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Deep Dive into the Recovery Fund: A (Real) Chance for Inner Areas? The Abruzzo Region Study Case, Italy

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Abstract

The National Recovery and Resilience Plan (NRRP) represents a transformative opportunity to reduce territorial, gender and generational disparities in Italy. It plays an even more important role for inner areas, which make up about three-fifths of the entire national territory and require structural investment to improve infrastructure, social services and access to healthcare services. This study aims to analyse the distribution of funds by project type, and to develop a geostatistical analysis-based methodology to critically evaluate two key aspects: the ability of small municipalities to access resources, and the effectiveness of the funding programme in meeting the specific needs of inner areas. The developed methodology consists of several steps aimed at collecting, standardising, geo-spatialising and analysing data relating to NRRP funds. This methodology is then applied to a case study of the Abruzzo region (Italy), which is considered particularly interesting due to its physical, historical and socio-economic characteristics that make it particularly vulnerable to natural disasters. The developed methodology consists of several steps aimed at collecting, standardising, geo-spatialising and analysing data relating to NRRP funds. The results of the spatial autocorrelation and cluster analyses were then overlapped and compared with the internal areas defined by the National Strategy for Inner Areas (NSIA). The outcomes reveal how investments interact with existing spatial planning instruments and development strategies, underscoring the critical role of accessibility, infrastructure, and public services in fostering equitable and sustainable regional development. The analysis offers insights into addressing structural disparities and enhancing territorial cohesion, with implications for policy alignment across multiple levels of governance.

Keywords: territorial transformations; National Recovery and Resilience Plan (NRRP); inner areas; cohesion strategies; spatial statistics; cluster analysis

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1. Introduction

The National Recovery and Resilience Plan (NRRP) has been, and continues to be, an opportunity to address macroeconomic imbalances and reduce gender, territorial and generational disparities that hinder economic growth [1]. It supports the National Reform Plan (NRP) and is consistent with European economic governance, introducing a new economic framework built around three strategic axes: digital transition and innovation, ecological transition and social inclusion with territorial rebalancing. In line with the six pillars of the Next Generation EU, the measures defined in the six missions of the

NRRP correspond to these three strategic axes. The NRRP forms part of a wider European initiative aimed at driving post-pandemic recovery while tackling persistent structural imbalances, such as regional disparities and sustainability challenges [2].

This investment and reform framework aims to trigger transformative processes that will reshape the current development model. These processes will encompass various aspects of social, productive and territorial structures [3]. These transformations are intended to foster resilience and innovation, and address Italy's uneven regional development. This has historically impacted southern regions and inner areas the most [4].

Comprehensive assessment within the framework of spatial planning tools is required for physical interventions such as upgrading public facilities, enhancing territorial healthcare services, developing infrastructure for sustainable mobility, implementing land protection measures and strengthening territorial cohesion. The National Primary Healthcare System, for example, requires greater integration of digital technologies and improved communication between hospitals and community healthcare providers [5]. There is also a growing need to restructure the healthcare service network by enhancing accessibility to public health services, particularly in marginal [6] and underserved [7,8] areas and by strengthening outreach services.

The set of planned measures promotes a comprehensive reshaping of territorial systems. This is expected to have an impact on accessibility to services and infrastructure, demographic trends, the evolution of settlement patterns and synergies with ongoing development strategies and programmes. This multidimensional approach is consistent with the Organisation for Economic Co-operation and Development's (OECD) goals of sustainable regional development, which emphasise the integration of social, economic and environmental considerations [9]. Their effectiveness will be measurable over the long term [10] and proportional to the expected impacts on economic growth, environmental sustainability, and social cohesion [11].

The territorial transformations resulting from these investments should thus serve as an opportunity to improve socio-economic and environmental conditions, particularly in regions most affected by depopulation, socio-economic marginality and environmental fragility [12].

Referring to these areas as regions that, in recent decades, have been disconnected from urban-centred development models and are now experiencing marginalisation and depopulation [13], the relevant Italian reference legislative framework is the National Strategy for Inner Areas (NSIA). It stands as one of the most compelling examples of the EU's territorial cohesion goals [14]. Similarly to other European countries [15,16], the ultimate goal of the NSIA is to guide development that minimises spatial imbalances and fosters the effectiveness of policies and investments, tailored to the specific characteristics of different territorial systems [17].

It is clear that the substantial funding provided by the NRRP is being directed towards areas that are already highly complex and have had different policies in place for several years. In some cases, these strategies have been prompted by emergency events, such as major earthquakes, landslides and floods, as well as by disadvantaged socio-demographic conditions.

This research critically explores the intersection between space and policies in the implementation of Italy's NRRP. It aims to address a relevant, emerging research question:

To what extent does the NRRP identify and address the needs of municipalities, paying particular attention to those in the inner areas as defined by the NSIA?

In order to answer this question, two fundamental aspects must be critically assessed.

The first issue concerns the criteria and mechanisms for fund allocation, which directly determine the capacity of municipalities to access and manage these financial resources.

Unequal or overly complex allocation processes may risk excluding smaller or less well-resourced municipalities, reinforcing existing territorial disparities. Conversely, a transparent and equitable distribution system can strengthen local governments' ability to invest in strategic projects, promote balanced territorial development and ensure that the benefits of recovery and transition policies reach communities across the country.

The second issue relates to the extent to which the funding programme effectively addresses the specific needs of inner areas. If the measures are not sufficiently tailored to the structural challenges of these territories—such as demographic decline, limited infrastructure and restricted access to essential services—there is a risk that resources will fail to generate meaningful impact. On the other hand, a targeted approach that recognises the unique socio-economic conditions of inner areas can enhance their resilience, foster local development, and contribute to reducing long-standing territorial imbalances.

The spatialization of the projects envisaged by the NRRP represents a crucial first step in establishing a comprehensive assessment framework [18]. It enables the in-depth analysis necessary to evaluate consistency not only with the NSIA but also with other spatial governance instruments adopted at various scales to address broader objectives—such as national strategies for sustainable development [19] and climate change adaptation. In this context, this article focuses on the case study of the Abruzzo region, analysing the distribution of the funding allocated to each municipality within the different NRRP missions.

Cluster analysis was used to analyse the data and identify patterns of similarity and difference in the distribution of projects and funding. These results were then overlaid with the boundaries of inner areas. A comparison with the NSIA classification of municipalities provided further insights.

The study analysed the territorial distribution of funds in the Abruzzo region to investigate how territorial cohesion policies reflect—and sometimes reproduce—spatialised forms of power and unequal development strategies.

2. The Case Study

Abruzzo is a region in central Italy characterised by a complex polycentric structure, including urban poles and rural areas, industrial districts, a touristic coastline characterised by phenomena of territorial coalescence and mountain environments markedly affected by depopulation [20]. Covering a wide range of physical, historical and socio-economic environments, it is overall a region that is highly vulnerable and exposed to natural disasters [21], socio-economically vulnerable and poor in infrastructural endowments [22].

Two disruptive earthquakes (in 2009 and 2016) worsened the already stagnating economic performance, and the pre-existing conditions of marginalisation posed a significant challenge to the reconstruction process. However, the large amount of funds that came in during the post-earthquake phase constituted an uncommon opportunity to establish transformative patterns of development, cooperation and innovation [23]. Of the funds allocated for reconstruction, 68 municipalities in the region received investment during the two earthquake events. As is the case for much of the national territory, the regional territory is characterised by small municipalities that make up the inner areas, for which particular recovery and regeneration strategies are being implemented. In fact, the Abruzzo region has seven inner areas covering 139 municipalities, accounting for almost 46% of the total (Figure 1).

According to the 2023 Annual Report of the Italian National Statistics Institute (ISTAT) [24], Abruzzo region experienced a 3% population decline between 2011 and 2022, with an ageing population and a sharp drop in birth rates, especially in the inner

areas. In these regions, people aged over 65 make up more than 25% of the population, with some small towns reaching up to 30%.

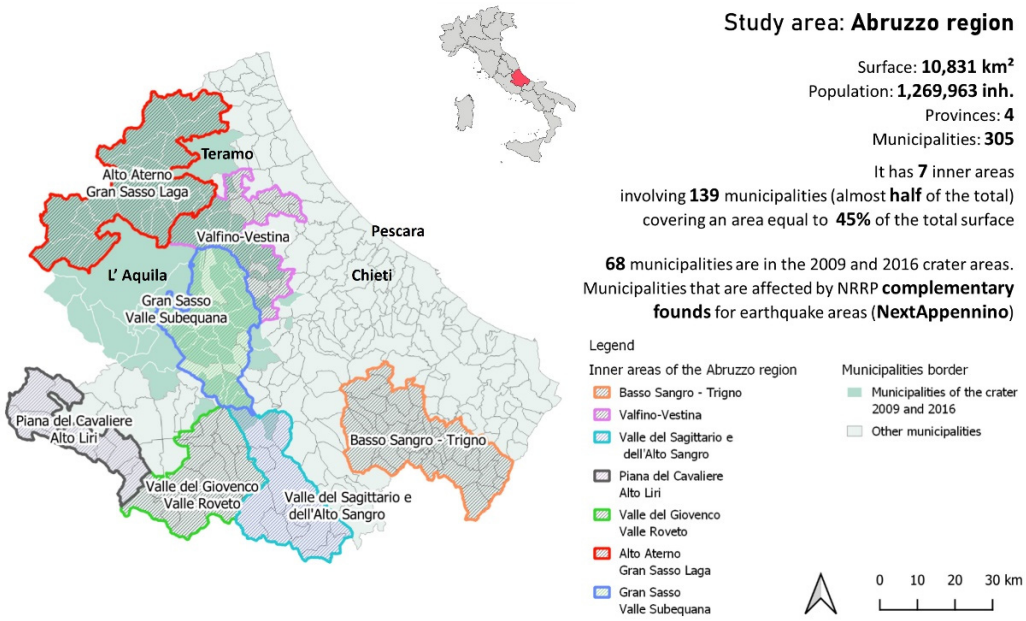

Figure 1. Study area with the identification of the seven inner areas and the municipalities of the 2009 and 2016 crater areas.

The situation is being exacerbated by the negative migration balance, which is mainly due to the outmigration of young people to cities or other Italian regions.

Socio-economically, coastal and urban areas such as the cities of Pescara, Chieti, and Teramo exhibit greater dynamism thanks to the boost from sectors such as tourism, services and industry. In contrast, the inner areas continue to suffer from chronic economic stagnation, linked to traditional sectors such as agriculture and crafts, which have been hit hard by competition and a lack of modern infrastructure [25]. According to ISTAT data, the unemployment rate in the inner areas is higher than the regional average, with youth unemployment exceeding 30%. The NSIA aims to reverse the socio-economic decline in Italy's inner areas by improving access to services, promoting local economic development, and fostering social cohesion. However, the 2023 Annual Report reveals that these policies have achieved only limited success to date. The future impact of the NSIA will depend largely on the capacity of these inner areas to attract investment and develop infrastructure that fosters innovation and growth, which are critical for long-term socio-economic revitalization.

The NSIA plays a crucial role in regions such as Abruzzo, where the pronounced territorial disparities between coastal and inner areas have had a negative impact on the social and economic fabric. The inner areas of the Abruzzo region have historically experienced de-population, geographical isolation and limited economic opportunities. The NSIA aims to address these issues through a comprehensive multi-sector approach. Its significance lies in fostering balanced and inclusive territorial development, not merely through the financing of individual projects, but by advancing a broader strategic vision designed to reduce inequalities and create long-term cohesion across regions. The NSIA aims to create better living conditions for those residing in these areas by improving access to essential services (healthcare, education, transportation) and fostering new economic opportunities based on innovation and the utilisation of local resources. This will help to curb depopulation and reverse socio-economic decline.

In Abruzzo's inner areas, the actions of the NSIA address specific issues such as limited access to public services, an ageing population, and structural difficulties in attracting investment. The strategy aims to revitalise these areas, not only economically, but also in terms of improving the quality of life, strengthening social cohesion and promoting territorial resilience. Interventions such as strengthening digital and transport infrastructure are essential for reducing the gap with more dynamic urban areas, while supporting local entrepreneurship can create new jobs in traditional sectors such as agriculture and sustainable tourism.

For the NSIA in Abruzzo to be successful, it must be able to coordinate interventions at local, regional and national levels, involving both public and private actors. As highlighted in the 2023 ISTAT Annual Report, the effectiveness of territorial cohesion policies will depend largely on these areas' ability to attract resources and capital, and on the active participation of local communities in decision-making.

The NSIA represents an essential tool for the revitalization of Abruzzo's inner areas. It is a sustainable development perspective that addresses the root causes of socio-economic problems, seeking to create a more inclusive and prosperous future for these communities. In this context, the challenge launched by the NRRP could represent a paradigm shift in the management of these areas and how their strategies are defined.

3. Materials and Methods

The applied methodology comprises three main steps:

- Dataset building concerning the distribution of NRRP projects in the Abruzzo region among its 305 municipalities, which constitute our sample;
- An autocorrelation analysis was carried out to verify whether the amounts financed for each mission aggregate spatially;
- A cluster analysis was performed to investigate whether contiguous areas within the sample of municipalities pursued the same investment strategy.

Figure 2 shows a methodological scheme that summarises the entire process.

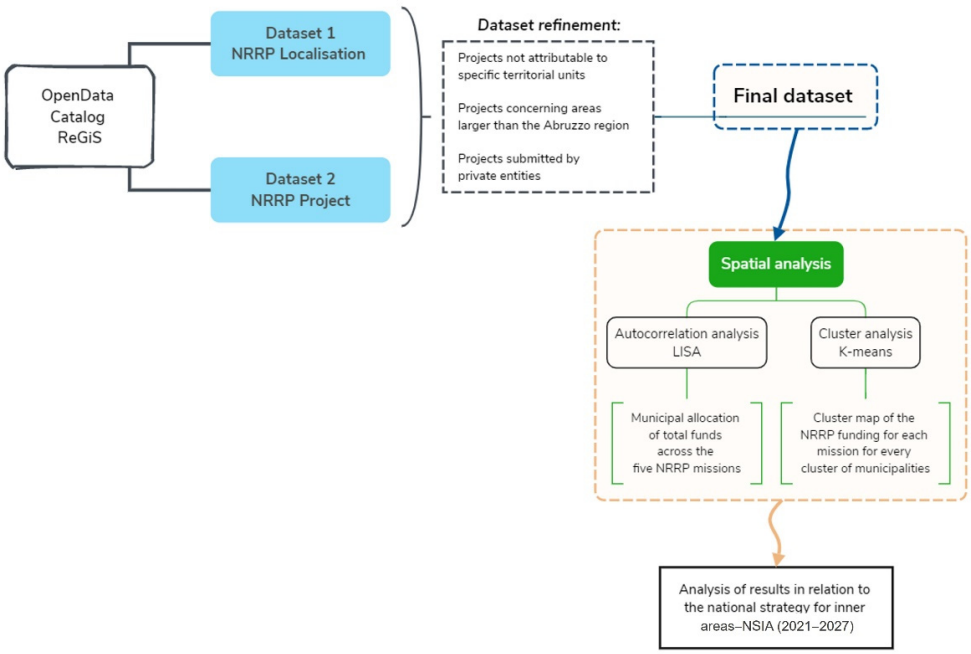

Figure 2. Methodological framework.

3.1. Dataset Building

The dataset is derived from the Open Data Catalogue, which is updated monthly in ReGiS [26], the information system developed by the Italian Ministry of Economy and Finance to ensure compliance with public works monitoring requirements. In particular, it includes the entire structure of the NRRP, enabling the precise display of measures, responsible parties and financial resources, as well as the monitoring of progress on each project in relation to national and European milestones and targets, and the characteristics of individual measures (e.g., climate and digital tags).

As part of this work, the data included in datasets 1 and 2 (NRRP Localisation and NRRP Project, respectively) were analysed and spatialized. Dataset 1 contains the following information for each project: the unique submission code, the project code (CUP), the local project code, the reference municipality with the province and address indicated and the date on which the data was last updated. Dataset 2, on the other hand, contains the following information for each project: the unique submission code, the CUP, the local project code, the NRRP Mission (hereafter referred to as "M"), the specific mission component (hereafter referred to as "C") and the total amount of funding. Furthermore, dataset 1 encompasses a greater number of projects than dataset 2, as a single project may span multiple locations (municipalities, provinces, regions or territorial areas).

For example, if a project with a unique CUP has been developed in four municipalities, dataset 1 will contain four rows, one for each municipality, with the CUP and local project code repeated. Dataset 2, on the other hand, will contain only one row with the CUP and the total funding provided by the project (as well as other information).

The two datasets contain different information and combining them makes it possible to link the funding of each project to its respective municipality, thus enabling the data to be visualised spatially. In fact, dataset 2 contains no information about the spatial extent of the project (municipality, region, province or other extent), whereas dataset 1 does. To achieve this, a biunivocal correspondence (one-to-many) was established between the CUP and the local project code. This double condition was necessary because the database contains multiple CUPs for different municipalities. Merging the two datasets returns a third dataset in which several critical conditions occur that will be resolved as follows:

- The total project amounts are repeated with the CUPs for the several different municipalities included in each project. To overcome this limitation of the union and avoid overestimating total project funding, it was assumed that the amount would be divided equally by the number of municipalities involved in the project in all cases where reference to the municipalities was explicit.
- For projects referencing a province but indicating all municipalities, funding was divided among all the municipalities belonging to the relevant province.
- In cases where the project does not appear to have an impact on specific municipalities, it has been eliminated entirely as it cannot be associated with a spatial dimension. One example is the project concerning the establishment of additional scholarships for the general medicine course.
- Projects referring to spatial extensions covering the whole nation, ministries, regions (without referring to municipalities), provinces and sub-territorial areas were eliminated and not considered in the database for analysis.
- All projects related to M3 (Infrastructure for Sustainable Mobility) were excluded from the analysis because they are nationally important projects relating to the modernisation and safety of rail and road networks (e.g., High Speed Rome—Pescara, Speeding up Pescara—Foggia—Brindisi, interventions along the A24–A25).

The analysis reveals the building of a dataset which, for each municipality in the case study, systematically organises information on the number of projects funded and the

corresponding NRRP funds received, broken down according to the different missions and specific components.

3.2. Autocorrelation Analysis

Spatial autocorrelation is a geostatistical technique used to analyse the spatial distribution of a variable across contiguous geographical areas and to evaluate local effects and clusters [27].

Based on the idea that data can be affected in terms of both geographical shape and spatial proximity and the values attributed to the same units, Tobler developed this method of jointly analysing the spatial behaviour of the analysed variable and what happens in its proximity [28].

In particular, it is useful to detect hotspots, i.e., high values accumulation areas, as well as cold spots, i.e., low values accumulation areas [29], assuming that space is homogeneous [30].

Since spatial autocorrelation analysis helps to understand whether spatial units have similar properties, this paper applied the Local Indicators of Spatial Association (LISAs), to measure local spatial autocorrelation among the municipalities of the Abruzzo region. The variable used was the total amount of money allocated to each of the five missions of the NRRP.

The LISAs index is calculated as follows:

$$I_i = \frac{(x_i - \underline{x})}{s_x^2} \sum_{j=1}^{N} \left(w_{ij} (X_j - \underline{X}) \right) \quad (1)$$

where represents the number of statistical units (i.e., the 305 municipalities of the Abruzzo region), x_i is the analysed variable in region i (i.e., the total amount of money for each mission), X represents the sample average, ${S^2}_x$ is the standard deviation and represents the weight matrix.

When running LISAs, the GeoDA (ver. 1.22.04) software also enables several specifications to be selected, including distance options, number of permutations and significance values [31].

Performing this analysis in the GIS environment allows us to take advantage of a spatially explicit decision support tool [32–34] showing the interrelationships between municipalities focusing on their applications for each NRRP mission. In particular, it is possible to detect five different situations:

- The hotspots (High-High), when high amounts of money and high levels of similarity with the nearby municipalities are observed;
- The cold spots (Low-Low), when low amounts of money and low levels of similarity with the nearby municipalities are observed;
- High-Low cluster, when high amounts of money occur with low levels of similarity with the nearby municipalities;
- Low-High cluster, when low amounts of money correspond to high levels of similarity with nearby municipalities;
- The municipalities not belonging to any of the above clusters do not show significant values of spatial autocorrelation.

3.3. Cluster Analysis

A cluster analysis was performed on the same dataset within the sample of the 305 municipalities of the Abruzzo region to verify whether similar strategies were pursued for project funding by the NRRP in different areas.

In particular, a cluster analysis was conducted by means of k-means [35], an unsupervised algorithm aimed at dividing a data sample into k clusters in such a way that within each cluster, the maximum degree of similarity is obtained and, at the same time, the maximum degree of dissimilarity between elements belonging to different clusters is obtained [34,36]. The algorithm, run over a configurable number of iterations, begins by randomly selecting k centroids and then assigns each element in the sample to the nearest centroid based on a Euclidean distance criterion [37]. At the end of each iteration, the average of the points assigned to the specific cluster is taken as the new centroid; the process then continues by convergence of the centroids.

A key element in executing the analysis is choosing the number of clusters, which is usually proportional to the size of the population in the original dataset. For the purposes of this study, it has been arbitrarily set at seven, which strikes a balance between minimising the overall variance and representing the spatial distribution of the obtained clusters.

4. Results

The project dataset update period for the Abruzzo region varies between 24 October and 11 November 2023. The dataset consists of 6537 projects distributed among all the missions for a total funding amount of EUR 1922 million.

As can be seen from Figure 3a, most of the projects concern interventions aimed at the digitalisation of Public Administrations (PAs) (M1C1: 2240 projects) through the strengthening of the adoption of the PagoPA platform services and the IO application, the enhancement of the adoption of the national digital identity platforms and the National Registry and the adoption of the Digital Civil Service and cloud enablement.

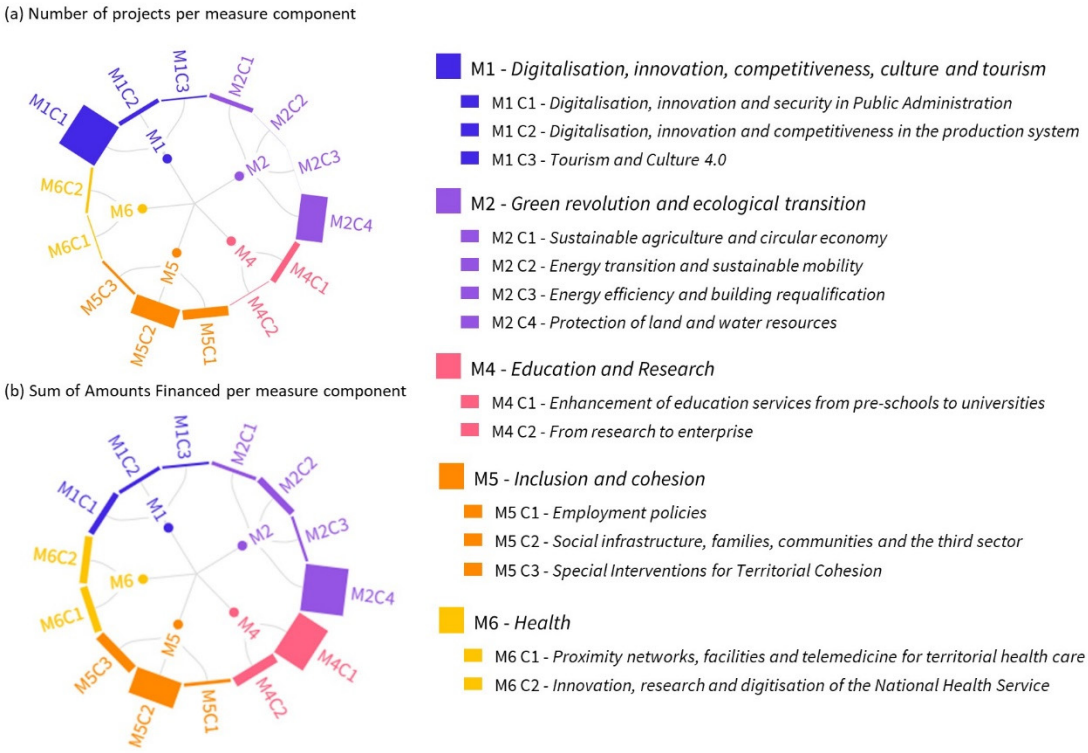

Figure 3. Overview of the (**a**) number of projects funded in the Abruzzo region and (**b**) allocation of funded amounts, by missions (Ms) and components (Cs).

In terms of funding, however, the M2C4 projects are the most substantial, with a total budget of EUR 491 million (Figure 3b) for 1424 projects. In fact, they are projects that require large investments because they involve protecting portions of the territory with respect to

water resources. Most of them concern investments in water infrastructure and the irrigated agro-system, with the aim of achieving sustainable management of water resources. Other projects focus on measures for flood risk management and reducing hydrogeological risks.

Of particular interest are the 202 projects and the total funding of EUR 175 million for mission M6, which focuses on health. This includes the construction of proximity facilities and telemedicine networks for territorial healthcare, as well as innovation, research and digitization of the National Health Service.

Of the collected dataset, 246 projects were not taken into account for the following reasons: they were not directly attributable to specific territorial units, they concerned areas larger than the Abruzzo region, the financing requested by private activities (hotels or B&Bs) was small, as well as other reasons. These projects cover a total of EUR 766 million in financing.

The first step of the applied methodology involves allocating the funding amounts for each NRRP mission to municipalities. As the aim of this paper is to interpret this data in the context of the NSIA, the initial analysis focused on understanding the distribution of these amounts among the seven inner areas planned for the 2021–2027 programming period.

As can be seen from Figure 4, all inner areas have invested mainly in M2, with values reaching EUR 23 million in 'Gran Sasso Valle Subequana', almost EUR 29 million in 'Valfino Vestina' and over EUR 35 million in 'Basso Sangro Trigno'.

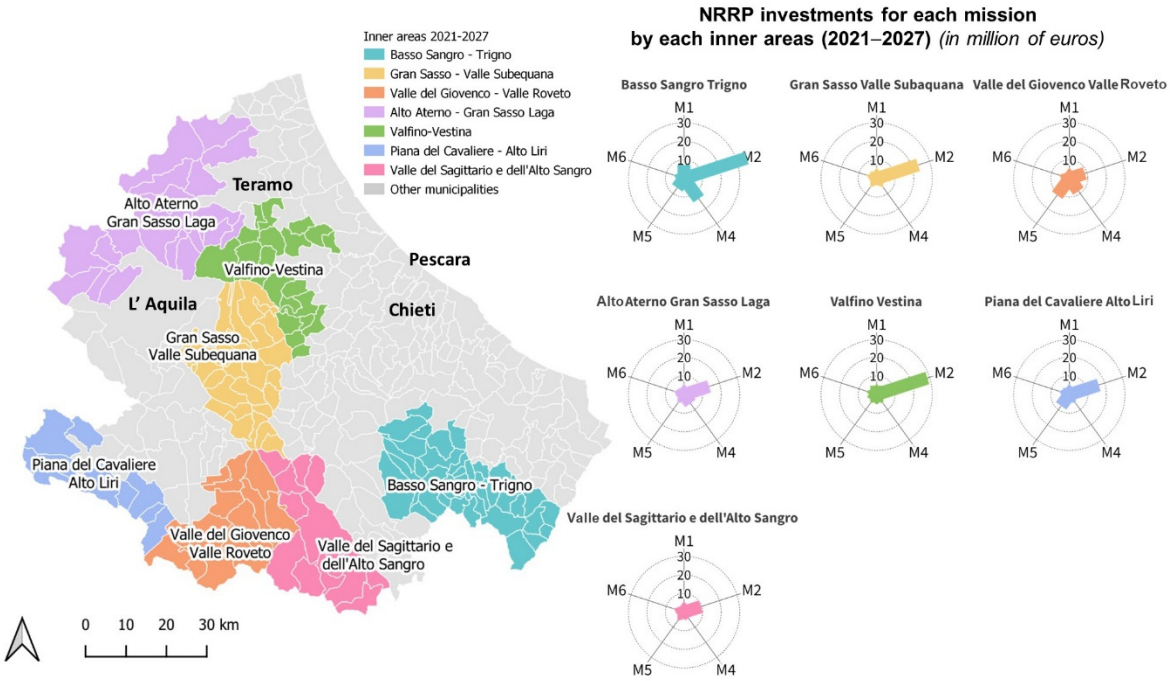

Figure 4. Overview of the spatialisation of NRRP funds by mission considering inner areas planned by the NSIA for the 2021–2027 programming period.

The 'Valle del Giovenco Valle Roveto' area has a budget for expenditure that is evenly distributed between M2, M4 and M5.

Almost all inner areas spent on all missions. The only exception is the 'Valle del Sagittario e dell'Alto Sangro' area, where the number of projects (and consequently the amount allocated) on Mission 6 is zero.

The results of the autocorrelation analysis, carried out to verify whether the amounts financed for each mission aggregate spatially, and of the cluster analysis, performed to

investigate whether contiguous areas pursued the same investment strategy for project funding by the NRRP, are set out below, according to the methodology set out in Section 3.

The autocorrelation analysis (Figure 5) highlights the dichotomy between the cost areas and the municipalities in the hinterland of the province of L'Aquila. In fact, there is an area centred around the provincial capitals of Pescara and Chieti, including smaller municipalities, which emerges as a high-high cluster with respect to all NRRP missions. Conversely, it is clear that the inner municipalities are having difficulty applying for projects and making use of the resources offered by the NRRP. The municipality of L'Aquila is also included in the high-low cluster for three out of five missions, meaning it has invested much more than the surrounding municipalities.

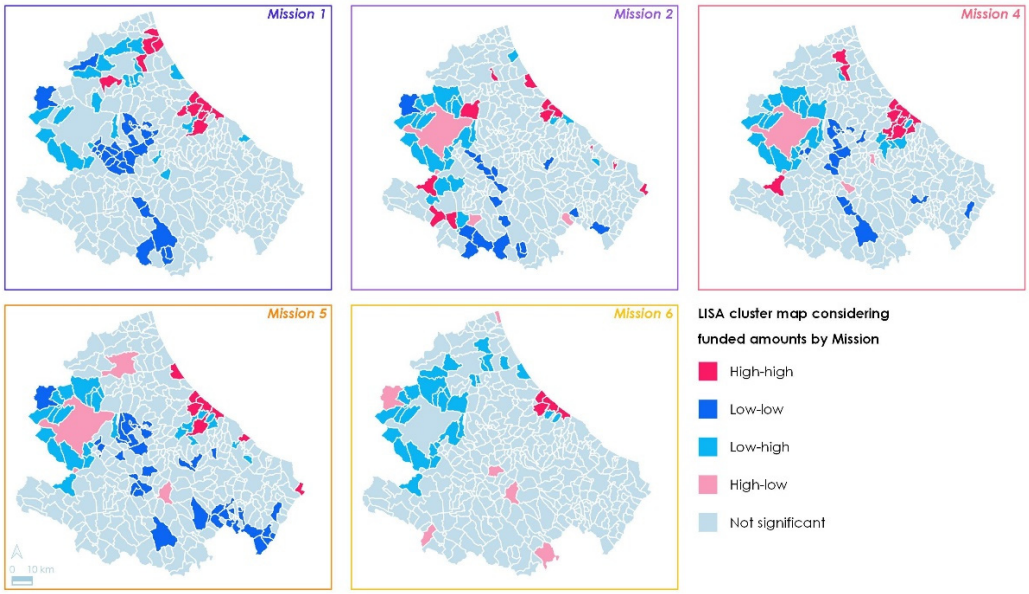

Figure 5. LISAs cluster map obtained considering the overall amounts related to each mission.

Figure 6 shows the result of the cluster analysis carried out on the basis of the investments for each NRRP mission. The first cluster, the largest, includes 270 municipalities whose investments exceed EUR 1 million only for Mission 2, with an average investment of approximately EUR half a million.

The second cluster includes 20 municipalities that invested between EUR 1.6 and 4.7 million on all five missions, with a preference for M4.

Cluster 3 invested more than EUR 17 million in Mission 5, around EUR 3.7 million in Missions 2 and 4 and around EUR 1.3 million in Missions M1 and M6.

The fourth cluster is characterised by spending ranging from EUR 2 million for M1 to EUR 22.8 million for M2, with an average value of around EUR 10 million. It comprises four municipalities, three of which are along the coastal strip, with only one in the hinterland.

Cluster 5 is made up of the two provincial capitals Teramo and Pescara, which invested over EUR 10 million in each mission, with a maximum of about EUR 31 million in M5.

Cluster 6 is the regional capital (L'Aquila), which has invested about EUR 91 million in M4, EUR 53 million in M2, EUR 45 million in M5, about EUR 33 million in M6 and only EUR 5 million in M1. Its average investment is more than EUR 45 million.

Finally, the last cluster (Cluster 7) is made up of the city of Chieti alone, which invested mainly in Missions 4 (more than EUR 47 million) and 5 (around EUR 39 million), with a minimum of EUR 2.5 million for M1.

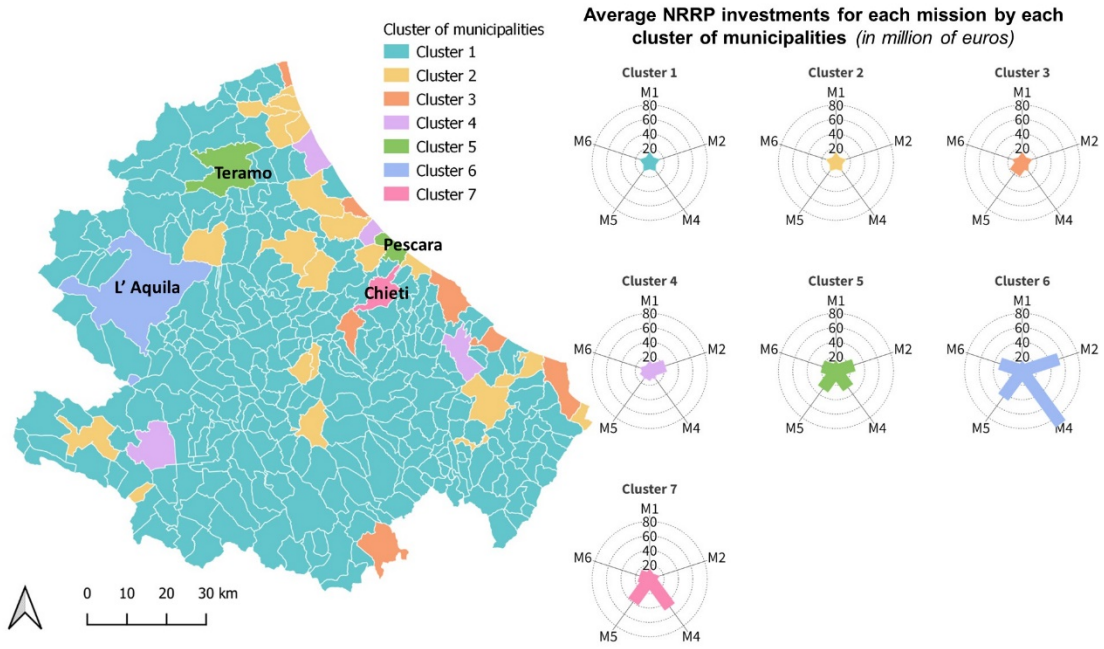

Figure 6. Overview of cluster analysis results. Radar charts represent the amounts of funding for each mission for every cluster of municipalities.

5. Discussion

The developed methodology and the related findings allow us to draw discussions and implications concerning two main points related to structural funding programmes.

Firstly, the relevant role of the criteria and methods used to allocate funding emerges.

Overly complex or unequal processes risk excluding smaller municipalities and deepening territorial disparities. Our findings in fact confirm what was recently highlighted by the European Investment Bank [38], the fact that smaller municipalities—especially those in less-developed marginal areas—face persistent and multi-faceted barriers in accessing public funding. The scientific literature also outlines that a significant number of local governments report that a lack of funding and complex regulatory procedures significantly hinder their capacity to invest in critical infrastructure, including climate actions. Shortages of technical and environmental expertise [39] further compound this problem. Additionally, smaller municipalities frequently lack the administrative capacity and in-house expertise necessary to manage funding applications, a barrier highlighted by the OECD as detrimental to smaller public entities undertaking EU-funded projects [38]. Bachtler et al. (2014) [40] reinforce these findings, showing that capacity gaps in small and rural municipalities also risk amplifying regional disparities by concentrating resources in larger urban centres better equipped to navigate funding systems. Another concern deals with citizens' engagement, with a general lack of municipal attention to civic participation, and warns that large-scale, multi-level funds may risk undermining social equity [41].

While rapid decision-making is recognised as synonymous with efficiency, Raco et al. (2018) [42] call for the need to have "slow cities" in order to better respond to funding opportunities with processes oriented to more sustainable and long-term perspectives.

In other words, evidence suggests that the good intentions for rethinking social protection and fostering innovation of funding programmes are not enough. Their success hinges critically on how funds are managed at the local level, how projects are implemented and the ability of local authorities to access funding and convert it into benefits for communities [43].

Notable examples of successful outcomes include the Bando Borghi initiative launched by the Italian Ministry of Cultural Heritage and Activities' (MiBACT), which channelled NGEU resources towards the sustainable recovery of mountain villages and inner areas [44]. Also, in Greece, the Recovery and Resilience Facility (RRF) funding was the main driver to reform urban policy and introduce Local Urban Plans and Special Urban Plans, aimed at tackling traffic congestion, environmental degradation and loss of green spaces, while promoting sustainable mobility and climate resilience [45].

Conversely, in Germany, even with equal funding, disparities emerged in the implementation of local climate policies, stemming from differences between the local administrations tasked with managing the resources [46].

The findings of this study corroborate a trend of pronounced heterogeneity in the allocation of NRRP funds among municipalities in the Abruzzo region. The territorial distribution of projects across different NRRP measures appears to be shaped less by the substantive needs of local contexts—such as infrastructure provision, service availability and risk mitigation—than by the administrative capacity to access funding and formulate project proposals.

The second issue concerns whether the funding programme adequately addresses the specific needs of inner areas. In this context, we consider the Italian NRRP, which is closely aligned with the 2021–2027 Cohesion policy framework. The NRRP represents an unprecedented opportunity to strengthen the capacity of the Italian public administration [47], bring about significant changes to development dynamics [48] and lay the foundations for building resilience, especially in fragile territories [49]. However, the effectiveness of these investments in inner areas must be considered in the context of a polycentric spatial organisation in need of widespread intervention. This context is characterised by significant structural fragility [20]. Moreover, these areas are affected by long-term depopulation, an ageing population, weak institutions and a lack of capital. This unfavourable concomitance of factors also negatively affects resilience to sudden shocks [50], as regretfully proven during the 2016 earthquake.

The many specific characteristics of inner areas outlined above mean that the effectiveness of investments in responding to specific needs must be evaluated in a spatially explicit way. As pointed out by [51], this becomes even more relevant when measuring the changes financed against the pursuit of sustainable goals. Currently, however, it is difficult to spatialise the data made available on the e-gov website. This is because it is challenging to disaggregate investments [52] and in trace them back to where they will result in change [53].

From the perspective of the NRRP's expected impacts, the results offer several points for discussion. Although the NRRP recognises the importance of the expected impact on social, economic and territorial cohesion, it pays little attention to the effects on citizens' well-being compared to economic growth [11]. However, there is a high risk that structural limitations, related to reform capacity and resource absorption, will prevail. In addition, the new highly centralised governance structure could cause implementation problems, as sub-national actors have been marginalised, contradicting European indications [54].

The announced paradigm shifts to opportunities for inner areas under the NRRP have not yet occurred and apparently will not take place. In fact, the clusters overlapping the seven inner areas of Abruzzo demonstrate that little investment has been made in projects, almost nullifying the chances of revitalisation. Another relevant factor is that the percentage of the population over 65 living in inner areas is generally higher than the national and regional average [55,56].

In these areas, therefore, there should be a strong interest in expanding care facilities for the elderly and dedicated medical services [57], i.e., everything summarised in

M6 of the NRRP, which is designed to reform the healthcare system by redesigning its territorial network [58].

In contrast, very few projects concerning M6 were submitted by municipalities in the inner areas: only 11 out of 139 municipalities did so. This often reflects a lack of the resources and skills needed to participate in complex calls for proposals, resulting in a 'windfall effect' that favours a few municipalities with the necessary expertise. This situation highlights the lack of an efficient territorialization of the NRRP, both at national level, with clear differences between north and south [51], and inside individual regions [59]. The capacity to calibrate interventions on the basis of the social and physical characteristics and specific needs of territories, or "territorialisation", appears to be lacking. Not all contexts require the same priorities, such as digitalisation or widespread healthcare, nor do they have the same capacity to reap long-term benefits from investments. Without long-term benefits, an intervention is inevitably in danger of failing. Failures can also be generated by the sheer complexity of the NRRP measures and by the extremely long timeframes for implementing the interventions [49], which risk misrepresenting their real function. For example, the NRRP has incorporated other already active programmes such as those on the quality of living (National Innovative Programme for the Quality of Living—PinQua) whose principles and objectives do not exactly reflect what is contained in the various measures. Regarding the Abruzzo region, the impact of the 2009–2016 Earthquake Areas Supplementary Fund under Macro measure B 'Economic and Social Revival' of the National Plan for Complementary Investments to the NRRP is significant. While complementary funds play a fundamental role, when they are incorporated into NRRP measures, they risk losing their original purpose of reconstruction. This also de-naturalises the recovery and resilience interventions envisaged by the various NRRP measures. Consequently, while the NRRP enabled funding to be increased for existing programmes and plans, it also distorted its original objectives.

Another mismatch between demand for investment and requirements relates to the protection of land against hydrogeological risks. This is one of the key interventions under the mission on the Green Revolution and Ecological Transition (Mission 2 Component 4), which receives the largest share of funding from the NRRP at the national level—approximately EUR 69 billion [60].

Although inner areas constitute fragile territories [61] characterised by a high-level hydrogeological risk [62], not all inner areas of the Abruzzo region benefit from substantial investment in this funding line.

6. Conclusions

The novelty of this research lies in its spatial interpretation of the findings derived from a critical analysis of fund distribution in inner areas. As with most spatial analyses, it is inevitably affected by the edge effect, since the influence of neighbouring territories cannot be entirely accounted for during the clustering process. This limitation could be addressed in future studies by either broadening the spatial scope to include adjacent regions or employing interscalar approaches that consider cross-border interactions.

The analysis highlights the complex relationship between national programming and local development strategies, underscoring the political implications of how public resources are territorialized. It also raises critical questions about the transformative potential of infrastructure policies in promoting territorial cohesion and addressing structural imbalances. Although GDP or other direct economic indicators were not explicitly included, the study engaged with the economic dimension by examining inner areas, which are structurally disadvantaged in terms of accessibility, demographic trends and economic vitality. NRRP investments in these territories are therefore intrinsically linked to their

potential for socioeconomic development. A recent JRC study [63] confirms the systemic impact of these instruments, estimating that the RRF mobilises around 4% of European GDP and generates direct and indirect effects in all Member States, with Italy among the main beneficiaries thanks to investments in the green and digital transition. In this context, the results of the analysis suggest that the distribution of NRRP resources should not be considered simply as a financial allocation, but as part of a broader framework where spatial, economic and political dimensions intersect to shape patterns of territorial marginality and development opportunities.

The NRRP, in its original conception, does not seem to fully address the real challenge: ensuring compatibility between economic development, employment, welfare and environmental sustainability [64]. Simply stimulating GDP growth without introducing radical innovations in production technologies and consumption models risks exacerbating territorial inequalities and environmental vulnerability, without ensuring an equitable distribution of benefits. A territorial approach, on the other hand, makes it possible to assess whether investments are targeted at those sectors and supply chains capable of generating quality employment and local resilience.

In particular, the results obtained for the Abruzzo region indicate that the effectiveness of the allocated NRRP investments may be compromised, especially in the long term, by the way in which these resources have actually been implemented. This finding reinforces the observation of [65], according to which local capacity building and support for policy makers are priority areas for the allocation of funds, constituting a necessary step to enable local administrators to invest in a targeted manner, responding to the specific needs and characteristics of their territories. In this framework, the methodology proposed in the study is designed as a decision support tool, providing detailed geospatial information useful for the construction of territorial planning and governance strategies, helping to guide investment policies in a way that is more in line with local characteristics and needs. Future developments in the research aim to deepen the analysis beyond the distribution and territorial allocation of funds to explore the extent to which the NRRP is effectively integrated with the Sustainable Development Goals (SDGs). In particular, an important step will be to map investments across the different dimensions of the SDGs—such as clean energy, resilient infrastructure and sustainable communities—and to assess their effectiveness through targeted indicators, including their ability to contribute to reducing regional disparities. More detailed data at the municipal level and cross-cutting approaches that simultaneously consider economic, social and environmental variables will be essential to carry out these analyses.

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