

Cohesion Policies in Italian Metropolitan Cities. Evaluation and Challenges

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Abstract. The 2014–2020 European programming is coming to an end with numerous critical issues that will have to be resolved by 2023, both with reference to spending power and with reference to performance evaluation. The European institutions are currently in the process of drafting the new Cohesion Policy 2021–2027, which will respond to the difficulties encountered in the previous programming through three key rules: simplicity, flexibility, efficiency and transparent administrative processes. The ambition of the new programming is to make the countries of the European Union smart, sustainable and increasingly inclusive economies. Three priorities that mutually reinforce each other to help achieve high levels of employment, productivity and social cohesion in the Member States. In this context, the present study intends to evaluate the "smart specialization" (S3 strategy) deriving from the 11 thematic objectives (or sectors of intervention), in particular that of the "environment", in the 2007–2013 and 2014–2020 periods, through the Local Indicators of Spatial Association (LISA), thus identifying areas of intelligent specialization.

Keywords: Cohesion policies · Metropolitan cities · Smart specialization · Environment

1 Introduction

The profound economic and social transformations in Italy make the spatial governance increasingly complex [1, 2]. The new challenges imposed by the globalized market, new technologies, demographic flows and balances, climate change, etc. require integrated and negotiated planning strategies between public and private actors, as well as connected with ongoing technological innovation processes [3]. The future of planning, in fact, requires developing relationships between realistic and sustainable public - private

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actors [4]. In Italy, the multiple interpretations and articulations of its internal space have been many and have been mainly referred to the principles of economic geography [5, 6]. In fact, as early as the 1960s and 1970s, efforts were being made to find the 'optimal size of the territory', and not the 'efficient size', which is closely related to the functional urban characteristics and spatial organization [7]. The search for the urban and territorial dimension, although it is an ancient phenomenon, has been in the last 50 years in Italy that there have been the main changes to the structures, the result of demographic, economic and environmental changes. In particular, the Urban Planning and Environmental Planning Plans have always acted through the concept of "limit" beyond which, following any possible variation, the "advantage" decreases or the "risk" of the agglomeration increases. Also, to overcome this old concept of 'limit' with the reform of the Italian intermediate bodies through Law 56/2014 (Delrio law), a new intermediate level of Governance of a large area compared to the Region has been introduced [8]. The aim is to "focus on the development of the metropolitan area; promotion and integrated management of services, infrastructures and communication networks of interest to the metropolitan city: institutional relations relating to its level, including those with European cities and metropolitan areas." (L. 56/2014, art. 2). Among the functions of the metropolitan city there is the adoption and annual update of the three-year Strategic Plan of the metropolitan area, which addresses the exercise of the functions of the Municipalities (L. 56/2014, art. 44). The participation flexibility approach typical of Strategic Planning with respect to traditional urban planning (based on the limit), is in fact better able to favor the construction of a vision of development through the enhancement and systematization of the contribution of the multiple actors, both public and private individuals, thus providing effective coordination of all actions towards common and shared objectives [9].

It is no coincidence that Strategic Planning (SP) constitutes one of the most important innovations in urban and territorial governance that emerged in the last twenty years [10].

However, this importance is the result of an international evolutionary process, which we can group into three main phases (Fig. 1):

1. **First generation**. The SP were related to urban infrastructure and macro-uses. Born from the English but also French experience of the 1960s and 1970s, to identify large strategic infrastructures and relevant macro-decisions on land use. The fundamental areas of the SP referred to the identification of urbanizing territories, the areas of agricultural and landscape protection, in the context of defining the network of large transport infrastructures and the localization of metropolitan functions;
2. **Second generation**. The SP of mixed type of a corporate nature. Born in some cities of North America and later in Europe in the 1980s, they were characterized by the application to territorial planning of methods, languages and analogies drawn from the planning of large corporations. They presented a relevant context analysis and a long-term vision and the role of leadership. These SPs established themselves in a context of profound change in urban dynamics on the occasion of the information technology paradigm, the growing economic globalization and competition between cities;

3. **Third generation**. The SP as a shared vision through networks of synergies, complementarity and active citizenship. Born around the 90s with the aim of the sustainable city in relation to its physical growth, the main economic changes and its metabolism.
4. **Fourth generation.** The SP as a search for the balance of competitiveness objectives with those of environmental quality and social cohesion, in response to socio-economic and environmental changes. Born in the 2000s, in the transition from smart city to smart region understood as a cluster of municipalities united by a long-term development and innovation perspective.

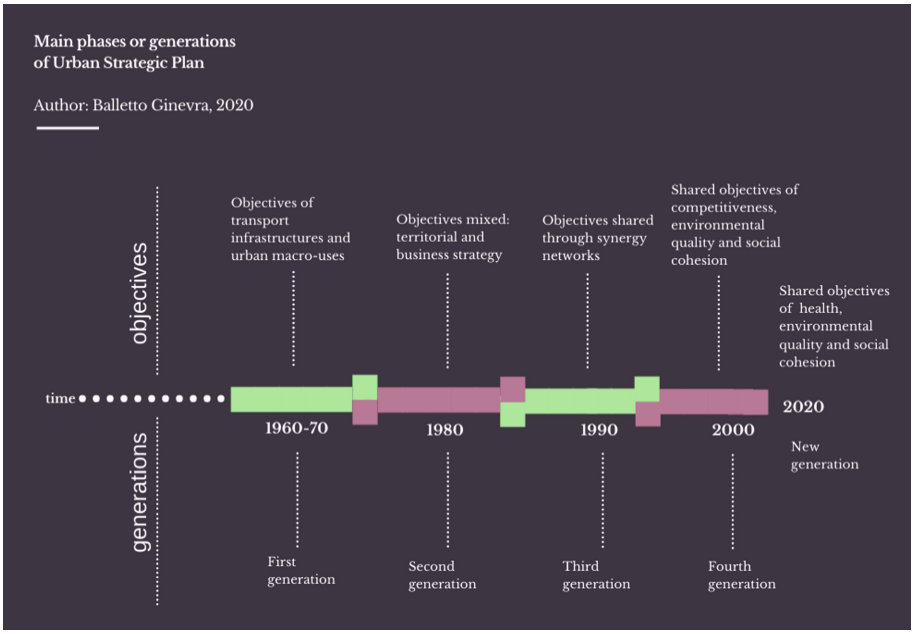

Fig. 1. Main phases or generation of Urban Strategic Plan (Author: G. Balletto, 2020)

In addition, the recent international health emergency has highlighted the need to re-evaluate and remodel the strategic objectives to guarantee primarily the health and well-being of the communities [11]. In response to these challenges, in recent years various 'recipes' have been indicated by urban development experts who have found syntheses in definitions such as: green cities, livable cities, digital cities, intelligent cities, knowledge cities. Furthermore, according to the results of the Triennale di Milano - UrbanPromo 2016 [12], it can be summarized how all these definitions are substantially attributable to three main groups: sustainable cities, resilient cities and smart cities. These three ideas of cities with three distinct conceptual approaches, which although strongly interrelated and complementary in their ability to respond to major global challenges, have only recently started to be considered jointly [33]. Furthermore, the recent health emergency has highlighted the need to approach according to an

ecological paradigm referred to overlapping-integration, understood as the necessary complementarity between cities: sustainable, resilient and smart [13].

In this framework, the contribution aims to evaluate the spatial autocorrelation with the LISA method in reference to the two programming cycles of the European Structural Funds, with particular reference to the 'Environment' sector. It is in fact the 'Environment' sector with all its applications, which guarantees the pre-health conditions of its communities both in ordinary and extraordinary conditions [14]. In addition, the choice of the LISA method referring to Italian provinces and metropolitan cities allows to evaluate the autocorrelation of cohesion policies. However, it should be remembered that through an institutional act some old 'provinces' have been transformed into 'metropolitan cities'. More a semantic variation than a reorganization of the urban system through a real geographical and planning evaluation [15]. In this Italian geographical and administrative context, the article is developed in the following paragraphs.

- Paragraph 1 - Introduction is dedicated to the framing of the research topic;
- Paragraph 2 - Materials - explores the challenges of the Metropolitan Strategic Plan to govern the development of contemporary urban systems;
- Paragraph 3 - Method - describes in detail the LISA method adopted to develop this research;
- Paragraph 4 - Results - highlights the main results obtained from the study;
- Paragraph 5 - Final remarks - is dedicated to the final considerations.

2 Materials

In the face of the multitude of changes that have taken place over the past 30 years, both natural and anthropic, the strategic plan therefore seems to respond effectively to the new economic and social demand that was no longer answered in classic planning.

The Strategic Plan is in fact oriented towards integrating socio-economic actions rather than regulating land use. Furthermore, the recent administrative structure of the Italian metropolitan cities together with the idea of complementarity of the sustainable city, resilient city and Smart city [33], require a renewed systematic approach, where objectives and actions are no longer the sum of the individual components, but the deep integration of them. In this sense, strategic planning captures the speed of transformations and the complexities of urban development. The reticular strategic plan approach of sharing and co planning policies, based on relational networks, participation and negotiation, allows to interpret the contemporary complexity [16].

The SP is not prescriptive-binding but voluntary referred to smart governance. In fact, the network underlying strategic planning is something different and qualitatively superior to the individual actions of the urban plan, instead attributable to zoning with geometric forms referring to land use. In this sense, strategic planning processes have received increasing attention from Italian metropolitan cities in recent years, as a suitable method for developing new forms of urban and territorial governance [17]. The status of the strategic planning situation referred to the 14 Italian metropolitan cities is shown below. The Fig. 2 highlights how the Strategic Planning was concluded in

Northern Italy and how the Center - South is still lacking. However, all cities have initiated the Strategic Plan procedure represented in Fig. 3 where their respective missions and visions are represented.



Fig. 2. Italy, metropolitan city and approved or ongoing strategic plans (2020). Author: A Milesi (2020)

Within this scenario, cohesion policies were investigated, with particular reference to those relating to the environment, which include interventions on the distribution, waste treatment and management. Risk prevention interventions, which include the construction of defense works for inhabited centers, production sites and infrastructures, as well as the prevention of coastal erosion and hydrogeological instability, interventions to combat climate change, the promotion of biodiversity and nature protection (including the European Natura 2000 network). The environment also constitutes the transversal and prevalent sector on which all the other intervention sectors are grafted. In fact, planners and geographers converge on the need for an ecological approach to ensure a more balanced urban development, in response to the right to the city within the framework of the 2030 Agenda objectives (Fig. 4).

MC	Mission	Vision
Bari	- Promoting participatory and federated development models in an innovative and "smart" way that join the different Municipalities of the metropolitan area and stimulate the energies of young people, creativity and entrepreneurship.	- "European-level "smart area" with a specialization in the ICT, energy efficiency and sustainable mobility sectors. - Pole of excellence in agro-food, mechatronics and in the chemical-pharmaceutical sector, strongly attractive for productive investments. - Tourist center of national importance, which enhances the landscape, the typical local features and the recognisability of the Puglia brand.
Bologna	- Being a logistic, productive and research hub for the Northern Italy. - Building a highly integrated network of Municipalities connected by state-of-the-art infrastructures - the "Greater Bologna" - which surpasses the traditional polycentric development model and has high homogeneous service standards for citizens, businesses and hospitality.	- Center of industrial and service excellence in the automation / machinery, health and agri-food sector. - Pole of attraction and growth of SMEs, internationalized and competitive, with a widespread entrepreneurial culture throughout the metropolitan area. - Reference fair center of Emilia Romagna.
Cagliari	- Being a cohesive metropolitan area open to the outside, strongly attractive to talents, businesses and life settlements, capable of being a driving force for growth for the entire Region, through a development model that focuses on the quality of life , widespread well-being and innovative high-level services for residents' needs.	- Center of the digital new economy (ICT, Internet Service Provision) and integrated ecosystem of start-ups, innovative companies and large players. - Research hub for: health technologies (biomedicine and neuroscience), digital and computer science. - Advanced center of the industry of the sea industry. - High level tourism destination that leverages on local products of excellence.
Catania	- Building a metropolitan area that grows through integration with the surrounding territories, with a aggregation and specialization model. - Being the relationship hub for the Mediterranean ("open" city), capable of enhancing the welcome and inclusiveness in terms of opportunities for economic development and social and institutional innovation.	- Widespread "Startup city", able to accelerate entrepreneurship and investments (especially in microelectronics, biomedical and agrifood). - Center of reference for sustainable construction. - Tourist attraction that integrates agri-food, cultural and landscape offerings and intercepts international cruise flows. - Laboratory for testing good practices for P.A. in Italy.
Firenze	- Being the "cradle" of luxury brands and the reference area where to live the humanistic dimension in a contemporary key through the enhancement of environmental sustainability and new technologies at the service of quality of life.	- high-quality manufacturing and craftsmanship center, based on the Fashion and chemical-pharmaceutical system. - reference destination for international tourism, through an integrated offer system in the metropolitan area for cultural and natural-landscape assets.
Genova	- Being the port of the Northern Mediterranean and the gateway to Northern Italy and southern Europe. - Promoting a growth model that combines economic development and sustainability with a widespread "area quality" and a strong sense of belonging to the Community.	- Port hub developed in all supply chains connected to it. - center of high-tech industries where to invent new products and services. - Pole for the accumulation of skills and solutions in the field of soil protection and hydrogeological risk mitigation. - tourist territory with a multi-product offer that leverages quality of life, climate and personal services.
Messina	- Being the Metropolitan City of the Strait - gateway to entrance to Sicily - integrated with Reggio Calabria according to a complementarity paradigm and with a diffuse and polycentric development model in the territory.	- International reference destination for sea-nature and art tourism, with supra-metropolitan offer (Strait area). - Industrial center with relaunch of the shipbuilding industry and expansion of the agri-food sector. - Laboratory for testing new energy technologies.
Milano	- Being a European reference center competitive, welcoming and attractive of investment and talent and a socio-economic laboratory of modern capitalism capable of driving the development of the country, acting according to a system logic with the rest of Italy.	-Hub of the knowledge economy and laboratory of experimentation of its organization in an industrial key (places, spaces, work models, etc.). - Center of excellence in the health supply chains, life sciences and the welfare system.
Napoli	- Being an integrated and multipolar networking urban area, with a unifying identity capable of enhancing the autonomy and specificity of its Municipalities.	- Industrial hub with a "brain intensive" model, high innovation rate guide chains (aerospace, biotech and automation), and traditional excellence (textiles, goldsmiths and agrifood). - Tourist destination, among the first in the world, for tourism of "mass of excellence". - Center of the sea economy
Palermo	- Being a metropolitan area made of interconnected places that promotes sustainability and balance in the development and processes of social innovation, lifestyles and land use patterns.	- Production area with a vocation on the advanced service sector and tourism. - Center for shipbuilding and ship repairs. - Administrative and political center.
Reggio Calabria	- Being the Metropolitan City of the Strait, integrated with Messina to promote co-development initiatives in the reference territories.	- Entrepreneurship and innovation laboratory, starting from the sustainable construction, agro-food and innovative industries sectors. - Logistics and transformation center. - City of tourism and art integrated into the main international circuits. - University training center, with strong attractiveness in the Mediterranean basin.
Roma Capitale	- Being a metropolitan area of global reach, the heart of Italy and national values. - Create an integrated system that promotes metropolitan citizenship and an urban development model according to principles of sustainability, polycentrism and quality of life.	
Torino	- Being the Metropolitan City of "being able to do", catalyst of talents, knowledge and strategic investments, able to reinvent itself thanks to the multiple vocations of the territory and capable of combining manufacturing tradition with technological innovation. - Being a metropolitan European area modern, dynamic, multicultural, inclusive with a participatory governance.	- Industrial and innovation hub, home to production centers of excellence (automotive, mechatronics, aerospace, biotech and smart solutions and ICT). - University city of international scope with strong collaboration between research and businesses. - National reference center for health services and technologies.
Venezia	- Enhance its specialty as a city of water, with the role of logistic, productive and cultural center of the North-East, crossroads of traffic to Northern Europe and the East, connecting in its development on these axes the other vast areas of its water catchment area. - Retrieving the ancient tradition of City-State, neutral, highly inclusive, respectful and a factor of development for its many communities, at the service of the economic recovery of the entire country.	

Fig. 3. Italy, strategic metropolitan plans: vision and mission (2020)

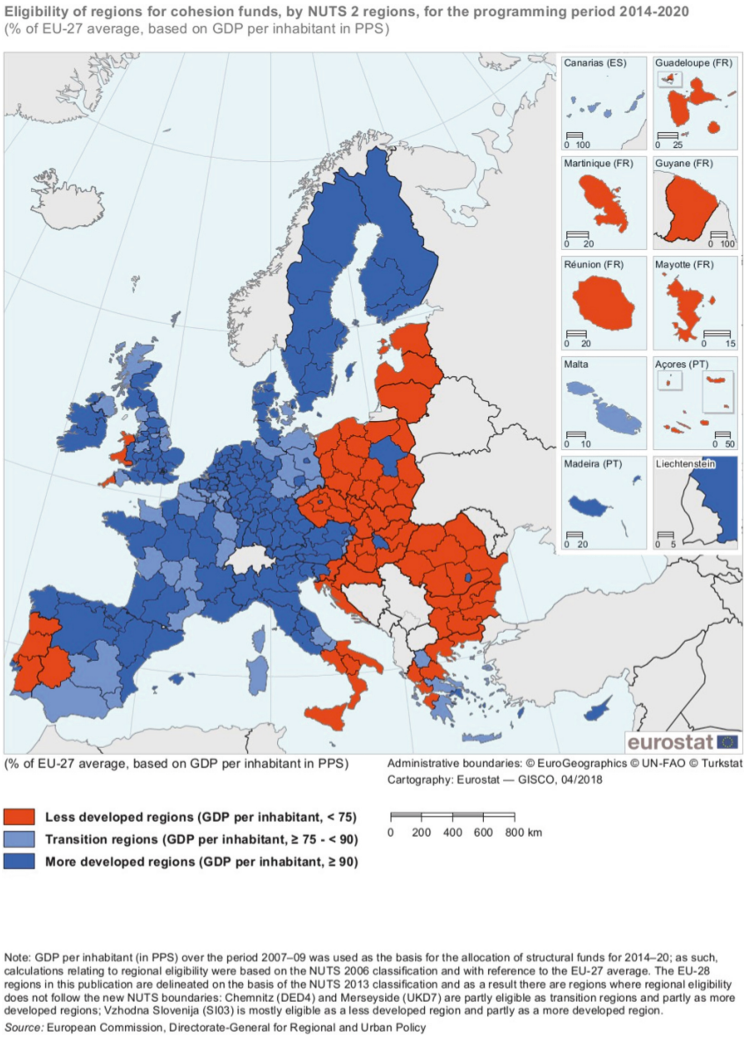

Fig. 4. Eligibility of regions for cohesion funds, by NUTS 2 regions, for programming period 2014–2020 [18].

3 Methods

Cohesion policies, referring to spatial units that are generally contiguous in geographical terms, can benefit of a vast set of spatial analytical techniques to evaluate their local and proximity effects. In such sense, evaluating the so-called spatial autocorrelation of some kind of data or indicator to a set of contiguous geographical units, can be useful for evaluating local effects and clusters in terms of attribute and geographical data. Area units in fact can mutually influence themselves in geographical terms and in terms of the data referred to such units. In geographical analytical terms, it

is the capability of analyzing locational and attribute information at the same time [19]. It is recalled by Tobler [20] as "nearby things are more related than distant things", apparently an intuitive approach [21], although only recently rediscovered [22].

In analytical terms, spatial autocorrelation can be defined as follows [23]:

$$SAC = \frac{\sum_i^N \sum_j^N c_{ij} w_{ij}}{\sum_i^N \sum_j^N w_{ij}} \tag{3}$$

Where:

1. i and j are two objects;
2. N is the number of objects;
3. c_{ij} is a degree of similarity of attributes i and j;
4. w_{ij} is a degree of similarity of location i and j;

From the general formula two indices derive as the Geary C Ratio [24] and the Moran Index I [25].

Defining x_i as the value of object i attribute; if $c_{ij} = (x_i - x_j)^2$, Geary C Ratio can be defined as follows:

$$c = \frac{(N-1)(\sum_i \sum_j w_{ij}(x_i - x_j)^2)}{2\left(\sum_i \sum_j w_{ij}\right) \sum_i (x_i - \bar{x})^2} \tag{4}$$

If $c_{ij} = (x_i - \bar{x})(x_j - \bar{x})$, Moran Index I can be defined as follows:

$$I = \frac{N \sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i \sum_j w_{ij}) \sum_i (x_i - \bar{x})^2} \tag{5}$$

As recalled and applied recently in several Italian contexts [11, 14, 26], these indices are quite similar, differing by the cross-product term in the numerator, calculated using the deviations from the mean in Moran, while directly computed in Geary.

The main message coming from the indices is highlighting the presence - or absence - of spatial autocorrelation at a global level in the overall distribution, while the local presence of autocorrelation can be highlighted by the LISA (Local Indicators of Spatial Association), or, as after Anselin [27, 28], a local Moran index, as the sum of all local indices is proportional to the value of the Moran one:

$$\sum_i I_i = \gamma * I$$

The index is calculated as follows:

$$I_i = \frac{(X_i - \bar{X})}{S_X^2} \sum_{j=1}^N (w_{ij}(X_j - \bar{X})) \tag{6}$$

The index allows assessing for each location assess the similarity of each observation with its neighbors, and five combinations can be obtained from its application:

- Hot spots: areas with high values of the phenomenon and a high level of similarity with its surroundings (high-high H-H);
- Cold spots, as areas with low values of the phenomenon and a low level of similarity with its surroundings (low-low L-L);
- Potentially spatial outliers, with high values of the phenomenon and a low level of similarity with its surroundings (high-low H-L);
- Potentially spatial outliers, with low values of the phenomenon and a high level of similarity with its surroundings (low-high L-H);
- Lack of significant autocorrelation.

The interesting characteristic of LISA is in providing an effective measure of the degree of relative spatial association between each territorial unit and its neighboring elements, thereby highlighting the type of spatial concentration and clustering. An important element to be considered in the above-mentioned equations, related The neighborhood property is analyzed by means of the parameter weight, w_{ij}, [29] whose values indicate the presence, or absence, of neighboring spatial units to a given one. A spatial weight matrix is realized, with w_{ij} assuming values of 0 in cases in which *i* and *j* are not neighbors, or 1 when *i* and *j* are neighbors. Neighborhood is computed in terms of contiguity such as, in the case of areal units, sharing a common border of non-zero length [30].

4 Results

The evaluations of the elaborations of data collected by the present research, according to a geographic and territorial planning approach that refers to the provincial/metropolitan city scale, allows authors to obtain some important results, which will also be developed in future steps. In particular, the autocorrelation of the total public cost and of the per capita total public cost of the first programming cycle (2007–13) (Fig. 5) as well as of the second cycle (2014–20) in the 'environment' sector (Fig. 6) highlights the following spatial autocorrelation:

– In the first and second programming cycle, the total public cost is found in a portion of the South (Province of Naples and then, from 2016, metropolitan city of Naples and contiguous provinces; Province of Palermo and then metropolitan city of Palermo (2016), Province of Messina and then the metropolitan city of Messina and contiguous provinces), but in the second programming cycle there is less autocorrelation than in the first;
– The total public cost and the per capita total public cost of both the first and second programming cycle is always found in the south; a high-low autocorrelation of the metropolitan city of Florence emerges in the north.

A confirm is represented in Figs. 5 and 6.

The cost of cohesion policies is autocorrelated in Southern Italy, whether because of the lower GDP of the south compared to that of the north, in line with the assessment of Fig. 4, or because of the lack of a Cohesion Fund (CF).

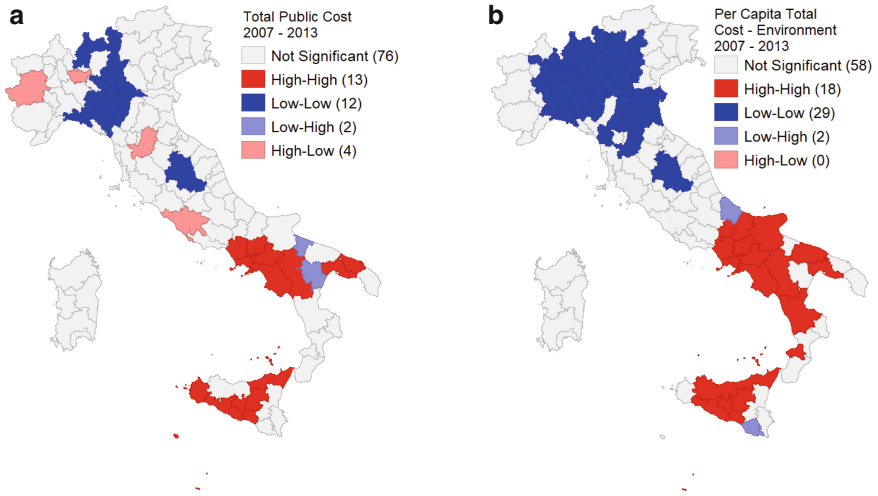

Fig. 5. Lisa Map: a) Total Public Cost 2007–2013; b) and Per capita Total Public Cost 2007–13

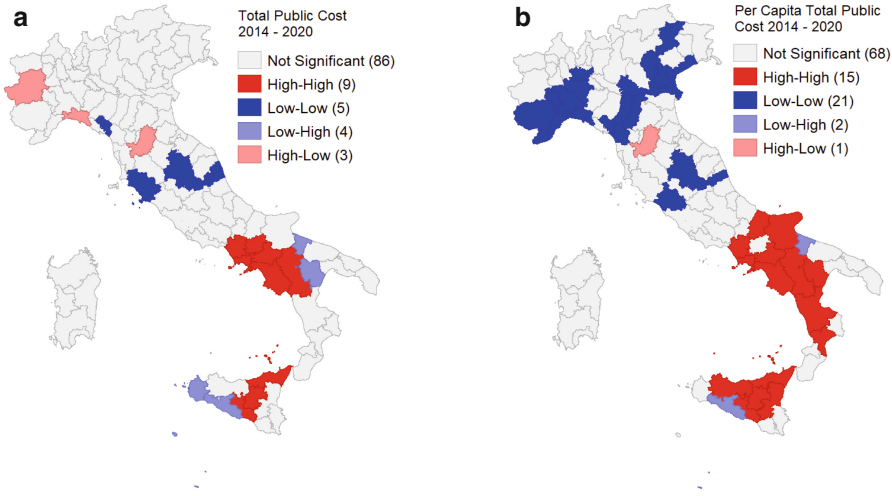

Fig. 6. Lisa Map: a) Total Public Cost 2014–2020; b) Per capita Total Public Cost 2014–20

Furthermore, the analysis of the total public cost and the per capita public cost of the 'Environment' sector related to the first programming cycle (2007–13) (Fig. 7) and to the second (2014–20) (Fig. 8), highlighted the following autocorrelations:

– In both the first and second programming cycles, the public 'environment' cost can be found in a portion of the south (metropolitan city of Naples and contiguous provinces up to the Adriatic border). However, a less autocorrelation can be observed in the second cycle than in the first, while other autocorrelations emerge. In particular, a high-low autocorrelation in the metropolitan cities of Milan, Genoa, Venice and Florence.

– The per capita 'Environment' public cost of the first and second programming cycles is always found in the south, including a large part of Sardinia with the exception of the metropolitan city of Cagliari, while high-low autocorrelations emerge in the metropolitan cities of Venice and Genoa in the north.

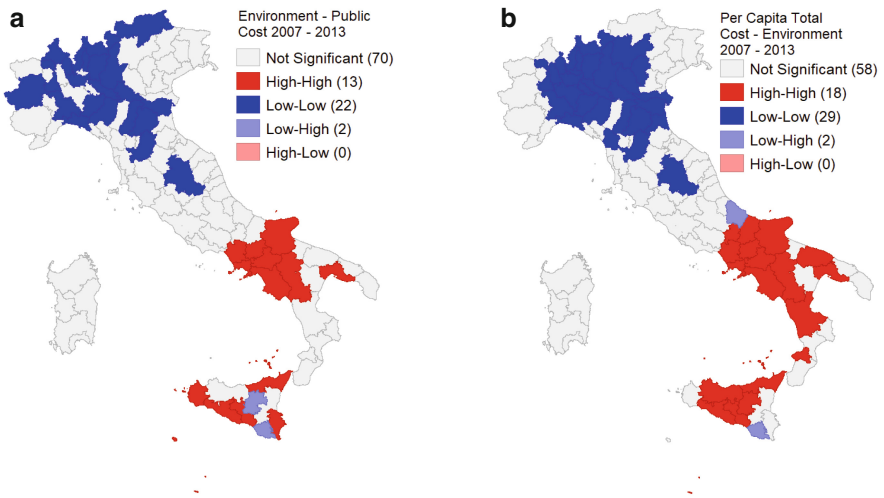

Fig. 7. Lisa Map: a) Environment – Public Cost 2007–2013; b) Public Cost Per capita 2007–2013

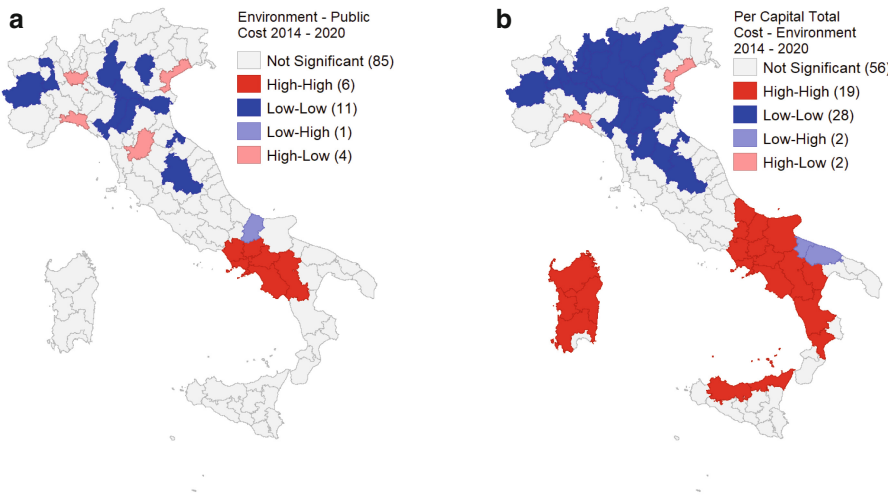

Fig. 8. Lisa Map: a) Environment – Total Public Cost 2014–2020; b) Public Cost per capita 2014–2020

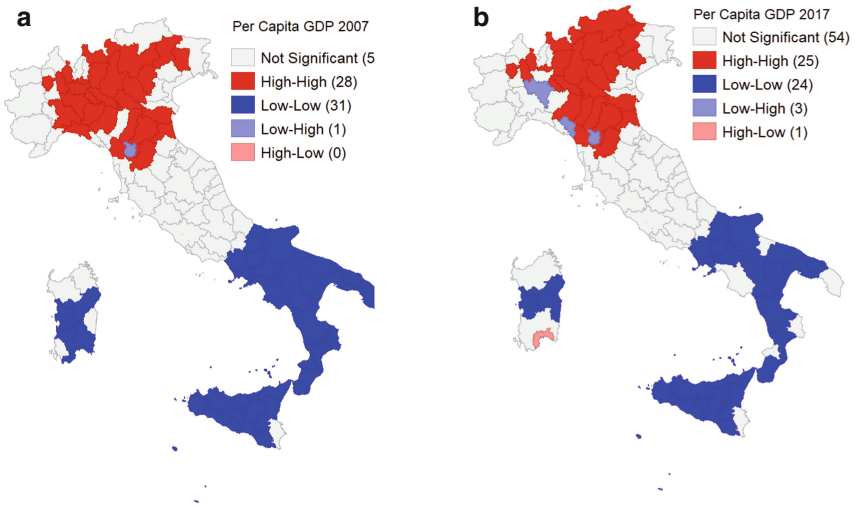

Fig. 9. LISA Map: a) GDP Per capita 2007, b) GDP Per capita 2017

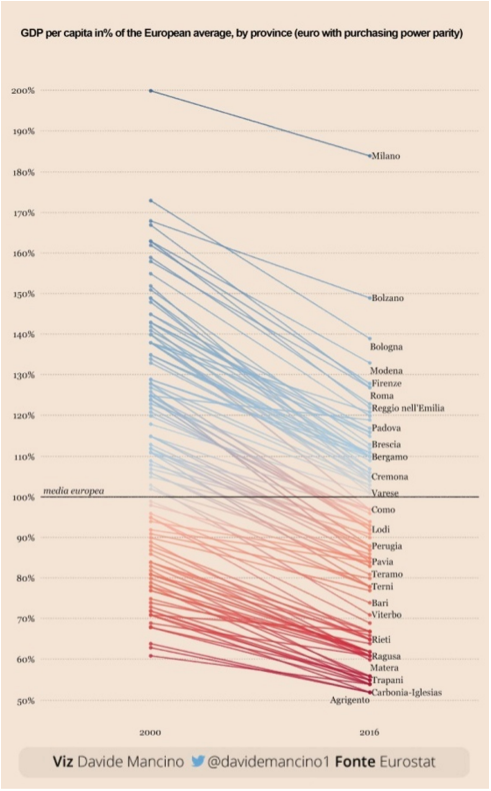

Fig. 10. GDP trend - by Province 2000–2016. Source: Il Sole 24 ore.

Authors then proceeded to evaluate the GDP indicator recognized at the basis of cohesion policies (by province/metropolitan city; 2007–17) through the autocorrelation method (Fig. 9), which led to make the following consideration:

– The GDP has positive autocorrelations in the north. However, the same decreased from 2007 to 2017 in terms of extension and moved to the east side.

This decrease is in line with the trend of the Italian average GDP which saw a significant decrease between 2000–2016, also in northern Italy (Fig. 10). Besides, it is in line with the European GDP that sees an increase in the Eastern EU countries [31, 32].

5 Final Remarks

The analysis through the spatial autocorrelation by means of LISA has highlighted how in the absence of the European Cohesion Fund for Italy, the Cohesion policies, and in particular of the - environment sector - have had a spatial autocorrelation in southern Italy and that in the last 2014–20 cycle a gradual autocorrelation occurred in northern Italy. This is partly related to progressive decrease in GDP that interested all of Italy without excluding the North. In this context, which allows the North of Italy to see an interest in the direction - Environment - of cohesion policies compared to the past, it is possible to recognize the result of the combination of multiple factors, including the increasingly urgent renewal of the ecological approach of urban and territorial planning. Furthermore, the recent health emergency from Covid-19 highlighted such need. Also following this emergency, or rather its results on the national economy, the Cohesion Fund in Italy will also be re-evaluated, which has the reduction of economic and social disparities and the promotion of sustainable development as its main purpose. In this sense, through the assessment of the sector - Environment - we have in fact investigated the Italian trend over time and some phenomena have been encountered, such as the gradual autocorrelation of total and per capita expenditure in the northern provinces. This highlights how Italy also presents a dual role towards the EU, a country divided in two areas: North and South, with relative differences in GDP which are the consequence of a generalized socio-economic crisis with consequent and its implications on the environment. The environmental emergency highlighted some aspects that require maximum attention both for economic recovery and for social cohesion.

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