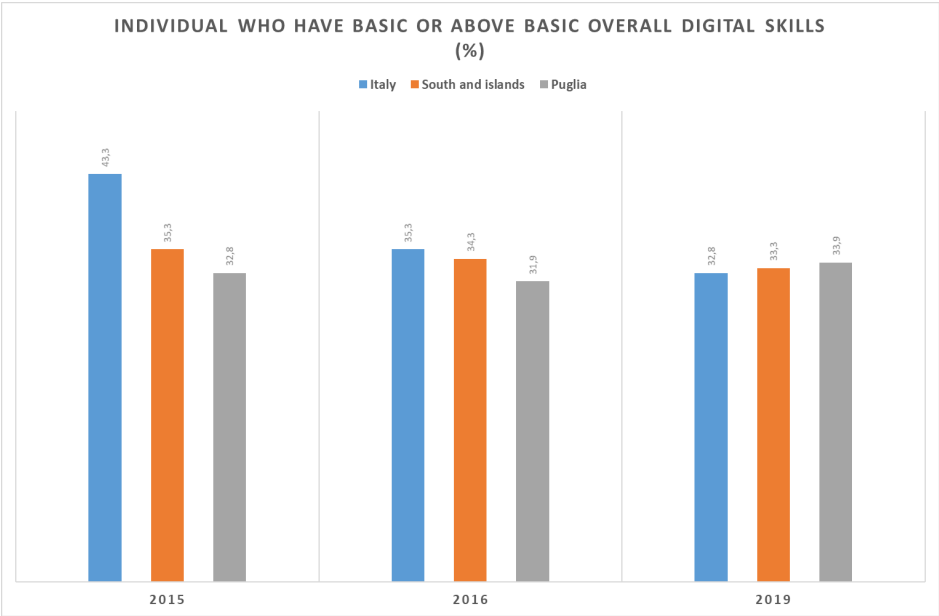
Figure 64. "Percentage of seats authorized in socio-educational services for early childhood (nurseries and supplementary services) on children aged 0-2 (SGD 4.2)" – statistical trend.



Source: Istat, Survey on nurseries and supplementary services for early childhood

— Another relevant aspect in the agenda of the Puglia Region is to increase digital knowledge. This information seems to be missing from the JRC set of indicators, so it might be useful to consider an indicator like this as well: "*Individual who have basic or above basic overall digital skills (%)*". The source is Istat, frequency triannual, available for all Italian regions. Through this indicator, it is possible to see how digital skills, at least the basic ones, are on the rise in the Puglia region, even exceeding the national average (Figure 65).

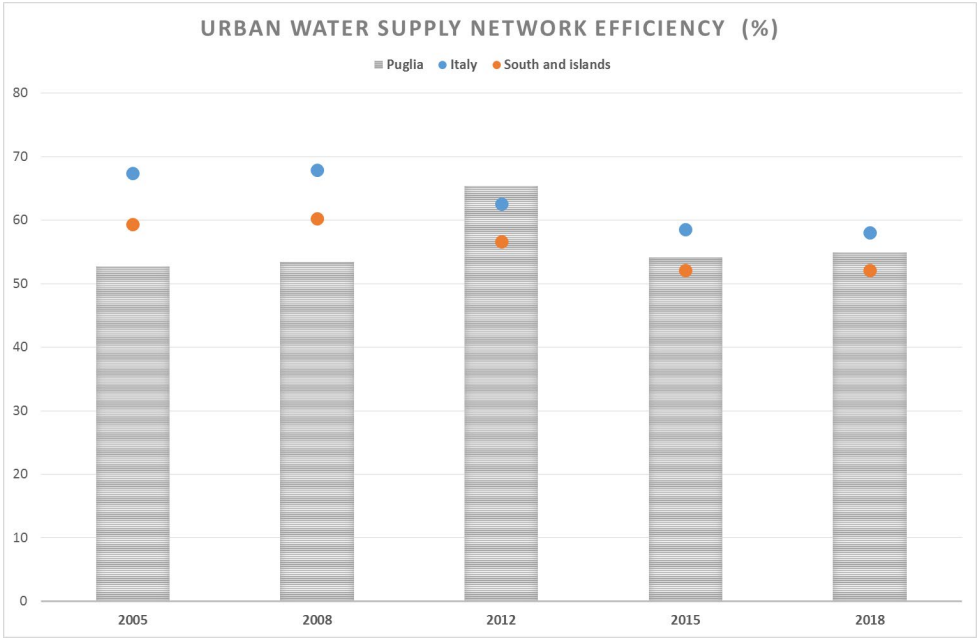
Figure 65. "Individual who have basic or above basic overall digital skills" (SDG 4.4) – statistical trend.



Source: Istat

— Another relevant aspect in the agenda of the Puglia Region is to improve the efficiency of the water supply (target 6.4 Change in water use efficiency over time). A useful indicator is elaborate from Istat (every three years) and is "*Urban Water supply network efficiency*". The results of these indicator are shown in the Figure 66.

Figure 66. "Urban water supply network efficiency" (SDG 6.4) – statistical trend



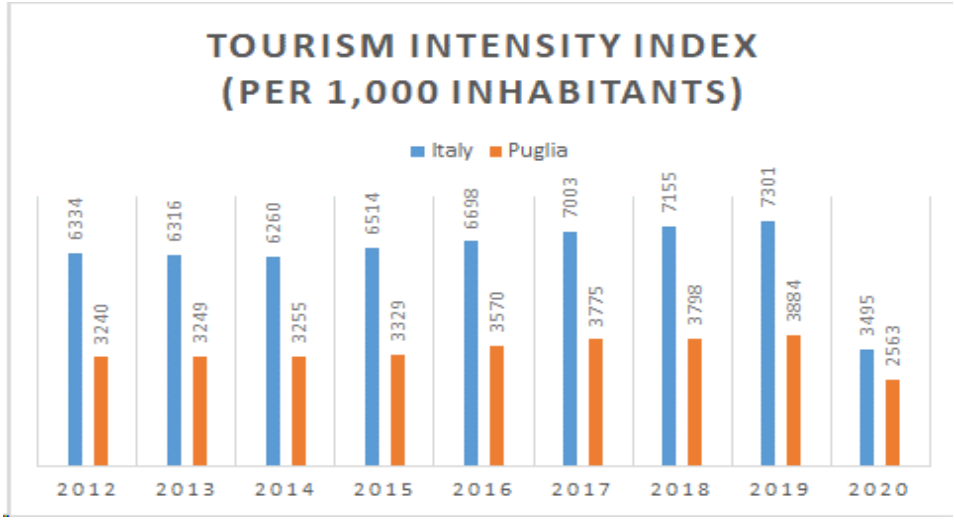
Source: Istat

Sustainable cultural tourism is an essential element of regional development strategies. The changes that await us in the near future, with the process of ecological transition and the implementation of the National Recovery and Resilience Plan (NRRP), represent a historic opportunity, first and foremost to strengthen public commitment to the protection and enhancement of the landscape and cultural heritage, but they also entail risks, which inevitably accompany the implementation of investment programmes of this magnitude and call for a renewal of the regulatory framework. In this approach, which must now take concrete form in the practice of planning at all levels, the landscape - the product of the interaction between nature and culture - becomes the most useful and functional category for interpreting the territory: no longer a catalogue of constraints but the matrix in which interventions must be placed and against which their sustainability must be assessed.

From this perspective, culture is both an engine and a catalyst for sustainable development. For the transition to sustainable tourism could be useful to observe the following indicators:

— "*Touristic intensity index*" (source: Istat); this indicator is calculated as the ratio of nights spent at tourist accommodation establishments relative to the total permanent resident population of the area. It is possible to observe the statistical trend in the Figure 67. Following continuous growth from 2009 until 2019, tourism in Puglia, as in Italy, was among the most affected sectors by the Covid-19 pandemic in 2020.

Figure 67. "Tourism intensity index" (SDG 12.b) – statistical trend.



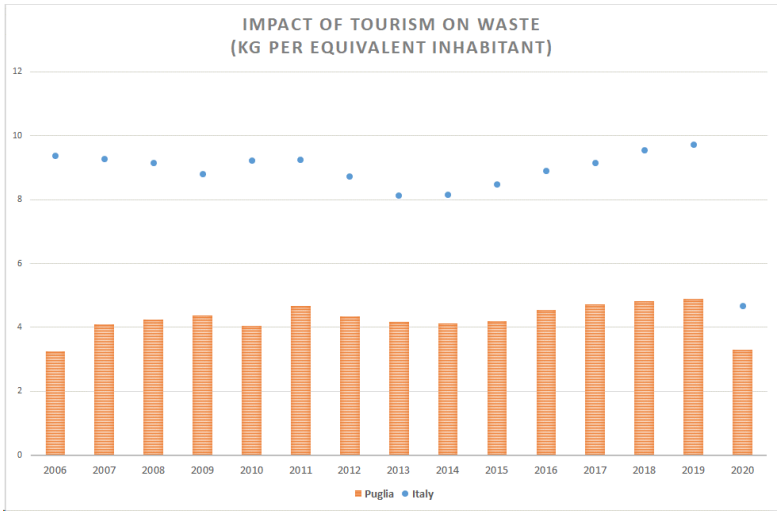
Source: Istat

— "Impact of tourism on waste" (source: Istat). This indicator shows the contribution of the tourism sector to municipal waste generation and the extent to which waste generation per capita is affected by tourist movements. The indicator is obtained from the difference between the per capita production of municipal waste calculated on the basis of the resident population and the per capita production of municipal waste calculated on the basis of the "population equivalent". The latter is obtained by adding to the resident population the presence of tourists recorded during the year and spread over 365 days.

Tourism is crucial to economic growth and has major environmental and social impacts. The socio-economic impact of tourism is extraordinary in cities, but it brings at the same time a range of negative externalities, including high levels of unsustainable resource consumption and waste production. In comparison with other territories, tourist cities have to face additional challenges related to waste prevention and management due to their geographical and climatic conditions, the seasonality of tourism flow and the specificity of tourism industry and of tourists as waste producers.

It is possible to observe the statistical trend in the Figure 68.

Figure 68. "Impact of tourism on waste" (SDG 12.b) – statistical trend.



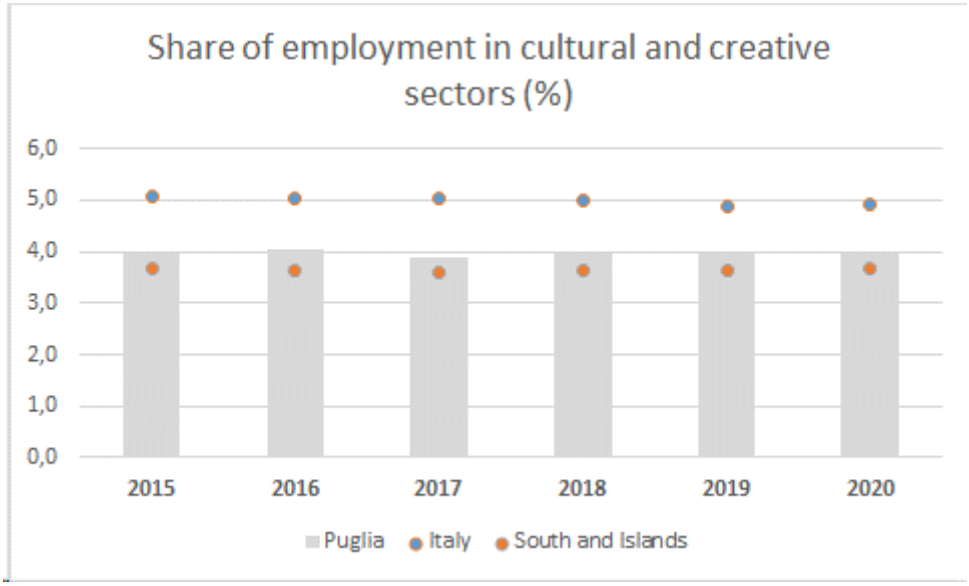
Source: ISPRA

The importance and potential of cultural and creative sectors as drivers of the crisis recovery is revealed from a great number of studies (OECD 2022). Cultural and creative sectors create jobs and economic activity. They generate tax revenues and enterprise turnover. According to OECD analysis, around 7% of firms in the business economy were from cultural and creative sectors. In 2020, cultural and creative employment accounted for up to one in twenty jobs in some OECD and EU countries and up to one in ten jobs in some cities and capital regions. They are highly skilled jobs. According to OECD analysis, 62% of cultural and creative employees hold a tertiary degree compared to 40% of the workforce generally. These jobs are "future proof" (10% at high risk of automation vs 14% in general workforce). On average about 40% of creative professionals work in other sectors (e.g. designers working in car manufacturing) driving innovation and creativity across the economy. In addition to being good business, culture makes our societies happier, healthier and inclusive.

In Italy it is possible to monitor this sector through official data coming from Istat.

- "*Share of employment in cultural and creative sectors*"; It is possible to observe the Puglia region statistical trend in the Figure 69. It is interesting to note, that it is lower than the national average, but higher than the other Mezzogiorno regions.

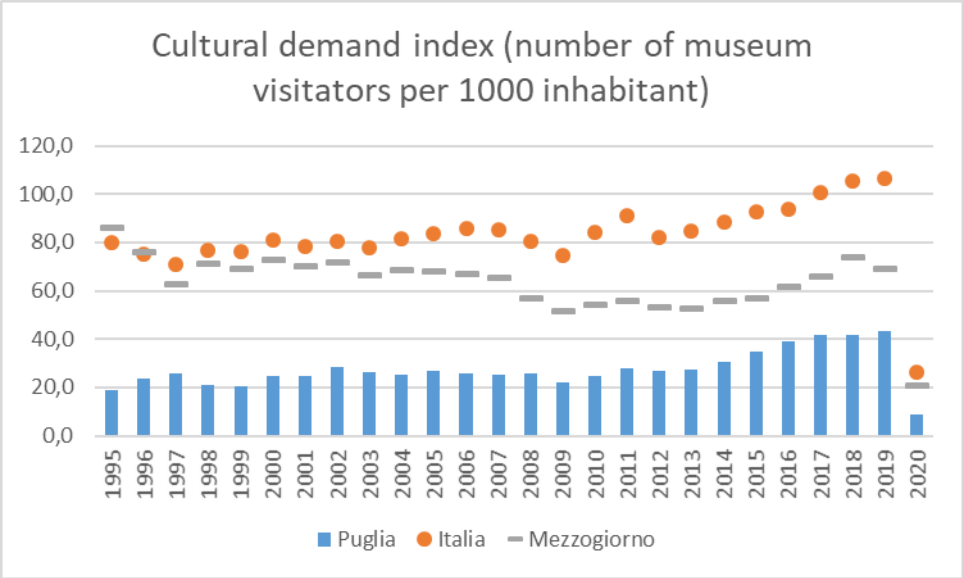
Figure 69. "Share of employment in cultural and creative sectors" (SDG 12.b) – statistical trend.



Source: Istat

— Number of persons living in local administrative unit without cultural events (Istat elaboration on SIAE data); "Cultural demand index" (Istat elaborations on Cultural Ministry data (MiC)). The statistical trend can be seen in Figure 70. It is interesting to note that the national average is higher than the data for the Puglia region, as for the other regions of the Mezzogiorno.

Figure 70. "Cultural demand index" (SDG 12.b) – statistical trend.



Source: Istat

Box 1 Puglia: Regional Sustainable Development Strategy (SRSvS)

by Annamaria Fiore, ARTI

In conformity with the Italian national provision (Legislative Decree 152/2006; art. 34), the Puglia Region has started its own process of building a Regional Sustainable Development Strategy (SRSvS) in April 2019.

The project of structuring the Puglia's SRSvS benefits continuously from support and technical debates developed within initiatives promoted by the Italian central government and, specifically, by the Environment Ministerial Department, also thanks to two collaboration agreements signed in 2018 and 2019.

Currently, the definition of the system of Regional Sustainable Development Goals (RSDGs) of Puglia moves within the framework defined by the Regional Government Program, adopted on November 26, 2020, with which the Regional Council outlined the strategies and policies to be implemented over the legislature, to be able to combine competitiveness, attractiveness and solidarity as expressed by the 2030 Agenda and the Italian National Strategy for Sustainable Development.

The list of the Regional Sustainable Development Goals was then defined in a preliminary guidance document approved in April 2021. Initially, the RSDGs have been divided into 10 policy areas, variously related to the 17 SDGs. Each policy area is then broken down into several regional sustainability choices and regional sustainability targets. These are then associated with context indicators. In its first release, this indicators-based monitoring plan already included up to 12 of the indicators proposed by REGIONS2030 project.

During the months dedicated to the REGIONS2030 project, efforts have been done in Puglia to associate all the proposed indicators (except two, for different reasons) with at least one regional sustainability choice.

What the SRSvS effectively is

The SRSvS represents a strategic tool:

- to identify shared objectives

- to orient regional policies

in coherence and in implementation with the National Sustainable Development Strategy (SNSvS) territorialising the UN 2030 Agenda:

Figure 71. Regional Sustainable Development Strategy (SRSvS)

Source: Puglia Region

Therefore, the Regional Sustainable Development Strategy is the framework for regional planning considering policy coherence and a tool for assessing the contribution of regional policies to the achievement of regional, national and 2030 Agenda sustainability goals. It is conceived as a long-term vision document that projects the Apulian government towards achieving the horizons of the UN 2030 Agenda.

As already noted, the preliminary guidance document for the Regional Strategy for Sustainable Development was approved by the Regional Government on April 26, 2021 (DGR n. 687) as a guideline for the definition of the SRSvS that incorporated a context analysis including:

- the 2030 Agenda SDGs

- the SNSvS Goals

- the Development Goals of the Apulia 2030 Government Programme

- the Apulia Region Gender Agenda Goals

- the Policy Goals of the EU 21-27 regional programme

Afterwards, a coherence analysis (internal and external) has been made by the Regional Environmental Department also considering the current regional sectoral programming documents and the related strategic objectives.

Whereas the internal coherence analysis considered all regional policies connected to the three sustainable dimensions (social, economic, environmental), the external one took into consideration:

- the 17 2030 Agenda SDGs

- the 55 context indicators selected in the SNSvS.

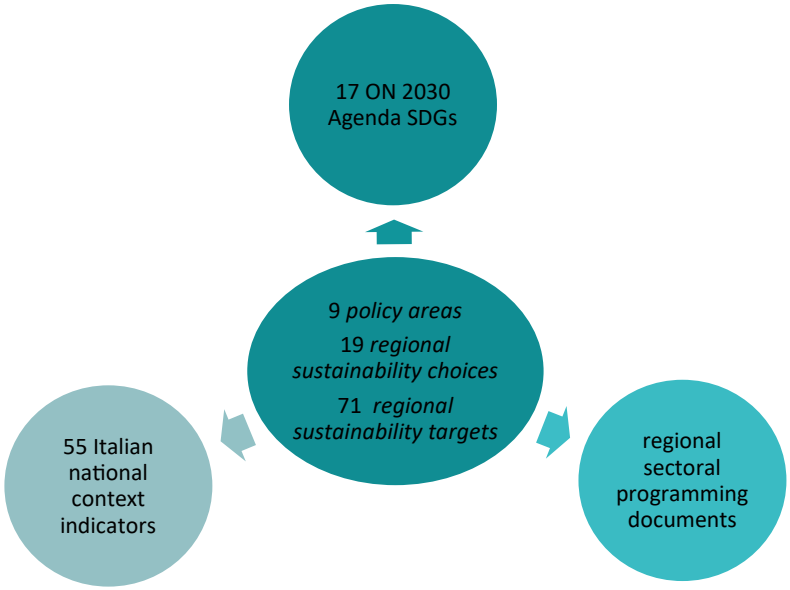
The 55 national context indicators are of particular relevance, since:

- they are necessary for purposes of integrated monitoring and annual reporting for the SNSvS

- all Italian regions have to collect them, unless territorial specificity and flexibility.

This process can be summarized as follows:

Figure 72. The coherence process for the SRSvS



Source: Puglia Region

The participatory process and the monitoring plan

The last part of the process for the building a Regional Sustainable Development Strategy is the fine-tuning of the monitoring plan with the exact definition of the list of the indicators identified following a process of continuous refinement.

A particular attention is devoted to the participatory process, with a high involvement and engagement of all Regional Department responsible for regional sectoral programmes: the strong conviction is in fact that in order to achieve a SRSvS truly capable of triggering transformative actions, it is necessary for the Apulia Region to build a shared strategic path that sees the active participation of all internal organisational structures.

Activities to date have included:

- verification of the correct assignment to each regional structure through the circulation of the objectives matrix (March 2023)

- identification of a contact person for each Department/Section who can liaise with the structure in charge of defining the Regional Sustainable Development Strategy for the subsequent connection activities (March 2023)

- first selection of the set of indicators to be associated with the Regional Sustainable Development Targets (March/April 2023)

- calendar of bilateral meetings, scheduled by Regional Environment Department, with all Section Directors aimed at sharing and validating the regional sustainability choices and targets and the proposal of indicators (May 2023)

Following the outcome of the scheduled bilateral meetings with all structures, a shared matrix of regional sustainability choices and targets and monitoring indicators will be defined for approval by the SRSvS Regional Council Resolution (July 2023).

This process is also being enriched by the activities carried out by the Apulia Region as a pilot region of the REGIONS2030 project, through:

- the consistency check of the 83 proposed indicators in the regional sustainability choices

- numerous meetings between the experts involved and the competence exchange

The final outcomes of the process will be shared during the final regional event scheduled in October 2023 aimed at a reflection on the SRSvS monitoring system functional to the integrated monitoring of SNSvS.

8. CHALLENGES

In the last two decades, there has been a growing amount of territorial statistical information in Italy. It has been generated on the one hand by the ever-increasing information and monitoring needs of the cohesion policies of the last three programming cycles, on which a large part of the Italian territory relies heavily (e.g. the database of indicators for development policies, with its more than 330 indicators, is a demonstration of this). But also, by the existence of structured regional administrative organisations with growing autonomy and competences in various fields (environment, health and education) and therefore also in need of statistical tools to be able to assess, monitor and act.

Italy's economic dualism, characterized by geographic areas of extreme economic backwardness (the regions of Southern Italy) and extremely advanced areas (Northern Italy), has favored the historical development of this territorial statistical information. This dualism has made the study and analysis of territorial disparities relevant and thus the availability of statistical data and indicators at an increasingly detailed geographical level. Moreover, its evolution over time from North-South dualism into other types of core-periphery dualism (e.g. between cities and inland areas or between large and small cities) means that the statistical information base, however broad, is still not sufficient to answer all questions and must therefore always be expanded and updated.

Data collection has therefore been facilitated by the existence of this broad and freely accessible statistical information base. This process will soon become even easier: by October 2023, Istat will publish the Statistical Atlas of Territories, in which all the territorial information currently scattered in different territorial databases (Database of Development Policy Indicators; Statistical Atlas of Municipalities; Statistical Atlas of Infrastructures; BES Territories, SDGs Territories, as well as the related Istat data warehouse) will be integrated in the same information system.

The wide availability of spatial data facilitates information gathering and policy monitoring. However, it can also pose a risk in terms of dispersal and inaccurate cataloguing and monitoring of phenomena. One of the main challenges, therefore, is to correctly identify and define the phenomenon of interest on which one would like to study and monitor the SDGs.

Some goals are monitored through indicators that are not clearly and correctly described or may be ambiguous. In fact, if the phenomenon is not clearly defined and well observable, there may be a tendency to include and monitor various additional indicators in order to get a more complete picture of the information. This could lead to a proliferation of indicators and related data. This could be confusing and dispersed, both for end-users and for monitoring.

A few indicators that are detailed and precise can certainly be easier to monitor than a large and numerous number of indicators and, above all, more consistent to read in terms of the results. This means finding the right number of indicators, as well as developing and disseminating an appropriate statistical culture among policymakers, citizens and public authorities.

Just as important is to understand how the phenomenon, and therefore the indicator, can be observed. It may be more useful to take a long-term view or a shorter-term view. To find a unique time series fitting all of the indicators. In order to ease comparisons, matching and data gathering, it could be useful to set at least common boundaries for time series, choosing which time span it is worth to explain. On the other hand, setting a common survey frequency for all the indicators (fitting the nature of underpinning phenomenon) across all of the surveyed EU-regions is probably not feasible, nonetheless, it should be set as an optimum to work for in the mid and long term.

However, the correct assessment of the direction taken is also a challenging objective. Increasing the value of an indicator by a certain percentage may be easy for some types of indicators, but much more complicated for others, especially more structural ones. Finding a methodology that is able to evaluate indicators while taking into account the specificities of the indicator, but that is also as objective and extensible as possible, is therefore a possible further challenge. Alternatively, it might be necessary to reverse the argument, first choosing how to observe the improvement or deterioration of a phenomenon and then choosing, among the possible indicators, those that can ensure such an objective.

It is also important to assess the performance of the indicator in relation to a correct benchmark: it is preferable to compare it with the national figure or with other regions in the same category of development. Again, a flexible approach should be adopted, taking both aspects into consideration.

It is not easy to understand the reasons behind the statistical trends, so it is important to go deeper into the information to be able to interpret it properly. It is important to move from purely quantitative information to qualitative information, which is sometimes necessary to bring together and link all the information from the various targets.

Another challenge is the different responsibilities of regional and national institutions. This makes it more difficult to monitor political decisions. It is important to be able to converge the monitoring at regional level with the national and European level. Measuring progress in achieving regional sustainable development objectives will then affect the National Strategy and, to a lesser extent, also the European Strategy. Therefore, it is important that regional strategies use as many of the national strategy monitoring indicators as possible.

To make the discussion more general, regional policies are less specific than the SDGs, so they sometimes lack more concrete indicators from official sources (for example, the absolute lack of indicators for the hydrogen strategy, part of the more general renewable energy production strategy). It is therefore important to be able to put the information needs of policy-makers and those who have to monitor the SDGs on the same table as those who produce the statistics, so that their needs converge.

Some data are not available at the requested level of territorial aggregation (eg. NUTS 2). Data providers were asked and interviewed to substantiate this stating and to understand under which conditions data at larger levels of territorial aggregation can be considered effective, reliable and useful. These activities were often time consuming.

When no data was available, the search for alternative indicators required time and through study and investigation, collecting qualitative information with interviews, round tables, to find field experts and field studies, to match and filter different ideas and proposals.

There is a risk that useful information will be lost or misrepresented if too short a time span is devoted to this research activity: on the choice of the most appropriate unit of measurement; on the search for official data sources with a higher frequency of surveys; on the control and traceability of breaks or notes in time series.

Finally, two last challenges appear to be both regional and globally relevant: blue economy and hydrogen economy. It is important to find indicators able to measure these phenomena, because they are cross-connected with different targets. While the hydrogen economy is currently subject of specific investments and studies; the blue economy is actually a trending research topic: the National Statistical Institute (Istat) is spending efforts to draw the boundaries of Blue economy, to identify the involved agents, and to efficiently measure performances.

9. RECOMMENDATIONS

Results collected so far about the JRC indicators set in Puglia showed that in order to develop a large set of local indicators it is necessary to support national and local official data sources investing in gathering data and statistics closer to the require territorial detail. Often, available data provide information at a large territorial aggregation than cannot be surveyed locally (eg. NUTS2) unless re-structured in new indicators. To solve this problem the surveys need to be newly scaled and projected. Another relevant step is to develop specific round tables among the local government institutions and the official data sources / providers, since that from one side data providers need to incorporate the issues coming from the local stakeholders and field experts, so to match data supply and demand; the local Government need to implement a finer network to collect data and provide administrative support and information to gather data properly. For this reason it is relevant to support the local Government in tuning its own strategies for sustainable development paying attention to match both the National and EU strategies, and to transfer strategies into concrete actions. This support requires local institutions to be more effectives and involved, taking concrete actions involving experts, data providers, policymakers, stakeholders, citizens and their organizations.

The most innovative results, in fact, stems from emerges from the collaboration with those regional governmental agencies (eg. The Regional Agency for the Innovation and Technology - ARTI and the Regional Agency for the environmental protection - ARPA) and field experts the more than others offered collaborative support up to offering hints for new indicators alternative to those from the JRC set.

Among all the local associations that were asked to participate for this report, some provided useful information and brought their experience in civic engagement. Food waste is one of the main topics that could be addressed otherwise. "*Avanzi di popolo 2.0*", an association that fights daily to reduce food waste and to ease access to food for poor people, shed a light on several issues concerning the food supply chains, inviting field experts to discussion and organizing meetings about Food Policy issues.

These experiences showed to connect policy-makers and stakeholder through button-up information flows, involving data providers and public officials from the local government, brings fruitful opportunities to tailor efficient SDG indicators.

Conversely, the search for a proxy or indicator of "*transparency*" was unsuccessful. The lack of a clear definition of this concept made it difficult to identify field experts and, moreover, which regional governmental agency to involve. All of the public regional agency are involved in a process to ensure transparency, thus making it difficult to locate a unique subject to interview. It also necessary to set what level of investigation to survey along the administrative organization: the regional government and its agencies, or lower levels of organization? For sure, this topic needs time and efforts for future investigations. A similar argument can be made for the indicator "Official Development Assistance; but, for the latter, in contrast to the former, it has not even been possible to identify a useful alternative.

Another recommendation is to consider the possibility of reclassifying indicators collected to monitor SDGs into their three main components: environmental, social and economic. This reclassification could help monitor all 17 SDGs with less dispersion.

Moreover, the pursuit of the more social goals (combating educational poverty, social inclusion, gender gaps, etc.) requires more time than the more purely economic development goals, as development programmes often have a greater economic impact on the dynamics of entrepreneurship, competitiveness, innovation and research. For this reason, it may be useful to differentiate the analysis and to monitor trends in different ways.

Pursuing each SDG with all other SDGs in mind could reduce the level of trade-offs between SDGs, e.g. the development of the productive sector should take the environment into account.

Defining a set of indicators that can be disseminated together with the underlying data is another recommendation. Free access to the data on which the indicators are based will not only increase the transparency of information, which is always desirable and recommendable, but it will help to better understand the indicators trend and their interpretation.

In conclusion, it would be desirable to create an information system that distinguishes between a core set of regional indicators that are valid and uniform for all European regions, and a set of indicators that are more characteristic and specific to individual regions and their individual regional strategies.

Some other recommendations are more specific. Some indicators, meaning their measures, definitions, units of measure, and benchmarks, need to be deepened. Difficulties in describing the performance and trends of indicators at the regional level caused to measurement unit of some indicator. For instance:

- GDP or GVA it is better to use as unit of measure the chain linked - reference year 2015 rather than the current prices above all if we are interested to study the historical trends; while if we want to compare European regions it is better the purchasing power parity (PPP);

- Gross Value Added (GVA) of agriculture, livestock and fishing, it is better to use as unit of measure the chain linked - reference year 2015 rather than the current price if we are interested to study the historical trends;

- Productivity (Gross Value Added per worker) in agriculture, forestry and fishing it is better to use as unit of measure constant prices, constant PPP, base year 2015;

- The indicator "GVA at basic prices" seems to be little useful to measure the Target defined in the JRC dataset. The SDGs target 8.2 achieves "higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors". It could be more useful use the indicator "Annual growth rate of real GDP per employed person (chain linked values)". This indicator is an official indicator, the source is the National Statistical Institute (Istat). It has a time-series from 2004 to 2020, with an annual frequency and available for all the European regions;

- Some indicators are not supported by historical series: for instance, the Gini index. An alternative exists: "Income quintile ratio". This is a widely used indicator in the economic literature, could be useful to use it;

- It might be useful to collect not only the indicator data, but also the basic data used to process them. This would provide a better understanding of the reasons for a specific indicator trend. Or at the very least, it might be useful to indicate whether or not the basic data is freely accessible and where it can be found;

- Using a rate or ratio as the unit of measurement or dividing by the population could be useful to get a clearer indication about indicators trend;

- Difficulties in describing the performance and trends of indicators at the regional level without a benchmarking analysis allowing to consider and evaluate (possible) gaps between Puglia Region's results and the national average or other similar Italian less developed Italian regions. A comparison with the results of the other 9 pilot regions of the "Regions2030 project" will be useful for future in-depth analysis;

- The are several breaks in the data. It may be important to report them in some way and take them into account when analysing the data (for example for all data using Labour Force Survey).

10. CONCLUSIONS

The initial set of 83 indicators has been tested in the Puglia Region, and verified that for 65 indicators there is a good data quality, availability and accuracy. Of these 65 indicators, 39 are perfectly in line with those provided by the Joint Research Centre, while the remaining 26, although perfectly suitable for measuring the SDGs at regional level, must be replaced by proxies or other indicators that are very similar but come from a different data source. On the base of these 65 indicators, it has been possible to carry out an analysis of both short-term and long-term trends, which reveals many positive aspects, but also some negative ones, for the Puglia region, particularly with regard to objectives 4, 5 and 8.

Others 17 indicators have been included to substitute the indicators for which there are no data availability (15), or for which the phenomenon is not relevant in Puglia (2). In order to provide information as close as possible to the original objective, these indicators have been researched and proposed with the primary aim of covering the same target. Meetings with regional experts and the set of indicators identified in the national strategy for sustainable development, as well as the extensive territorial information base available in the following databases (indicators for development policies and for the SDG), helped in this study. In fact, all the indicators, and especially the national context indicators, ensure that there are measures of clear interest to the regions (since the regional strategies must include these national context indicators) and that they guarantee reliable and up-to-date official data. These can certainly be extended to all Italian regions and, as they are often regulated by the EU, can easily be extended to all European regions. Where the use of official data was not possible with the help of technical tables and the collaboration of specialists, experimental indicators were proposed: food waste and the net entry rate in the job market of disabled people.

In addition, the development of a VLR by the Puglia region and the process of selection and monitoring of regional policy choices in the different areas of sustainable development through a wide range of indicators has favoured the identification of some issues which are very close to regional objectives but which do not deserve sufficient attention within the set of indicators proposed by the JRC.

In order to remedy this shortcoming and to integrate the initial dataset with regional specificities, 13 new indicators have been proposed, through which it is possible to monitor some relevant policies within regional sustainable development strategies: digital divide, culture, sustainability of tourism, gender agenda, strengthening services for vulnerable people, blue economy. In the next future (October 2023), the availability of new data at regional or sub-regional level provided by the Permanent Business Census (Istat) could further expand and populate the set of regional indicators, particularly regarding eco-innovations and environmental sustainability practices.

In conclusion, the set of data collected, albeit with its specificities that must be duly taken into account, makes it possible to monitor the sustainable development path of the Puglia Region in a partial but sufficiently adequate way. However, it is necessary to further integrate regional objectives with European ones and to better support the link between data producers and regions so that territorial statistics can better meet growing information needs coming from Regions.

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LIST OF ABBREVIATIONS AND DEFINITIONS

ARTI	Regional Agency for the Innovation and Technology
SDGs	Sustainable Development Goals
VLR	Voluntary Local Review (VLR)
ISTAT	National Statistical Institute
ISPRA	Italian Institute for Environmental Protection and Research
JRC	Joint Research Centre (JRC)
CAGR	Compound Annual Growth Rate
EU	European Union
SRSvS	Regional Sustainable Development Strategy
SNSvS	National Sustainable Development Strategy
NRRP	National Recovery and Resilience Plan

LIST OF BOXES

LIST OF FIGURES

LIST OF TABLES

ANNEXES

Table 9. Indicators by fit for purpose or not and replacement or alternative

SDG	Indicator Name	SDG Target(s)	Fit for purpose	Non-fit for purpose	Fit - No data	1 to 1 replacement with	Alternative indicator	New indicators	Extra information
1	Persons living in households with very low work intensity	1.2 (reduce poverty)	X						
1	Affected people due to disasters	1.5 (exposure to vulnerability)			X		Population exposed to water floods		
1	Material and social deprivation	1.1 (extreme poverty)			X		Severe Material deprivation rate		
1	Persons at risk of poverty or social exclusion	1.2 (reduce poverty)	X						
2	Gross Value Added of agriculture, livestock and fishing	2.3 (agricultural productivity)			X	X			
2	Organic farming: areas with different crops	2.4 (sustainable food production)			X	X			
2	Productivity (Gross Value Added per worker) in agriculture, forestry and fishing	2.3 (agricultural productivity)			X	X			
2	Overweight rate	2.2 (end malnutrition)	X						
3	Deaths due to Covid-19	3.3 (epidemics and diseases)			X	X			
3	Self reported unmet needs for medical examination	3.c (health financing and recruitment)			X		Unmet needs for medical examination		
3	Health personnel	3.c (health financing	X						

		and recruitment)							
3	Hospital beds	3.8 (universal health coverage)	X						
3	Infant mortality	3.2 (preventable death of newborns)	X						
4	Women 30-34 years old with higher education level	4.5 (gender and other disparities in education), 4.6 (youth and adult literacy)			X	X			
4	Students enrolled in tertiary education	4.3 (vocational and tertiary education)	X						
4	Participation in education	4.3 (vocational and tertiary education)	X						
4	Pupils enrolled in early childhood education	4.2 (access to early childhood education)	X						
4	Early leavers from education and training	4.6 (youth and adult literacy)	X						
4	Participation rates in selected education levels	4.1 (primary and secondary education)	X						
4	Distribution of pupils and students enrolled in general and vocational programmes	4.3 (vocational and tertiary education)	X						
5	Fatal victims of gender-based violence at the hands of their partners or expartners	5.2 (gender violence)			X	X			

5	Victims of violence against women	5.2 (gender violence)			X	X			
5	Female research and development personnel	5.5 (women participation and leadership)	X						
5	Inactive population rate due to caregiving responsibilities	5.4 (unpaid work)			X		Ratio of employment rate for women aged 25-49 with at least one child aged 0-5 to the employment rate of women 25-49 years without children		
5	Women in parliament and government	5.5 (women participation and leadership)			X	X			
5	Female achievement/disadvantage index	5.1 (gender discrimination)	X						
5	Gender gap in part-time employment incidence	5.4 (unpaid work)	X						
6	Water bodies that exceed a standardized quality rating	6.3 (water quality)			X	X			
6	Groundwater that exceed a standardized quality rating	6.3 (water quality)			X	X			
6	Population served by safely managed drinking water supply services	6.3 (water quality)			X		Percentage of households who report irregularities in water supply		
6	Population connected to wastewater with at least secondary treatment	6.3 (water quality)			X		Urban water treatment plants in operation by type of secondary/a		

							dvanced treatment		
7	Electricity production that comes from nuclear power	7.1 (access to energy)		X			Consumption of electricity from renewable resources in for transports (share of the final gross energy consumption)		
7	Electricity production that comes from renewable sources	7.2 (share of renewable energy)			X	X			
7	Energy intensity	7.3 (energy efficiency)			X	X			
7	People affected by energy poverty	7.2 (share of renewable energy)			X		Consumers' satisfaction about the Electricity providers' services		
8	Occupational accidents	8.8 (labour rights)			X	X			
8	Economic activity	8.5 (productive employment)	X						
8	Unemployment	8.5 (productive employment)	X						
8	Firm creation	8.3 (job creation)			X	X			
8	Employment	8.5 (productive employment)	X						
8	GDP at current market prices	8.1 (economic growth)	X						
8	GVA at basic prices	8.2 (economic productivity)	X						

8	Long-term unemployment (12 months and more)	8.5 (productive employment)	X						
8	Compensation of employees	8.5 (productive employment)	X						
8	Young people neither in employment nor in education and training	8.6 (youth not in employment, education or training)	X						
9	GVA of the industry with respect to the GVA of the total sectors (current price)	9.2 (sustainable industrialization)			X	X			
9	Gross Domestic Expenditure on R&D	9.5 (promote innovation)	X						
9	R&D personnel and researchers	9.5 (promote innovation)	X						
9	Employment in high-technology manufacturing as a % of total manufacturing employment	9.5 (promote innovation)			X	X			
9	Patent applications to the EPO	9.5 (promote innovation)	X						
10	Unemployment of people with disabilities	10.2 (inclusion irrespective of status)			X		Net Entry rate in the job market of people with disabilities		
10	Gini index of disposable income (after taxes and transfers)	10.4 (greater equality)	X						
11	Households expenses dedicated to housing costs	11.1 (access to housing)	X						
11	Transport performance	11.2 (access to			X		Seats/ km offered by		

		transport systems)					the local public transport service		
11	Daily accessibility	11.2 (access to transport systems)	X						
11	Stock of vehicles (passenger cars)	11.2 (access to transport systems)	X						
11	Difference between built-up area growth rate and population growth rate	11.3 (sustainable urbanization)			X		Marginal land consumption		
11	Land use	11.3 (sustainable urbanization)			X	X			
11	PM2.5 Emissions	11.6 (environmental impact)			X	X			
11	Household and commercial waste generation per inhabitant	11.6 (environmental impact)			X	X			
11	Victims in road accidents	11.2 (access to transport systems)	X						
12	Carbon footprint	12.2			X		Domestic material consumption		
12	Food waste	12.3 (reduce food waste)			X		Regional Food Waste		
12	Hazardous Waste	12.4 (chemical management)			X	X			
13	PM10 Emissions	13.2 (climate change measures into policy)	X						
13	CO2 Emissions	13.2 (climate change measures into policy)	X						

13	Greenhouse Gas Emissions	13.2 (climate change measures into policy)			X	X			
13	Cooling and heating degree days	13.2 (climate change measures into policy)	X						
14	Estuarine with high/very high water quality	14.1 (reduce marine pollution)		X			Beached marine waste		
14	Protected coastal area as a percentage of total coastal area	14.5 (coastal and marine areas)			X		Protected Marine Areas		
14	Coastal areas with good/very good water quality	14.5 (coastal and marine areas)			X		Coastal bathing waters		
15	Terrestrial protected areas as a percentage of total area	15.5 (degradation of habitats)			X	X			
15	Estimated soil erosion	15.5 (degradation of habitats)	X						
15	Land Abandonment	15.1 (restoration of ecosystems)			X	X			
15	Forest area over total surface area	15.1 (restoration of ecosystems)			X	X			
16	Transparency index	16.6 (effective institutions)			X		Composite index of service accessibility		
16	Participation in the last elections	16.6 (effective institutions)			X	X			
16	Quality of Government Index	16.6 (effective institutions)	X						

16	Extract from QGI an indicator on corruption	16.5 (reduce corruption)	X						
17	Official Development Assistance	17.2 (development assistance commitments)			X				No data/no alternative
17	Imports from developing countries	17.12 (imports from least developed countries)			X	X			
17	PCT co-patent applications that are done with foreign regions	17.6 (regional and international cooperation)	X						
17	Individuals who used the internet for interaction with public authorities	17.8 (enabling technology)	X						
4	Percentage of seats authorized in socio-educational services for early childhood on children aged 0-2	4.4						X	
4	Individual who have basic or above basic overall digital skills	4.2						X	
6	Urban water supply network efficiency	6.4.1 - Change in water-use efficiency over time						X	
8	Share of person not in regular occupation	8.3						X	
9	Share of manufacturing value added of small-scale manufacturing enterprises on the total	9.3						X	

	manufacturing v.a.								
12	Tourism intensity index	12.b tourism sustainability						X	
12	Impact of tourism on waste	12.b tourism sustainability						X	
12	Cultural demand index	12.b tourism sustainability						X	
12	Share of employment in cultural and creative sectors	12.b tourism sustainability						X	
13	Concern for climate change	13.3						X	
15	Fragmentation of natural and agricultural land	15.3						X	
16	Perception of safety walking alone in the dark	16.1						X	
17	Foreign workers' remittances	17.3						X	
11	Frequent users of the public transport service	11.2 (access to transport systems)							X (useful to build Trasport index)
11	Households declaring difficulties of connection with public transport means (	11.2 (access to transport systems)							X (useful to build trasport index)
10	Income quintile ratio (S80/S20)	10.4 (greater equality)							X (useful to replace eventually Gini index)

(2) And this is another table note.

Source: Own elaborations.

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