

## Article

# Value and Quality in the Dialectics between Human and Urban Capital of the City Networks on the Land District Scale

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**Abstract:** This contribution proposes an inter-scalar and multi-polar analysis evaluation model of the territory of the Enna district, aimed at providing a robust axiological representation of the salient aspects of the general issue of internal areas, and therefore of the set of criticalities affecting them from the perspective of the human and urban capital they express. In the prospect of investigating the relations between urban and life quality – corresponding to the “city effect” – in the territorial context of each of the 20 municipalities of the Enna district, a hierarchical descriptive-valuation model was created, which coordinates a relevant amount of information units (data) and the corresponding attributes, indicators and indices that have been turned in aggregate value judgments attributed to each administrative land unit, from the perspectives of the criteria referred to as the main forms of the territorial capital. This is a multi-dimensional valuation model based on the Multi-Attribute Value Theory. Each survey and processing is mapped with different levels of detail at the scale of municipalities, census sections and cadastral land units. The outcome of this complex process of analysis and assessment provides multiple comparisons, revealing unexpected and sometimes counter-intuitive aspects in several municipalities, some of which are characterised by innovative prospects and opportunities for redevelopment of their historic centers. Correlations between information units at the different levels of the dendrogram have also indicated interesting trends and attitudes, whose comparisons can address territorial policies on both a local and provincial scale. Furthermore, the focus on the “cities network” is here assumed and proposed as the privileged point of observation of territory and the related aspects of the quality of life.

**Keywords:** social-territorial disadvantage; inner land areas; land-urban multidimensional analysis; land urban economies; multicriteria analysis; land real estate market values

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## 1. Introduction

This paper is framed within a wider research project concerning the territorial disadvantage characterizing the inner land areas compared to the coastal metropolitan areas of Sicilia (Italy). On a wider scale (regional and national), these criticalities are due to the competition between territorial administrative units, which has been aggravating the territorial and socioeconomic imbalance in these territories.

This study aims at outlining an inter-scalar and multi-polar analysis evaluation model of the territory of the Province of Enna, Italy, (Figure 1), supporting a consistent axiological representation of the most relevant features of the territorial imbalance from the perspective of the human and urban capital asset that value they express.

Concerning these two forms of the social capital – and specifically regarding the effects of the progressive weakening of the former on the decaying of the latter – it should be noticed that all the components of the GDP (Gross Domestic Product) are involved in the displacement of the population towards the more developed urban areas.

New socio-economic prospects, which are as follows have been progressively transferred towards the richer areas: a greater supply of cheap labor, knowledge and skills, as well as – more recently –excellence; the increase in the demand for goods, services, and housing and payment of taxes. In addition, new public and private investments have been encouraged in the more developed territories and cities, whose companies have extended their market areas over the undeveloped ones. In fact, the progressively increasing territorial dis-equilibrium has been favoring the penetration of the weaker markets by these companies, which are also more likely to become monopolies due to the opportunity of differentiating their production, especially by practicing the “damaging quality”, to the detriment of the peripheral markets.

Concerning the integration of territorial (public and environmental) values and specific (local or private interests) ends, converging on the land, Colavitti et al. [1] remarked upon the prominent role of the urban general plan in respect to so-called “strategic planning”, which has replaced ends with means, and therefore fairness with cost-effectiveness and financial feasibility. The financialization of the real estate sector has extended access to real estate even to “non-owners”, thus increasing the ability of the real estate sector itself to influence planning. More generally, the new trends in the real estate sector stand out as one of the ways in which the economic sub-system prevails over the political one. As a result, real estate development does not integrate into the landscape. Furthermore, the authors, identify the cities network as the decisional interface between local development and global sustainability, as well as between the instances of urban capital assets and the shared prospects of human capital, namely, the environmental ones.

The environmental prospect of the relation between the urban and human dimensions of the social capital asset – meant as the part of the global social product that has been accumulating overtime in “artifacts and institutions” – has been sampled by Esposito et al. [2] by analyzing “the effects of the tertiarization process on urbanization-driven land consumption and the extent to which it can explain the complex relationship between growth and environment”. This is one of the most relevant risks that the weak territories run, and, once more, evidence of the prevailing effects of economic drivers over the political capacity to drive territorial development toward a landscape perspective. One of the most significant effects of economic growth regarding the relation between cities and territories is soil consumption, measuring the needs for locating housing, facilities, industrial assets and the related infrastructures. The authors find that the tertiarization of the economy – focusing on quality and services, rather than on quantity and goods – can contain soil consumption, thus standing as a more sustainable form of economic growth.

The transformation of the relationship between city and territory, driven by economic growth and the progress of private, public and integrated mobility, has always been interpreted considering the way populations and economies have been concentrated in dense areas or spread out in the rarefied space beyond the peripheries, according to the concepts of urbanization, suburbanization, counter-urbanization and re-urbanization [3].

Structural aspects of progressive socio-economic polarization, long-term environmental transformations and cyclical environmental fluctuations, such as natural disasters and pandemics, continue to stimulate the debate on new integrated localization models and the transformation of work and social relations that could be driven by digitalization, which encourage the repopulation of small abandoned urban centers.

This perspective is encouraged by the generalized recognition of the environmental issue, the overwhelming evidence for which has imposed the need for a progressive and structural ecological transition, triggered by unprecedented financial intervention by central governments, and by the prospect of initiating structural reforms in all strategic sectors of the state administration: taxation, health, basic training, research, land management, innovation, energy and digitalization.

As a specification of these wide prospects, this study proposes to identify the environmental issues affecting the relation between the city network and the territory as the set of circumstances leading to territorial-urban identity loss.

The thematic area of this research concerns the territorial imbalance in its problematic articulations in terms of “abandoned territories”, “internal areas”, “houses for one euro” etc. [4–16].



**Figure 1.** Geographic location of the Province of Enna.

Due to their complexity, these phenomena are usually seen through the thin opening of each of the different disciplinary niches that overlook them; each of them captures different specialized aspects connected, in turn, to the general perspectives of each disciplinary root: health, safety, sustainability, inclusion, responsibility, well-being etc.

The built heritage of the small hilly and mountainous towns – now inhabited by a few dozen families, mostly by the elderly – is characterized by “strong identity features which, however, seem to be heading towards extinction” [17].

The growing interest in the phenomenon of the abandonment of inland areas is also confirmed by the specialist literature, with multiple contributions on the topic of small urban centers [18–21] trying to interpret the causes of this phenomenon and propose redevelopment strategies.

The 2030 Agenda for Sustainable Development provides general measures regarding less developed areas (“11.c: Supporting less developed towns, possibly also providing technical and financial assistance, in constructing sustainable and resilient buildings using local materials”) [22,23] in the view of the prominent role that culture and heritage can play in sustainable development [24].

The Report on “Historic centres and the future of the country” from ANCSA (National Association of Historic-Artistic Centers) [25] provides an analysis of the vulnerability/resilience relationship of the 109 historic centers to the Italian provincial capitals. It provides rankings on the main 8000 Census indices from ISTAT (Italian National Institute of Statistics) relating to population dynamics, the composition of families, the aging of residents, the integration of foreigners, the adequacy of housing and employment. The comparisons between the indices calculated on the scale of the historic center and those relating to the rest of the municipal area, with reference to the average data on a national scale, are also of great interest [26–36].

The same study identifies guidelines regarding the enhancement of the relational space of the assets concerned and of the values at risk. The network of the historic centers

is identified as a territorial component "subject to integrated and coherent policies and interventions aimed at sustainability, preservation, regeneration" [37–65]

More generally, the ANCSA analysis underlines an overall lack of studies on historic centers: this is due both to the non-recognition of the economic value of this heritage, and the lack of coordination between institutions and regulations [25].

From the latter point of view, the study reports the ineffectiveness of some tools, specifically those aimed at small historic centers in inland areas, including the law of January 31, 1994 (law no. 97 "New provisions for mountain areas") [66]. On the other hand, the most recent "Law to save villages", 06/10/2017, n. 158 "Measures for the support and enhancement of small municipalities, as well as provisions for the redevelopment and recovery of the historic centers of the same municipalities" aims to support, through incentives, the development of small municipalities [67], even if, to date, it is cumbersome to apply (Decree of the Ministry of the Interior 10 August 2020) [68].

Although the ANCSA report is of great interest, it does not concern fragile territories, in particular small municipalities, focusing only on the provincial capitals [25].

The question of inland areas, as regards the relationship between historic centers, building expansion areas and rural territory, needs to be re-observed and reinterpreted within territorial and cultural contexts united by evident conditions of territorial disadvantage [69–73].

According to the recognized territorial and urban context value of these land units, planning is urged to identify and activate common strategies for all historic centers by creating new models and values – lifestyles and opportunities for meeting and exchanges – in an ancient site, home to knowledge, culture and traditions, thus removing it from oblivion and silence. [74–83].

The identification and recognition of the values from which to re-start are the premises of a new perspective on economic and social development for the reduction of territorial disadvantage [84–105].

By identifying the peculiarities, opportunities and criticalities of the territories, it is possible to re-inhabit the built heritage, as well as to re-build and re-live the social heritage of which it is a part. [106–109].

As for the issue of territorial disadvantage, the scope of the rebalancing policy known as the National Strategy for Internal Areas (NSIA) provides for support measures for the benefit of the territories affected by structural processes of depopulation and abandonment (1077 Italian municipalities and just over 2 million inhabitants) [110].

The problematic framework of this dilemma is articulated, in Italy, in the southern question, in the condition of the marginalization of disadvantaged areas, in the effects of territorial competition on all scales, in the city/countryside polarization, in the consequent "rurbanization" (that is the urbanization of the countryside) and in the more recent repolarization between large metropolitan areas and "second-class" territorial-urban fabrics. GDP, again, makes the real difference [111].

And COVID-19? One of the irreversible effects of home segregation in pandemic times was the crisis of the myth of human concentration in the small urban circumference, a myth that crumbled down when public space and, with it, human contact began to constitute not only a danger, but also the only target of the counter-offensive to the virus, which aimed to defend people and communities from contagion, as well as activities and economies from collapse. [112,113].

Even the openly (neo) liberal political systems did not hesitate to practice a war economy with authoritarian accents and centralist economic measures [114].

This is the background of this study on structured observation (data, information, indices, evaluations, correlations, interpretations) [115–121], by means of which it is possible to describe and represent the aspects of the "house-city-landscape system" at the provincial scale that are relevant in light of the possible relationships between the "armor" of the cities and the territory, in a turning point in which – precisely with reference to those municipalities that are becoming the symbols of the return to a more human urban

dimension – the scientific, economic and social community seeks the drivers of the hope that the tendency to abandonment can effectively – and in the short-medium term – be reversed.

In such a prospect, in fact, the city is more appropriately considered as a “condition”, or a “way of being”, rather than a mere territorial entity. As such, the urban condition has been assumed as a “sign” in a broader semantic field, within which it becomes the most significant explanatory unit of territory, which is, by definition, a social entity less dense in terms of “events” and “abilities to be worth”. The latter, in fact, are the drivers for the inversion of the development model outlined by the ecological transition: synergy between nature and culture, continuity of the house-city-landscape system, social inclusion and finally process integration as both an explanatory and planning premise.

The paper is organised into six sections:

- Section 2 presents the case study, starting from an overview of the general status of the overall land district of Enna as a whole and an in-depth analysis of the main territorial, societal, economic etc. characteristics of the municipalities;
- Section 3 introduces the methodological approach, proposing a hierarchical multidimensional model coordinating the five forms of the social-territorial capital asset;
- Section 4 describes the application in its double articulation: firstly on the scale of the cities network, and secondly on the scale of the city-territory relationship;
- Sections 5 and 6 propose some reflections on the centrifugal approach from city to territory, and about the role of evaluation within the overall analysis valuation planning-process in the face of the complexity of the redevelopment plan for the mitigation of territorial disadvantage.

## 2. Materials

### 2.1. The Study Area: General Issues

The object of this research is the representation of the value characteristics of the network of the 20 cities in the territory of the province of Enna defined by means of the extensive interweaving of territorial data representative of multiple conditions: human (population); material (housing); economic (production and work); real estate (volumes and prices) and income (income per capita). Such a representation is carried out by means of scoring, comparisons and rankings of the municipalities of this district.

The latter – despite the generally relevant abandonment phenomenon (–31% during the last 70 years) – still holds the most part of its own population within the urban centers. Due to the orography of the territory, which is mainly mountainous and characterized by the ridges of the Nebrodi, Erei and Madonie chains, the province of Enna has many of the typical characteristics of the urban centers of inland areas. These criticalities are part of the concern of the national territorial rebalancing policy known as the National Strategy of Internal Areas (NSIA), aimed at implementing support measures for the benefit of the territories affected by structural processes of depopulation and abandonment: this condition concerns 1077 of the 7904 municipalities in Italy, with a total of 2 million inhabitants. In particular, the territory of the province of Enna is excluded from the NSIA, although there are recognizable aspects of fragility, some of them demographic (Figures 1 and 2), economic and dimensional, as seven out of 20 municipalities can be considered as “small town centers”, therefore having less than 5000 inhabitants.

NSIA is “a place-based policy project, in which new ways of multilevel local governance are committed to an integrated approach oriented towards promotion and local development” [122]. The goal is to foster unexpressed local potentialities in accordance with the enhancement of the specificities (or uniqueness) of the local communities. In these territories, the most critical profiles of fragility and difficult accessibility have, on the one hand, strongly compressed the possibilities of adapting to the standards of contemporary lifestyles, while on the other hand they have been

preserving a sort of “constitutive inertia”. This resistance to transformation is due to genuine features that make these urban and landscape contexts stand out and justify differently valid reasons for remaining or returning there.

This perspective has supported the interest in this investigation, and the attempt to effectively organize the large amount of data from official sources. The robustness of these information profiles is entrusted to the fundamental categories of the science of economic-territorial evaluations (Appraisal) and to the more general economic category of capital. The category of capital assets is expressed in the two dimensions of value, the ability to supply flows of wealth (goods and services of various kinds) and the possibility that these flows accumulate and consolidate in stock-value.

These distinctive/assumptive categories are also applied with the same explanatory appropriateness to non-monetary value dimensions, and for this reason six different dimensions have been selected and described.

The set of surveys involved the entire provincial territory, though with different levels of detail and therefore with reference to study units on three different scales.

As mentioned, the priority interest in cities networks – and the prospect of further studies on historic centers that outline the reasons for “remaining/returning” [123] – has reversed the method of territorial investigation that began with the consideration of more detailed territorial units, namely, the Census Sections (SC). As a result, two areas of observation were identified:

- multiscale, with reference to the scale of the census sections of the cadastral microzones and municipalities;
- multidimensional [124], with reference to the six forms of territorial capital, that is, the different ability to be worth [125,126] expressed by the territorial units analyzed.

## 2.2. Early Overview of The Data Source

In a general sense, the following observations are aimed at suggesting an interpretative scheme of the weakening of historic centers with respect to the peripheral areas, of recent construction and with lower building density, which have been considered as some of the main premises of the urban good life in the more general background of territorial values.

The building density, if calculated with reference to the surface of the Census Sections, is very low, and this could be one of the reasons for the abandonment of old dwellings in favour of more accessible and open locations.

The indices that measure the location preference between Historic Center (HC) and Peripheral Areas (PA) of the Urban Area (UA). such as the Surface of occupied dwellings in the UA and CS, can be considered as:

- Complementary on the one hand, if the local inhabitants tend to move from CS to the more preferable life quality of the PA; in such a case, the discomfort attributable to the conditions of life in the HC as well as new opportunities in the PA converge, supporting an internal re-location pattern;
- Converging on the other hand, if the whole local and extra-local area is affected by a structural abandonment trend due to a deeper socio-economic discomfort, a general disaffection with traditional lifestyles, poor prospects for individual promotion and the desire for a relational space with a metropolitan imprint.

Two of the most relevant criticalities of this land district are indicated as follows.

Table 1 shows the population dynamics in the 20 municipalities since 1951, as well as the clear prevalence of Enna and Piazza Armerina, the only ones that exceed 20,000 inhabitants. Only three of the other municipalities exceed 10,000 inhabitants, while 9 municipalities have less than 5000 inhabitants.

**Table 1.** Population dynamics in the 20 Municipalities of the Enna District.

	1951	1961	1971	1981	1991	2001	2016
Agira	16,528	14,079	11,814	9146	9150	8348	8301
Aidone	10,106	8905	7551	7136	7275	6057	4852
Assoro	5563	5663	5167	5236	5319	5393	5135
Barrafranca	14,665	14,775	14,447	15,511	13,667	13,115	13,212
Calascibetta	8035	6956	5628	4837	5014	4829	4493
Catenanuova	3993	4406	4121	4420	5073	4876	4798
Centuripe	11,020	10,008	8172	6915	6612	5903	5416
Cerami	4652	4371	3427	3182	3100	2462	1979
Enna	27,263	28,323	28,189	27,838	28,273	28,983	27,586
Gagliano	5075	4846	4459	4172	4173	3772	3554
Leonforte	18,391	17,927	16,364	15,808	15,147	14,145	13,305
Nicosia	19,275	18,191	15,324	15,212	15,029	14,812	13,762
Nissoria	3438	3115	3032	3296	3152	3014	2992
Piazza Armerina	26,739	24,887	22,134	21,019	22,355	21,038	21,782
Pietraperzia	13,886	13,226	11,026	10,996	8015	7340	6919
Regalbuto	11,768	11,239	10,159	7621	7981	7744	7233
Sperlinga	1552	1432	1216	1053	1065	963	783
Troina	14,075	13,066	11,853	11,052	10,406	10,061	9310
Valguarnera	15,592	13,829	11,167	10,252	9171	8649	7774
Villarosa	11,059	9882	6881	6237	6205	5696	4866

Table 2 summarizes the ten-year percentage demographic balances, which are negative in most of the 20 cities except for Enna (+ 0.2%) and Catenanuova (+ 3.4%). In the face of these modest increases, considerable decreases stand out in all the other municipalities (min -12.9%, 1st quartile -10.6%, median -7.0%, 3rd quartile -2.9%, max 3.4%)

**Table 2.** 10-Years population variation rates in Enna District.

	1951–1961	1961–1971	1971–1981	1981–1991	1991–2001	2001–2016	Average
Agira	-14.8%	-16.1%	-22.6%	0.0%	-8.8%	-0.6%	-10.5%
Aidone	-11.9%	-15.2%	-5.5%	1.9%	-16.7%	-19.9%	-11.2%
Assoro	1.8%	-8.8%	1.3%	1.6%	1.4%	-4.8%	-1.2%
Barrafranca	0.8%	-2.2%	7.4%	-11.9%	-4.0%	0.7%	-1.5%
Calascibetta	-13.4%	-19.1%	-14.1%	3.7%	-3.7%	-7.0%	-8.9%
Catenanuova	10.3%	-6.5%	7.3%	14.8%	-3.9%	-1.6%	3.4%
Centuripe	-9.2%	-18.3%	-15.4%	-4.4%	-10.7%	-8.3%	-11.0%
Cerami	-6.0%	-21.6%	-7.1%	-2.6%	-20.6%	-19.6%	-12.9%
Enna	3.9%	-0.5%	-1.2%	1.6%	2.5%	-4.8%	0.2%
Gagliano	-4.5%	-8.0%	-6.4%	0.0%	-9.6%	-5.8%	-5.7%
Leonforte	-2.5%	-8.7%	-3.4%	-4.2%	-6.6%	-5.9%	-5.2%
Nicosia	-5.6%	-15.8%	-0.7%	-1.2%	-1.4%	-7.1%	-5.3%
Nissoria	-9.4%	-2.7%	8.7%	-4.4%	-4.4%	-0.7%	-2.1%
Piazza Armerina	-6.9%	-11.1%	-5.0%	6.4%	-5.9%	3.5%	-3.2%
Pietraperzia	-4.8%	-16.6%	-0.3%	-27.1%	-8.4%	-5.7%	-10.5%
Regalbuto	-4.5%	-9.6%	-25.0%	4.7%	-3.0%	-6.6%	-7.3%
Sperlinga	-7.7%	-15.1%	-13.4%	1.1%	-9.6%	-18.7%	-10.6%
Troina	-7.2%	-9.3%	-6.8%	-5.8%	-3.3%	-7.5%	-6.6%
Valguarnera	-11.3%	-19.2%	-8.2%	-10.5%	-5.7%	-10.1%	-10.9%
Villarosa	-10.6%	-30.4%	-9.4%	-0.5%	-8.2%	-14.6%	-12.3%

Table 3 shows the population variation rates in progressively decreasing time periods up to the period 2001–2016 and the average rates.

**Table 3.** Progressive population variation rates in the District of Enna.

	1951–2016	1961–2016	1971–2016	1981–2016	1991–2016	2001–2016	Average
Agira	−49.8%	−41.0%	−29.7%	−9.2%	−9.3%	−0.6%	−23.3%
Aidone	−52.0%	−45.5%	−35.7%	−32.0%	−33.3%	−19.9%	−36.4%
Assoro	−7.7%	−9.3%	−0.6%	−1.9%	−3.5%	−4.8%	−4.6%
Barrafranca	−9.9%	−10.6%	−8.5%	−14.8%	−3.3%	0.7%	−7.7%
Calascibetta	−44.1%	−35.4%	−20.2%	−7.1%	−10.4%	−7.0%	−20.7%
Catenanuova	20.2%	8.9%	16.4%	8.6%	−5.4%	−1.6%	7.8%
Centuripe	−50.9%	−45.9%	−33.7%	−21.7%	−18.1%	−8.3%	−29.7%
Cerami	−57.5%	−54.7%	−42.3%	−37.8%	−36.2%	−19.6%	−41.3%
Enna	1.2%	−2.6%	−2.1%	−0.9%	−2.4%	−4.8%	−2.0%
Gagliano	−30.0%	−26.7%	−20.3%	−14.8%	−14.8%	−5.8%	−18.7%
Leonforte	−27.7%	−25.8%	−18.7%	−15.8%	−12.2%	−5.9%	−17.7%
Nicosia	−28.6%	−24.3%	−10.2%	−9.5%	−8.4%	−7.1%	−14.7%
Nissoria	−13.0%	−3.9%	−1.3%	−9.2%	−5.1%	−0.7%	−5.5%
Piazza Armerina	−18.5%	−12.5%	−1.6%	3.6%	−2.6%	3.5%	−4.7%
Pietraperzia	−50.2%	−47.7%	−37.2%	−37.1%	−13.7%	−5.7%	−31.9%
Regalbuto	−38.5%	−35.6%	−28.8%	−5.1%	−9.4%	−6.6%	−20.7%
Sperlinga	−49.5%	−45.3%	−35.6%	−25.6%	−26.5%	−18.7%	−33.5%
Troina	−33.9%	−28.7%	−21.5%	−15.8%	−10.5%	−7.5%	−19.6%
Valguarnera	−50.1%	−43.8%	−30.4%	−24.2%	−15.2%	−10.1%	−29.0%
Villarosa	−56.0%	−50.8%	−29.3%	−22.0%	−21.6%	−14.6%	−32.4%

Further aspects of the territorial-urban fragility related to population dynamics concern the housing occupation rate, based on which the different municipalities can be compared from the point of view of the abandonment trend; the latter is one of the fundamental and original drivers of the relationship between urban quality and quality of life, as it transforms significant portions of the built heritage, which is sometimes of significant architectural value, into empty shells and redundant forms.

The inversion of “price/value semantics” and “monetary symbolization” – which culminated in the real estate paradox of “one-euro houses” – overwhelmed the concreteness and iconicity of the house – that is to say, its “intrinsic value” as an artefact that “is worth in itself”. On the supply side, the production, this value has become autonomous concerning the rarity of materials, components, specialist expertise and overall value of the building tradition. On the demand side, the use, this iconicity has been standing with reference to two basic aspects: functional, such as safety and symbolic, such as social identity, according to which the value of the house is the privileged means of self-representation; these two archetypes reflect on the different ways the relationships between construction system, typology and urban context become architectural language, showing the anthropological profile of local communities in the overall urban dimension, and therefore the forms of the social dialectic and the degree of common values and destinies.

The ISTAT sources relating to 2001 and 2006 on the census sections scale report data whose selection and combination provide the individual profile and the comparative framework of the different municipalities from the point of view of the “housing value” of the urban built heritage, analyzed with reference to densely built-up areas and, in more detail, to the historic centers.

Some data and attributes (in direct or normalized form) are reported aiming at an outlining the overall framework of the province territory, but from the point of view of the quality of the urban aggregates.



By projecting these observations onto a territorial scale, further connections and correlations between the urban and land dimensions have been carried out with reference to social, economic, entrepreneurial and real estate variables (Tables 4,5).

Table 4 shows the distribution of the Enna land district population between the 20 municipalities.

Table 5 displays the comparison between the towns belonging to this territorial community from the perspective of the population concentration rate within the urban areas and old towns related to two age indices. These early findings significantly depend on the general territorial structure of each municipality – land surface size, number of inhabitants, orography, accessibility etc. so that they have been successively connected to the structured mass of the further information characterizing towns and municipalities, from the points of view of the five forms of capital identified.

This early observation shows a possible correlation between the number of residents and their distribution within the municipal territory, and a lower concentration in the main urban center. Similarly, the concentration of the population within the old towns is somehow connected to both the average old age of residents, and to the size of the recently developed areas compared to those of the old towns.

**Table 4.** Data and indices concerning the distribution of the Enna land district population between the 20 municipalities.

	Residents in UA	Population concentration in UA	Residents in HC	Population concentration in HC	Old age index UA (%)	Average age UA (years)
Agira	7701	91%	5060	66%	81	38
Aidone	4929	100%	773	16%	124	44
Assoro	4872	91%	1553	32%	83	39
Barrafranca	13,393	96%	669	5%	90	40
Calascibetta	3802	82%	1241	33%	98	36
Catenanuova	4702	94%	137	3%	68	38
Centuripe	5098	91%	4547	89%	109	40
Cerami	1995	93%	776	39%	137	42
Enna	24,003	86%	5432	23%	109	39
Gagliano	3427	92%	1019	30%	121	41
Leonforte	13,878	100%	3886	28%	80	41
Nicosia	11,306	79%	3781	33%	89	35
Nissoria	2422	82%	634	26%	69	34
Piazza Armerina	18,169	82%	7731	43%	80	35
Pietraperzia	6832	95%	1358	20%	104	41
Regalbuto	6811	92%	2868	42%	95	39
Sperlinga	596	72%	127	21%	116	33
Troina	9081	94%	2946	32%	117	42
Valguarnera	7611	93%	5109	67%	88	39
Villarosa	4744	92%	1920	40%	97	40

Table 5 provides a selection of the main information units connecting some societal issues to location preferences between the old towns and the peripheral urban areas (SU). This information cluster expresses weak trends of abandonment of the old towns likely connected with the higher rate of education (therefore to higher incomes) and to larger families.

**Table 5.** Data and indices showing the distribution of the UA (Urban Area) population between SU (SUburbs) and HC (Historic Center).

	<b>% High Education Level UA</b>	<b>Families Average components UA</b>	<b>Building Cubage index HC</b>	<b>Building Cubage index SU</b>	<b>% inhabite d housing area in UA</b>	<b>% inhabited housing area in HC</b>
Agira	28%	2.22	1.41	0.0045	55%	35%
Aidone	38%	2.35	1.41	0.0034	70%	11%
Assoro	27%	2.24	1.45	0.0059	62%	20%
Barrafranca	31%	2.48	2.44	0.0424	66%	3%
Calascibetta	30%	2.04	2.26	0.0073	45%	15%
Catananuova	30%	2.34	2.33	0.0635	78%	2%
Centuripe	31%	2.15	1.44	0.0007	68%	61%
Cerami	30%	1.99	1.22	0.0031	57%	23%
Enna	41%	2.20	2.11	0.0107	61%	13%
Gagliano	32%	2.17	1.53	0.0088	56%	16%
Leonforte	30%	2.57	1.82	0.0148	81%	21%
Nicosia	29%	2.01	2.03	0.0078	56%	18%
Nissoria	28%	1.98	0.49	0.0074	55%	14%
Piazza Armerina	36%	1.95	1.80	0.0108	54%	23%
Pietraperzia	28%	2.29	4.59	0.0174	30%	6%
Regalbuto	32%	2.21	1.42	0.0062	54%	22%
Sperlinga	24%	1.72	1.10	0.0021	55%	10%
Troina	35%	2.23	1.72	0.0074	62%	21%
Valguarnera	30%	2.33	1.90	0.0514	72%	48%
Villarosa	31%	2.32	1.06	0.0119	58%	25%

Based on the different indicators reported in the above tables, the 20 Municipalities of the Enna Province are compared to each other by means of rankings displayed in the synopsis of Figure 2.

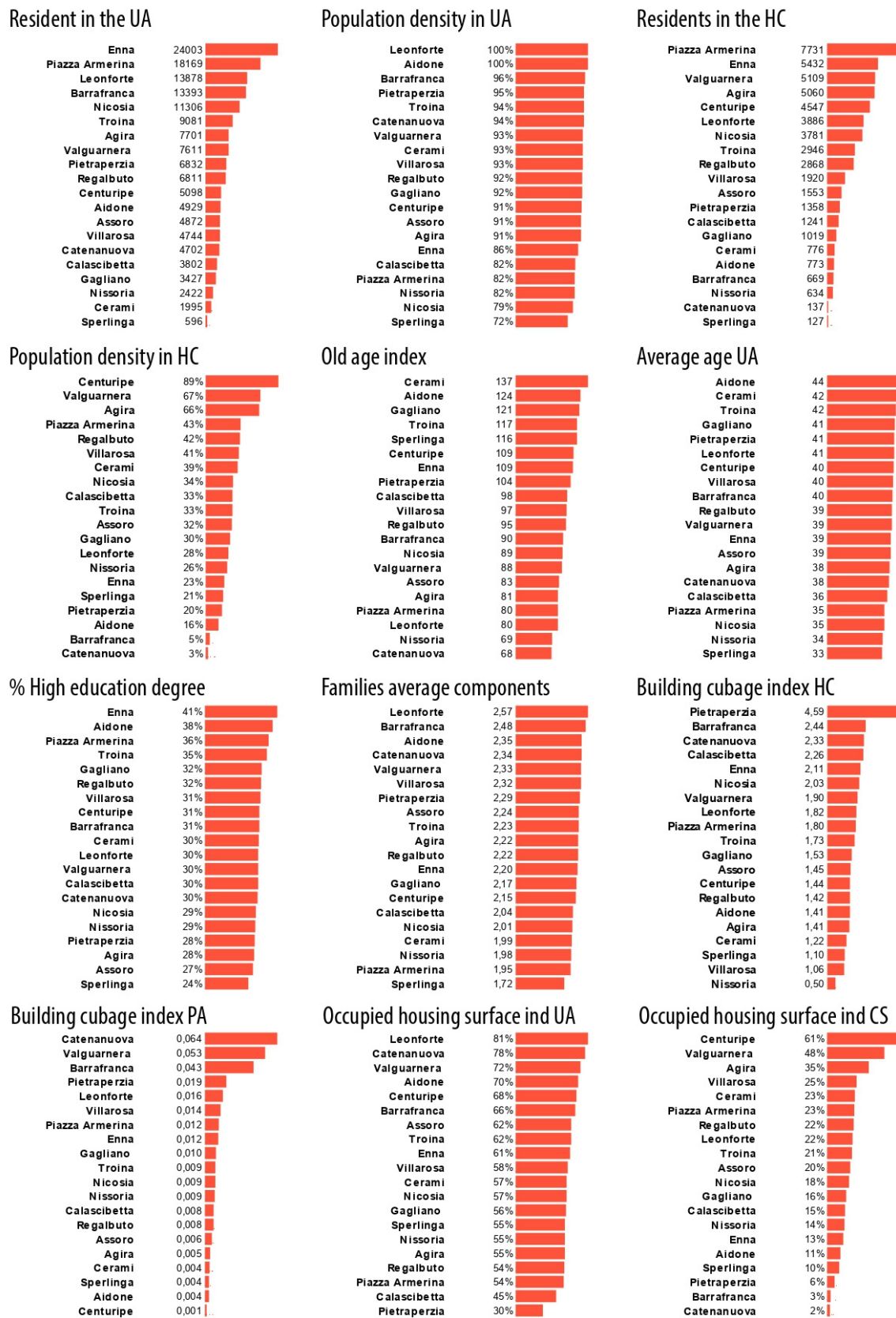


Figure 2. Rankings of the Municipalities from the perspective of the location territorial equilibrium indices.

### 2.3. Territory and Vulnerability

A more general overview of territory, assumed here as the overall background of a global concept of life quality, comes from the judgment on vulnerability provided by the Italian National Institute of Statistics (ISTAT) through a special section, 8000 Census, providing 99 information units (data and indices), referring to the census of the population and housing from 1951 to 2011, enriched with new sections and aggregated by themes: Population, Foreigners, Families, Housing, Education; Employment, Mobility, Vulnerability.

The 99 indicators selected make it possible to trace an unprecedented profile of the territory, both for the adoption of original indicators, capable of giving new responses to the need of knowledge for local government action (such as the social and material vulnerability index) and for the re-elaboration of more traditional indices, made comparable in historical series thanks to the reconstruction of the basic data [127–133].

The social and material vulnerability index is an indicator constructed with the aim of providing a synthetic measure of the level of social and material vulnerability of Italian municipalities.

It is a tool capable of expressing the different aspects of a multidimensional phenomenon with a single value, and which, thanks to its easy reading, facilitates territorial and temporal comparisons.

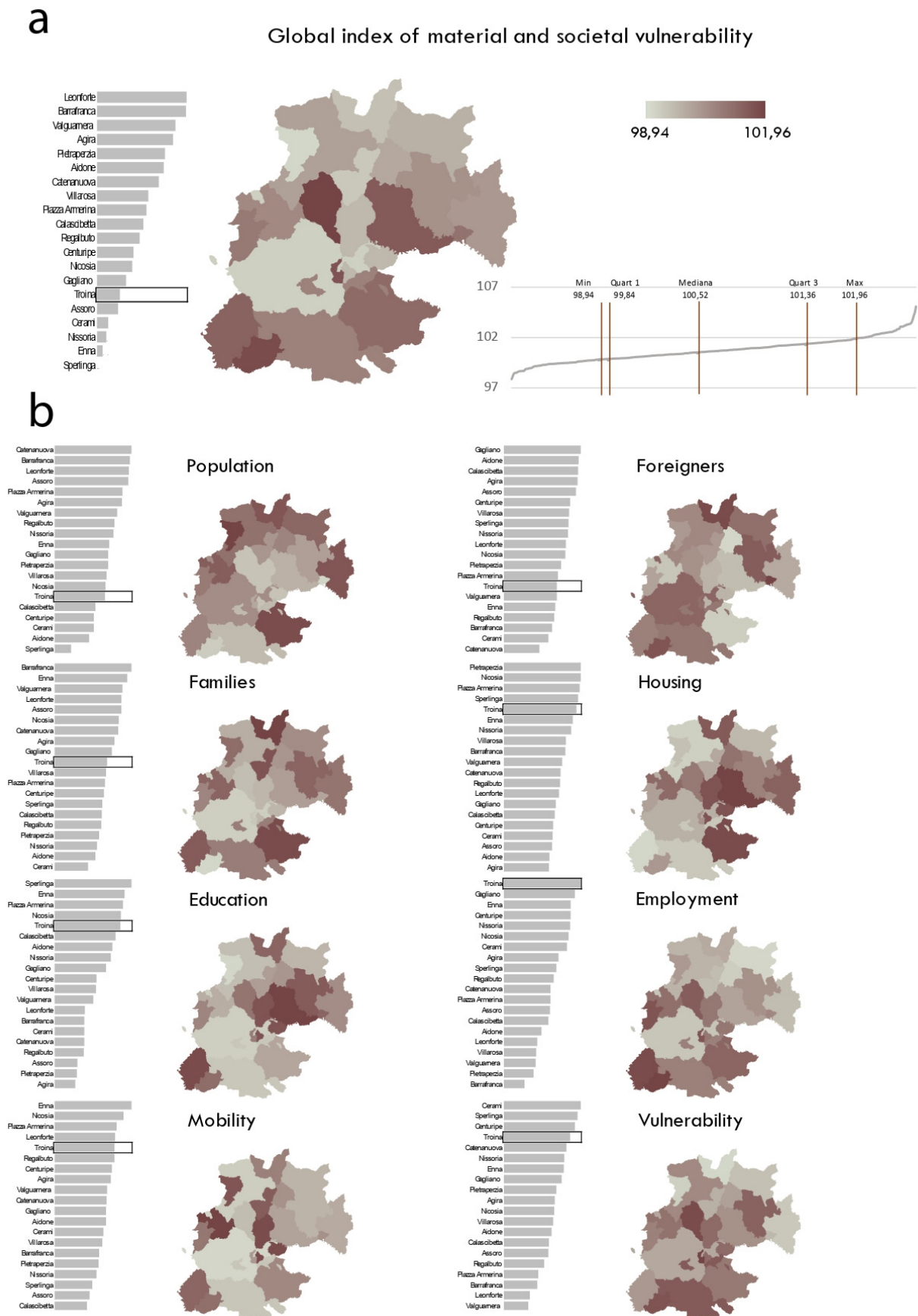
The index is constructed through the combination of seven elementary indicators that describe the main material and social dimensions of vulnerability. The values obtained, associated with the position in the national ranking, provide useful elements for identifying potential critical areas. The methodology used for the construction of the vulnerability index is based on the hypothesis of the non-"substitutability" of the various components, and allows the production of a synthetic index that is not compensatory and comparable over time in "absolute" terms.

The measurement of this phenomenon requires a preliminary conceptual definition, carried out through the decomposition of the general concept into its main components of meaning.

By social and material vulnerability we commonly mean the exposure of some segments of the population to risky situations, understood as the uncertainty of their social and economic condition. The index values measure different degrees of exposure among the population to vulnerable conditions that do not necessarily refer to an actual situation of hardship.

The main dimensions considered are degree of education, family structures, housing conditions, participation in the labour market and economic situation.

The territorial framework of vulnerability is represented in Figure 3, through a general map (on the left) and with specific maps for each of the eight matrices (on the right). Next to each map, the ranking of the 20 municipalities, referring to the theme represented, is displayed.



**Figure 3.** Rankings of the Municipalities from the perspective of the location territorial equilibrium indices (numerical values under the colour ramp): a. overall score; b. scores for each detailed index.

#### 2.4. *The Forms of the Land Capital Asset*

The dataset includes 464 elementary information units that express quantitative and qualitative absolute and relative measures (rates and indices), arranged in space and time and allowing comparisons between territorial units and progressively aggregated assessments, converging towards a more synthetic characterization of the territory articulated in the following five forms: human capital, economic capital, territorial capital, income capital and city capital.

##### 2.4.1. Human Capital Asset

The characterization of the forms of Human Capital collects the 99 indicators in the 8000Census section of the Istat, aimed at the assessment of material and social vulnerability and following its articulation regarding issues related to the population, the presence of foreigners, the size and composition of families, the adequacy of housing and the degree of education, work, mobility and vulnerability considered in a more specific sense.

##### 2.4.2. Economic Capital Asset

The characterization of the forms of Economic Capital gathers 177 indicators ordered with reference to the Ateco 2007 aggregations of the sectors, which are as follows: primary, the Agricultural Capital; secondary, the Manufacturing Capital; tertiary, the Capital of Communication and quaternary, the capital of creativity.

##### 2.4.3. Income Capital

The characterization of the forms of Territorial Capital in Volume and Value integrates the Istat database with that of the Real Estate Market Observatory of the Revenue Agency. In particular, reading through volumes integrates absolute and percentage measures relating to the physical size of the territories and their composition in terms of the degree of urbanization; the reading by values makes more specific reference to the building stock considering its testimonial value and therefore its age, and the economic value based on real estate prices in the articulation of the different types and OIREM (Observatory of the Italian Real Estate Market) Micro-zones.

##### 2.4.4. An In-Depth on Territorial Capital: the Real Estate Capital Asset

A significant part of Territorial Capital, Real Estate Capital assets assume great importance both in epistemic and operative terms. In this research, this form of capital has been represented in its two forms, material and quantitative, with reference to the consistency of the patrimonial assets used for the calculation of the degree of transformation of the territory, and in its monetary form with reference to the official market prices provided for each homogeneous area and for each type.

In view of the formation of a “Cadastré of Values” in place of the “Income Cadastré” that has always characterized the inventory of real estate present on the Italian territory, the Land Agency, Established by Legislative Decree 30 July 1999, n. 300, this tax agency was incorporated into the Tax Revenue Agency (TRA) with the decree-law of 6 July 2012, n. 95 [5] - converted into law no. 135 [134].

Furthermore, TRA has taken over the management of the Observatory of the Italian Real Estate Market (OIREM), an information system that allows the consultation of data on real estate prices (prices and rents per unit of surface area) throughout the country.

The OIREM data are aggregated by:

- Microzones: B, C, D, E, R;
- Typology: Civil dwellings, Economic dwellings, Boxes, Industrial warehouses, Typical warehouses, Laboratories, Warehouses, Shops, Offices, Structured offices, Villas and cottages;

Other information concern:

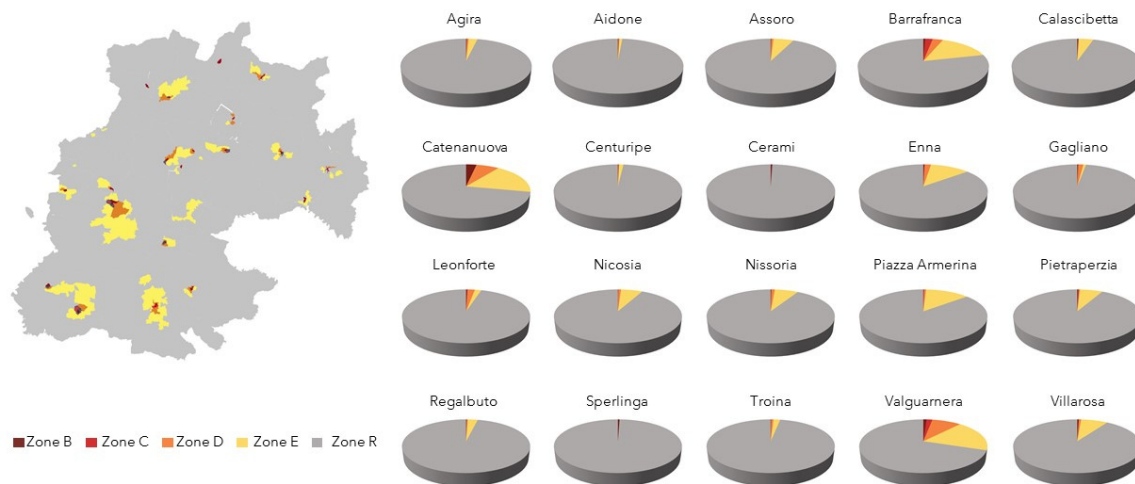
- State of conservation
- Unit prices and rents;
- Minimum, average and maximum quotations returned with reference to the normal or excellent state of maintenance.

The OIREM microzones of the Province of Enna are now 109.

The real estate values have been provided since 2001 every six months for each micro-zone, by functional type and by state of conservation.

The mapping of OIREM real estate values in the province of Enna was carried out with two levels of aggregation, the first by municipalities, the second by microzones, and in two directions, diachronic and synchronic.

In Figure 4, the map of the retail real estate values of the municipalities is shown as an example. The graphs display the proportions between the extensions of the different micro-zones with reference to the total of the municipal area. The municipalities of Valguarnera, Catenanuova and Barrafranca have a higher ratio due to the small municipal land. In particular, Barrafranca has the lowest degree of urbanization due to the large municipal land area, which is approximately five times as much as the average; this indicates a much more consistent development of the territory compared to the other two municipalities.



**Figure 4.** OIREM Micro-zone classification, and distribution of the urbanization of the municipality degree. An OMI zone is a territorial portion that reflects a homogeneous sector of the local housing market: B central, C semi-central, D peripheral, E suburban, R rural. The pie charts show the percentages of the OIREM Micro-zone in the municipal areas.

### 3. Methods

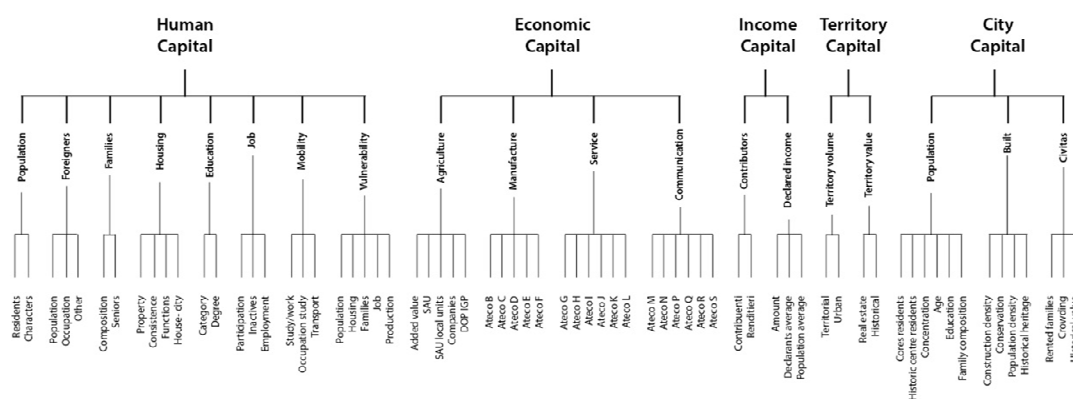
From a methodological point of view, this research is an experiment regarding the coordination of the regimes of description, evaluation and interpretation of territorial information units of different types and at different scales. The principle that justifies and addresses this experiment is the essence of value and, more specifically, the axiological direction implicit in the concept of territorial imbalance, in particular of socio-economic disadvantage, seen not so much from the point of view of the articulation of social subsystems, but rather from the point of view of local communities, and therefore of the

urban identities that make up the network of cities in a territory identified from a geographical, administrative and anthropic point of view.

The cognitive functions of description, evaluation and interpretation involved in this process were selected based on 1. the explanatory possibilities of the model, 2. the intermediate objectives and 3. the ultimate aims of a territorial evaluation aimed at the perspective of reducing territorial disadvantage.

The model has the form of a dendrogram, a hierarchical model that aggregates around a limited number of general terms of value (interpretative layer), a multiplicity of attributes specified by sets of indicators (evaluation layer) and indices, or elementary relationships, internally coherent and externally heterogeneous (descriptive layer) (Figure 5).

This structure allows firstly the placement of a single fragment of information bearing value (meaning) in an unambiguous way, and secondly to associate it with a measure of relative importance with respect to all the others, according to its significance in the overall equilibrium of the descriptive, evaluative and interpretative statement.



**Figure 5.** The dendrogram for the description, valuation and interpretation of the life quality within the territorial-urban relational space of the Province of Enna.

The large number of these elementary units of information coming from the official sources, in the absence of such a structure, does not allow decisions to be made in the process of protection and enhancement of the structural components of the territory, such as the socio-economic drivers based on which wealth is created and consolidated in fixed social capital [135].

With the aim of investigating the relationships between the "city effect" and the territorial context - both referring to the socio-economic category of capital [136] - a descriptive model organized on two different levels was created, aggregating the elementary indices in two ways:

- The level of "raw data", i.e. the measures of each phenomenon in itself ordered by groups;
- The level of "information", connecting the elementary measures to the value of the territorial capital based on the form to which they refer.

The vertical crossing of this hierarchical structure [137]:

- from top to bottom - through a process of progressive disaggregation of general forms of capital in terms of particular value - generates an orderly knowledge and places the detailed information term in a coherent taxonomy;
- from bottom to top, progressively turning indices into evaluations and aggregating [138] them into scores which step by step become more meaningful. The descriptive model turns data into information.



- Aggregation by groups does not identify any relationship between the indices other than by nature (population, work, housing, income, real estate values); these indices, taken individually, have a quantitative significance at a low informative level. Many of them use others of the same group and therefore not all of them are independent from each other; consequently, the significance of their simple aggregation by weighted averages could be affected by the “weight” they assume, as they are also indirectly involved in the formation of other indices.

The data used for the subsequent evaluation of the City system in the Enna area have different forms, such as:

- The nature of the data, and therefore the contents of the measures;
- The unit of measurement;
- The reference, i.e. if it concerns:
  - “stocks”, i.e., indices in a broad sense, i.e., absolute magnitudes (territorial surface, resident population, number of employees, total income);
  - “ratios”, i.e. indices in the proper sense, quantities referring to a specific delimitation;
  - “temporal values”, i.e. stocks or relationships referring to a specific period;
  - “monetary values”, different from the previous ones as abstract entities, ultimate consequences of concrete circumstances – the corresponding socio-economic drivers – and furthermore capable in turn of influencing the same premises, therefore of retroacting the causes.

Consequently, their representation can have meaning:

- In itself, if it refers to the same index characterizing the other study units;
- Beyond itself, if referred to other indices, therefore having relevance with respect to the other study units, but by means of a multiplicity of attributes.

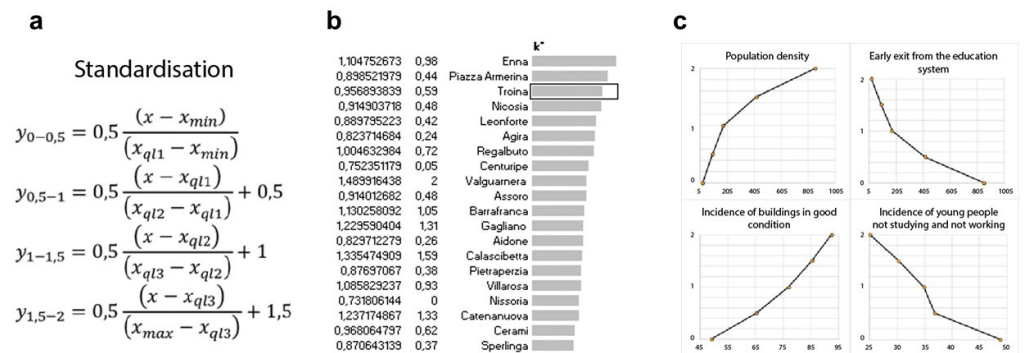
The representation of all these measures is proposed by consistency and by indices in view of the subsequent creation of information and therefore of the measurement of values.

In particular, for the representation of the measures having a meaning “beyond oneself”, their “alignment” was carried out according to a standard measurement scale, choosing the most effective one from time to time, based on three different normalization procedures, two ones linear, another one a polyline (Figure 6):

- The first one normalizes the different measures in an interval of scores defined between 0 and 2; in this case, 0 refers to the lowest value, and 2 to the highest recorded among the different study units, the municipalities; the defect of this representation consists in not taking into account the effects of the distribution of the measurements among the study units;
- The second, also linear, called “normalization Z” or “standardization”, is a procedure “which leads a random variable distributed according to a mean  $\mu$  and variance  $\sigma^2$ , to a random variable with a “standard” distribution, i.e. a mean zero and variance equal to 1”. Consequently, the minimum and maximum values, respectively negative and positive, are not fixed as in the previous case, but only the average one (0);
- The third normalizes the different measures in an interval of scores defined in this case, as in the first one, defined between 0 and 2, but according to a polylinear relation, according to which the score varies within intervals defined by five thresholds referred case by case to the values of the indices recorded for all municipalities:
  - a. 0.0 is associated with the minimum value;
  - b. 0.5 is associated with the value of the first quartile;
  - c. 1.0 is associated with the value of the second quartile (median);
  - d. 1.5 is associated with the value of the third quartile;
  - e. 2.0 is associated with the maximum value.

Finally, depending on its uses, normalization can be applied by orienting the polarity or not, thus accounting for the positive or negative relationship between the variation of

the index and that of the score. The orientation of polarities involves the sphere of value judgement, which does not concern the application of statistical functions.



**Figure 6.** Sample of polylinear standardization: a. standardization formulas; b. the ranking of municipalities based on k\*; c. indicators normalized according to the standardization formulas.

### 3.1. Cardinal Approach

The affirmation of the status of values in more complex decision-making activities, such as those that support planning [139] (Kahn, 2012), and in a more general sense the project, has extended the scope of knowledge of utility to hope for values and therefore from the Multi Attribute Utility Theory (MAUT) to the Multi Attribute Value Theory (MAVT) [140].

The MAVT provides methods to structure and analyse decision problems by means of "decision trees" (dendrograms), and to elicit the relative importance of the criteria in this structure.

In an attribute tree, the overall objective is hierarchically divided into underlying sub-objectives (called criteria) and lower-level measurable attributes, also called "leaf criteria".

An alternative  $x$  is evaluated from the point of view of each attribute  $i$ , by means of a function of value  $v_i(x)$ . In case of mutual independence of preferences between attributes, it is possible to proceed with a standard additive aggregation. Therefore, the overall value of an alternative is given by the sum of the products of all attributes for the relative weights [141]:

$$V(x) = \sum_{i=1}^n w_i v_i(x) \tag{1}$$

where  $n$  is the number of attributes,  $w_i$  is the weight of the attribute  $i$  and  $v_i(x)$  is the value function for the single attribute that reflects the performance of the alternative  $x$  with respect to the attribute  $i$ .

The sum of the weights is equal to 1 and the score is normalized between a minimum value of 0 and a maximum value of 2.

Weights measure the relative importance of each of the attributes compared to the others [142].

The MAVT can be used to form preference orders between alternative actions in choice problems involving a finite and discrete set of alternative actions to be evaluated basing on conflicting objectives. The model, in fact, assigns to each alternative a number,  $V(x)$ , obtained as explained above.

The MAVT can use quantitative and qualitative data; if quantitative data are not available, it is possible to resort to judgments by experts.

Since the MAVT aggregates the performance of the options from the point of view of the different criteria, to form an overall valuation it can be considered a compensatory type technique [140].

The formation of a MAVT model is divided into the following phases [142]:

- Definition and structuring of the main objectives and associated criteria;
- Identification of alternatives;
- Attribution of scores to each alternative from the point of view of each criterion;
- modelling of preferences and evaluation of substitution ratios (trade-off): elicitation of the value functions associated with each criterion and attribution of weighting factors;
- Ordering of alternatives: an aggregate score is calculated for each alternative.

The value function is the analytical representation of the human judgment on the option considered, starting from the analytical description of the value system of the subjects involved in the decision.

In particular, a value function translates the performance of the alternatives into scores that represent the extent to which a goal is achieved by each option [143].

Many approaches have been proposed in the literature to define value functions [144]. In particular, the following techniques have been proposed: direct rating; "curve fitting"; bisection; standard differences; parameter estimation and semantic judgments [141].

As for the weighting factors, the literature proposes different methods, it being unanimously recognized that the meaning and validity of the weight system are crucial to avoid improper use of the MAVT and therefore the procedures for defining them should not be independent from the way of using them.

In the MAVT approach, which is an additive approach, the weights are scalar constants that allow the functions of the marginal value to assume value in the same interval.

Weights, or scalar constants, can be attributed using different techniques, generally belonging to two families: numerical estimation and comparison. The ordinal procedures, direct weighing and swing-weights belong to the first one, while the trade-off technique belongs to the second one [145–147].

According to the original end of this study, which is the axiological mapping [148–154] of the Province of Enna in terms of the aggregate value of territorial capital in its different dimensions of value, the phases of the application of the MAVT are specified as follows:

- Representation of the identities of the main study units, i.e. the municipalities, instead of alternatives;
- Arrangement of the criteria dendrogram, having as root criteria the five forms of capital: Human, Economic, Territorial, Income, City, and as leaf criteria the indices coming from the different sources, connected at the root by their specifications (branches) consistent with the aforementioned forms of capital;
- Attribution of the leaf scores to each territorial unit by means of the polarized polylinear normalization of the indices referring to their variation ranges of these within the municipal territory, by means of comparison with the values of all municipalities of the entire provincial territory;
- Attribution of the weighting factors to the root criteria;
- Calculation of the scores at the level of the root-criteria by aggregation of the leaf-points;
- Calculation of the overall score attributed to each municipality by aggregation of the scores attributed at the level of the root criteria;
- Ordering of the territorial units based on the overall score attributed with the scalar product between the vector of the aggregated scores and the vector of weights: a total score is calculated for each alternative by means of the overall score.

### 3.2. Ordinal Approach

Parallel to the cardinal approach, which is substantially additive and therefore takes into account the distance in terms of the difference in score between different study units from the point of view of each criterion, a procedure based on comparisons between different municipalities based on their place in the ranking was applied. The model counts the number of times an alternative is in first, second, ..., last position by assigning a score inversely proportional to this position itself (20 for the first place in the ranking, 1 for the last place) and ordering the alternatives based on this new score.

## 4. Application and Results

### 4.1. Urban Network Quality Indices of the Civil Capital

By means of the analysis by census sections, new indices have been defined, starting from the comparison and aggregation of data and elementary indices, both by Census Section, and subsequently by Municipalities, in order to measure and map the fifth form of capital: – the City-Capital.

- The latter form of Share Capital includes clusters of indices referable to the population (Human Capital), the buildings - the housing complex only (Urban Capital) -, and finally the relationship between these two entities (Civil Capital).
- The Human Capital includes aspects of the entity, concentration and qualification (Age, Education, Composition of families) of the residents, distinguished by:
  - residents in the Historic Center;
  - residents in Urban Areas;
  - residents in the remaining part of the municipality;
- The Urban Capital, with reference to the size, density, state of conservation, population density and age of:
  - Urban nuclei;
  - Historic centers;
- The Civil Capital, with reference to the ownership of houses, to the degree of crowding and to the testimonial value, that is, to the degree of preference of location in:
  - Urban Areas;
  - Historic Centers

The calculated indices have been listed as follows:

- IV1 - Old age index 1 - is the ratio between +65-years-old and -20years-old residents. IV1 is also calculated for the UA only;
- EM - Average age - is the weighted average of each age group (terms) based on the number of residents (weights), divided by the total number of resident;
- CMf - Average composition of families - is the weighted average of the members (1,2, ... 6 and more) of households (terms) based on the number of families in each section (weights), divided by the number of families of each Census Section;
- AbOccS\* - Average occupied dwelling area - is the ratio between the surface area of dwellings occupied by at least one resident and their number;
- AbOccS% - Percentage of occupied housing surface area;
- EdVol - Building volume - is the product of the housing area by 3.2 m height;
- 2EdVal - Value of the urban landscape – is the index resulting from the aggregation of the third level indicators concerning the building types (in this case, traditional building types are valued in comparison to contemporary ones); number of floors of the buildings (a higher weight is associated with one storey buildings); building dating (the number of buildings constructed prior to 1960 is valued);
- EdDens - Building density – is the building volume divided by the surface of the Census Section;
- EdData <1945% - is the percentage of residential buildings prior to 1945;

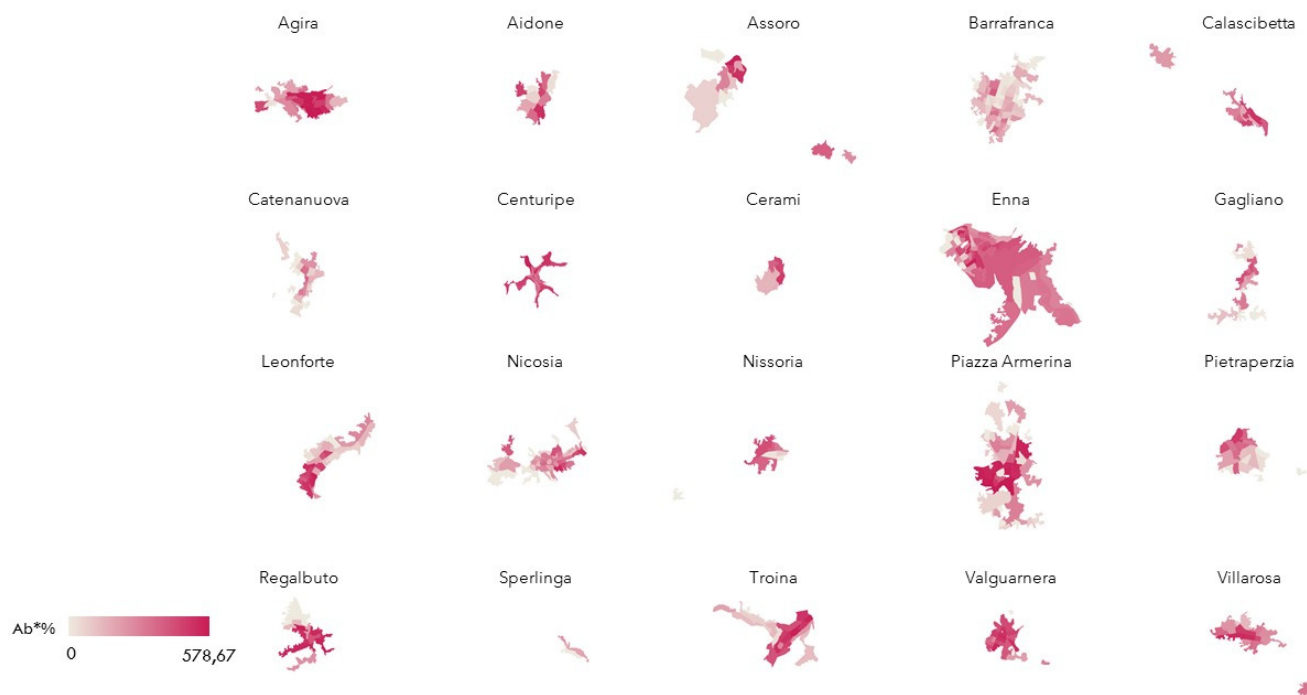
- $P * CS$  - Population/historic center: Testimonial value, which is the product of residents by the percentage of residential buildings prior to 1945;
- Sezcensval HS - this index measures the degree of preference for the historic center based on the following relations: if the population of the section is high and the number of buildings prior to 1945 is low, it is likely that the majority of residents located in this section prefer new buildings because there are fewer old buildings; if, on the other hand, the population is small and the buildings constructed prior to 1945 are many, it means that in that section the old buildings have been abandoned; if the population is large and the buildings constructed prior to 1945 are many, it means that the population prefers to settle in the historic center; if, on the other hand, the population is small and the buildings constructed before 1945 are a small number as well, it means that residents do not like to settle in areas where contemporary buildings prevail. Ultimately, in both cases, a low index indicates a low preference for the historic center, whereas a high index indicates a high preference for a location in the historic center.
- EdStConsB is the ratio between buildings in a good and excellent state of maintenance and the total building number (edbuono/TOT);
- EdStConsC is the ratio between buildings in a poor and mediocre state of conservation and the total building number (edCAT/TOT);
- Pistr% is the ratio between residents with a degree and a high school diploma and the total number of residents.

The indices calculated for the entire Province were mapped on the QGIS platform at the level of the Census Sections, and on the scale of the Urban Areas used for the assessments of Human Capital, Urban Capital and Civil Capital.

The simple indices can be variously interpreted according to the size and wealth of cities and the density or stratification of the areas quantities are referred to.

#### 4.2. The City-Capital: Human and Urban Capital

The question of the attractiveness of historic centers has highlighted significant correlations between different dimensions of Urban Capital and Human Capital on the scale of the Census Sections of each municipality. The Testimonial Value of each Urban Area was calculated (Figure 7), considered as the willingness to settle in the consolidated urban fabric, then calculated as the ratio between the resident population in the CS and the percentage of buildings erected prior to 1945. By relating the Testimonial Value to indicators that represent the consistency and quality of Human Capital, such as the level of education of the population, the old-age index or the composition of families, some interpretations of the loss of interest in internal areas can be hypothesized, especially for the less accessible historic centers with relevant issues of internal mobility.



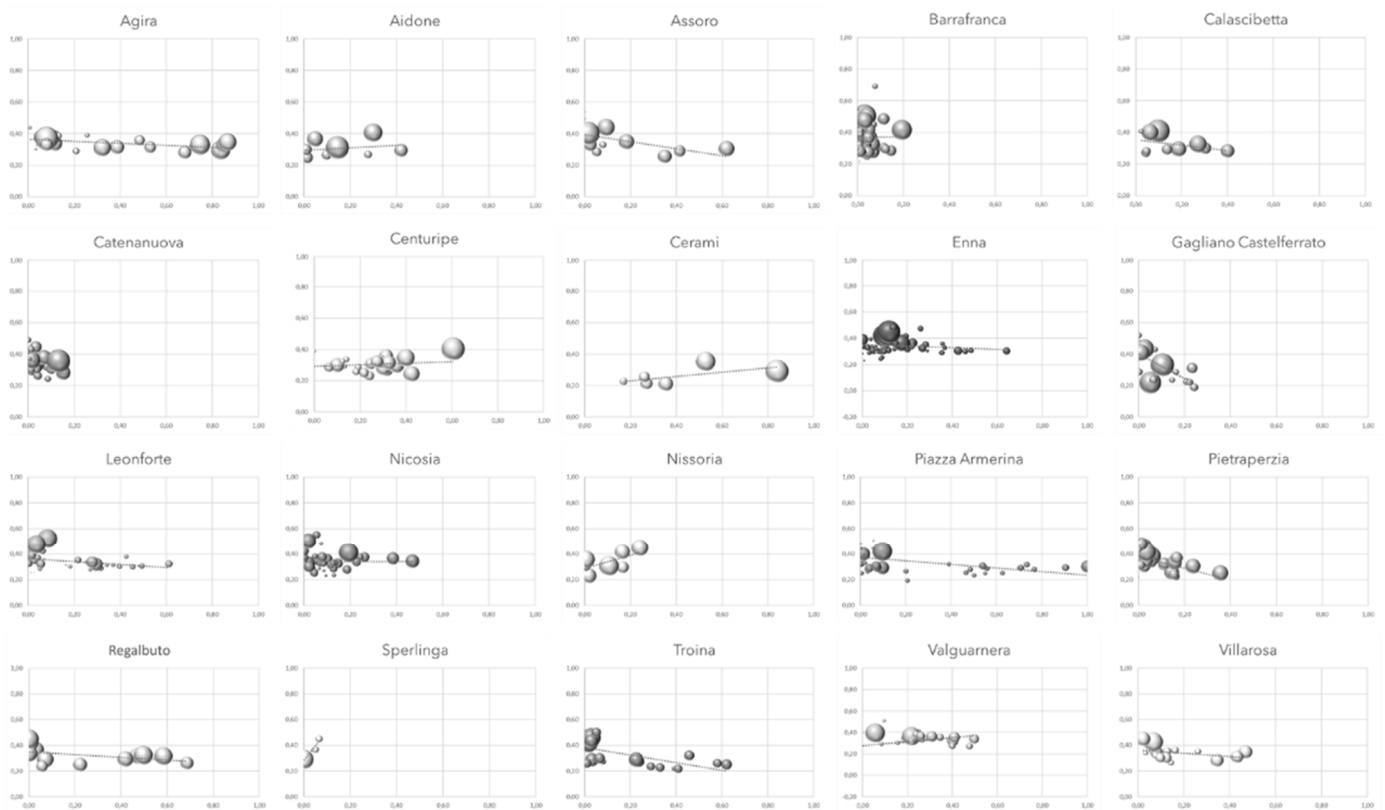
**Figure 7.** Map of the Testimonial Value on the scale of the Census Sections in the 20 towns of the Enna Province. The Testimonial Value is the product of the number of residents and the percentage of residential buildings erected prior to 1945. This index measures the degree of preference for the historic center. A darker red colour corresponds to a higher value.

Another index, useful for the purpose of describing a significant relationship between aspects of urban capital and human capital, is the ratio between rented households and total population (Figure 8). This index encompasses multiple aspects and certain dualities as regards the relationship between social position and urban profile, concerning level of income, stability of employment, roots in the territory, real estate market values, the state of maintenance of the built heritage which, where better, is more suitable for renting, job opportunities, the range and degree of development of the business fabric, and the panorama of opportunities for individual promotion. Considering that the lighter colour corresponds to a low concentration of rented households, in smaller, less developed municipalities with a lower level of real estate market values, the concentration of rented households depends on low income, whereas in the richer and complex towns like Enna, the larger number of rented households depends on the city effect, mostly given by the presence of some significant economic and educational drivers, particularly the University.



**Figure 8.** Map of the concentration of the rented households rate on the scale of the Census Sections in the 20 towns of the Enna Province. The darker brown area indicates the maximum value.

Among the many correlations that have been carried out for the purpose of a coherent interpretation of the quality profile of the urban space and the quality of life in the cities of the Enna area, the relationship between the average size of a household in the Urban Areas and the corresponding Testimonial Value is represented in Figure 9, showing a generalized, albeit weak tendency on the part of larger families to settle in less central areas.



**Figure 9.** Each graph shows all the Census Sections of the corresponding municipality. On the abscissa is the testimonial value, on the ordinate is the average size of families and the bubble size measures the surface area of the Census Section.

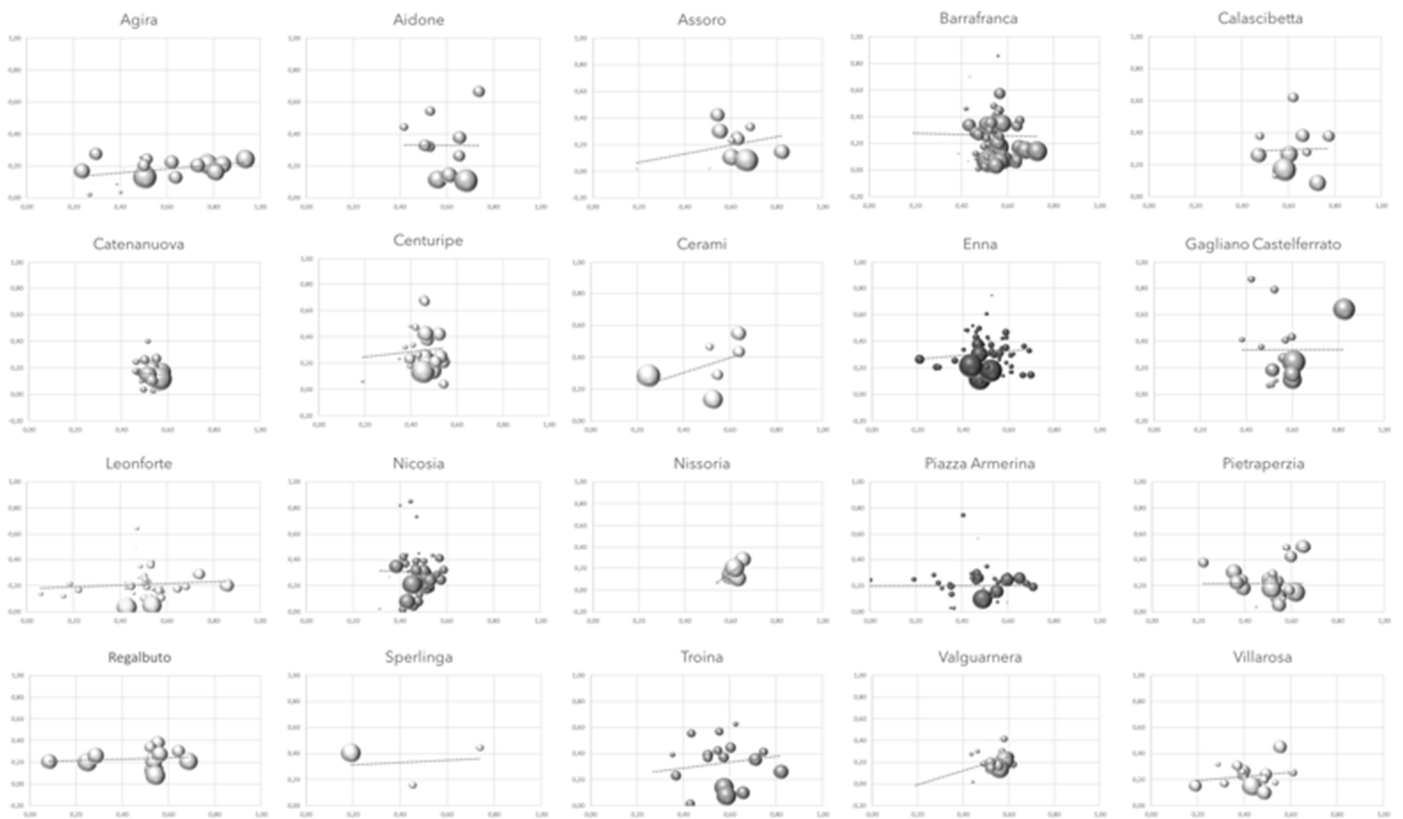
The proposed correlations show that the families with a lower average number of members remain in the CS with a higher testimonial value. Conversely, the larger and younger families tend to settle in the most recent peripheral areas.

In general, the graphs that allow the comparison of the municipalities, and are limited to the area of urban nuclei, from the point of view of the relationship between the level of education (indirectly linked to the level of income, data not available at the level of analysis of the census sections) and the tendency of residents to settle in the historic center, provide useful information on the system of location preferences according to the socio-economic status of residents. [155–157].

An opposite trend to the previous one, which concerns the reasons why historic centers become attractors of human capital capable of containing the tendency to abandonment, concerns the relationship between the old-age index and the quality of the urban landscape. The latter was calculated with reference to various aspects that characterize historic centers, in particular the presence of older buildings, the reduced standard building size, the building concentration (usually greater in contexts characterized by small buildings) and public spaces on a human scale.

The correlations represented in Figure 10 reveal a generalized tendency of the elderly population to remain in historic centers, and more generally in the most qualified areas characterized by the prevalence of original environmental-urban values, which are at present perceived by younger people as well.





**Figure 10.** Relation between urban-landscape value (abscissa) and old-age index (ordinate) over the 20 municipalities; the bubble size measures the surface area of the Census Section.

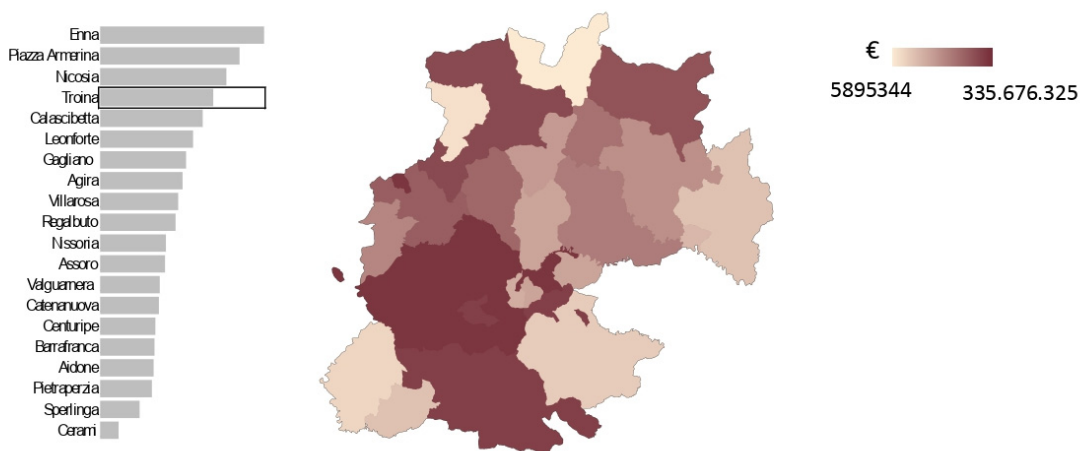
#### 4.3. Cities and the territory

The hierarchical model summarized by the dendrogram in Figure 5 constitutes the structure of possible ordered comparisons and correlations between specific aspects of the quality of urban space and aggregate values of the different matrices of the quality of living that are expressed on the territorial scale.

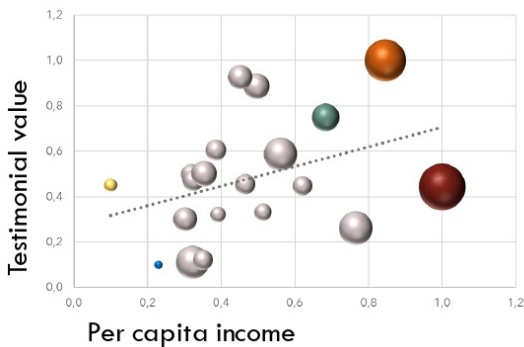
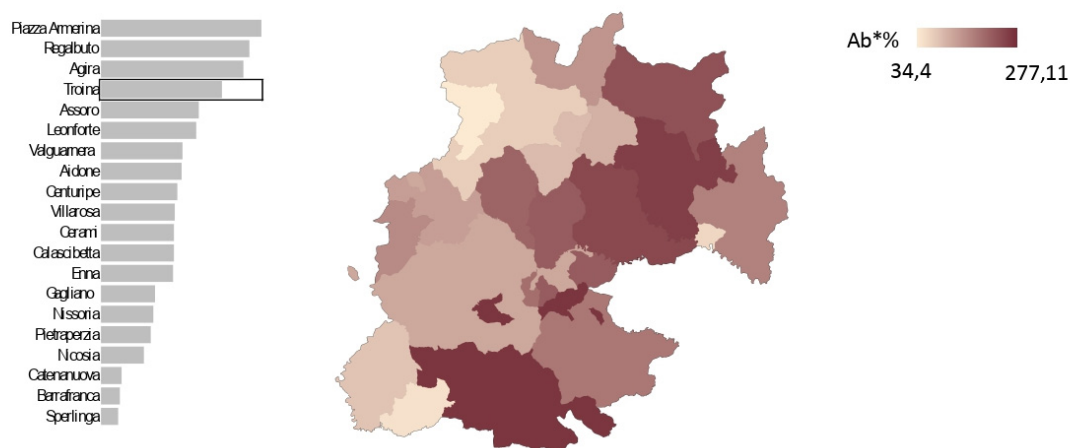
The most significant evaluations, obtained at the various levels of the cognitive process, can be compared to verify possible trade-off relationships, convergence and complementarity between the variables. These correlations can cross different forms of capital (correlation between criteria of city capital and economic capital) or different levels of the dendrogram by differently combining correlations between leaf/branch criteria, branch/root criteria and leaf/root criteria.

Two comparisons of great interest for the present purposes concern the relationship between per capita income and testimonial value (Figure 11) and that between Economic Capital and Testimonial Value (Figure 12), which show to what extent the richest local communities express a lower tendency to abandon the old towns.

### Per capita Income

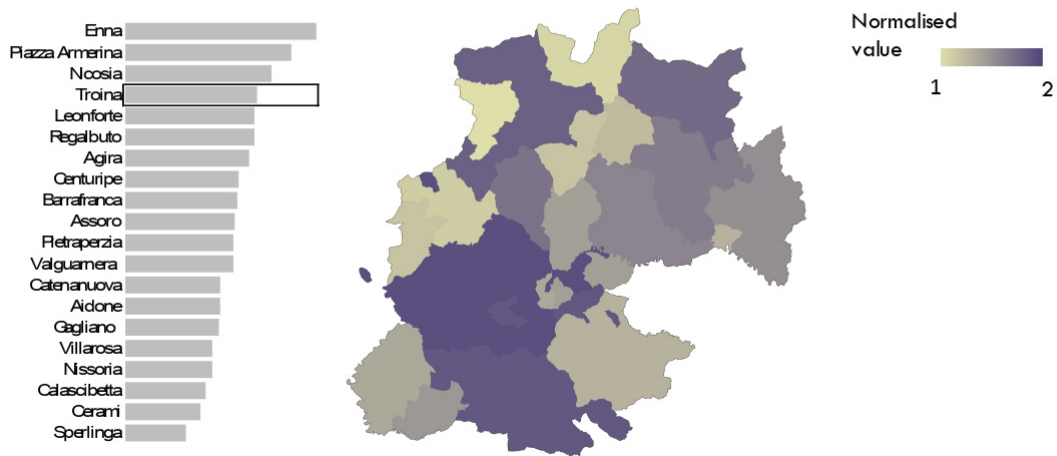


### Urban area testimonial value

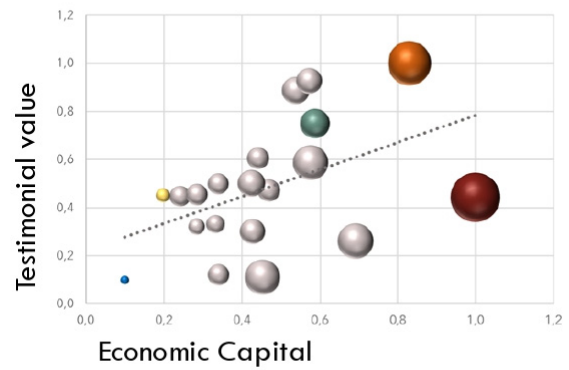
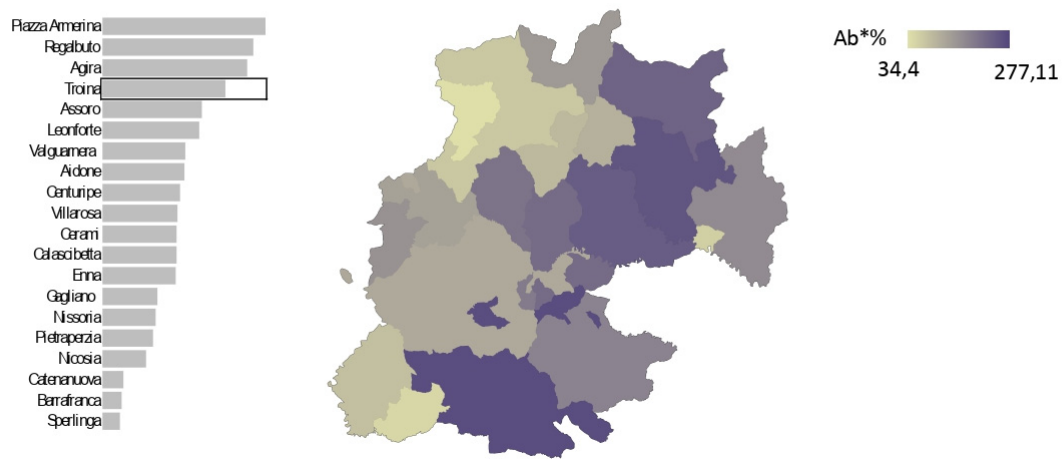


**Figure 11.** Maps and correlations of Per capita income and Urban area testimonial value in the 20 municipalities (numerical values under the colour ramp).

### Economic Capital



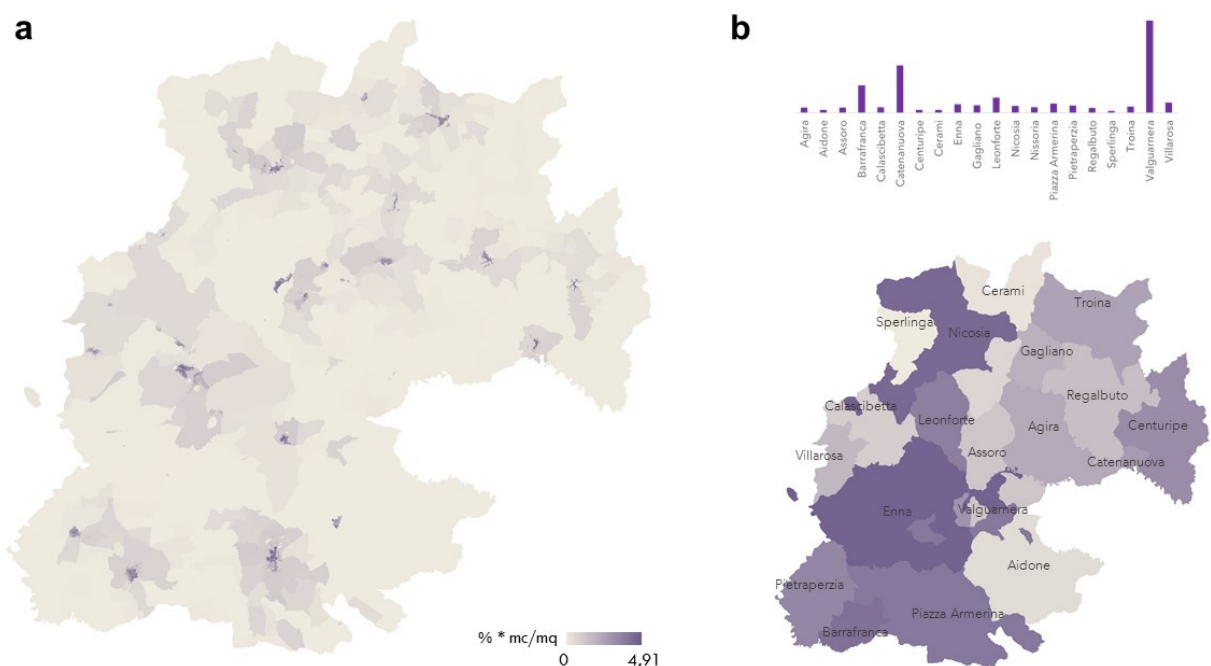
### Urban area testimonial value



**Figure 12.** Maps and correlations of Economic capital and Urban area testimonial value over the 20 municipalities (numerical values under the colour ramp).

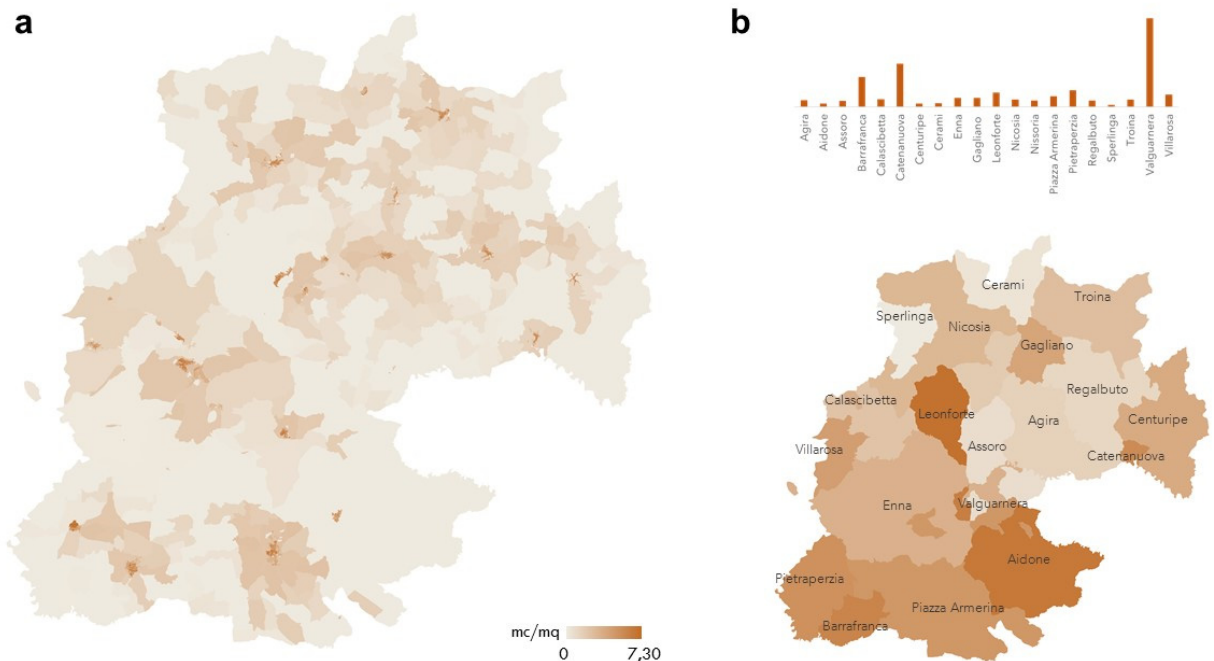
A further exploration of the relationship between the city network and the provincial territorial dimension was carried out by comparing the density values of the human and urban capital by means of representations at the two levels of detail, namely, the Census Sections and the Municipal administrative units.

As for human density, measured by means of the Building utilization rate (Figure 13), the underutilization of the housing stock in urban areas indicates poor attraction to the urban areas themselves. In reference to the peripheral areas, it indicates either that the new buildings do not meet residential needs or lifestyles, or that they are characterized by very large housing units; in reference to the old towns, it denotes that the general poor state of maintenance and the difficulty of access discourage settling in areas of high testimonial value.



**Figure 13.** Building utilization rate on the double scale of the Census Sections (a) and Municipalities (b) (numerical values under the colour ramp).

An index complementary to the latter is the building density (Figure 14), which is also mapped at the two levels of detail. The comparison with the previous human density indicator supports further in-dept analyses concerning the degree of redundancy of the building stock and the impact of this area of inefficiency in terms of unfairness of the development model on a territorial scale, especially if compared to the other indices and criteria.



**Figure 14.** Building density index on the double scale of the Census Sections (a) and Municipalities (b) (numerical values under the colour ramp).

## 5. Discussion

This experience has continued a path of studies, research and creation of cognitive and evaluative models, started at the beginning of 2020 with the object of the inter-scalar territorial analysis aimed at the structured knowledge of the territory and the cities through a critical approach coordinated in the logic of economic evaluation, and therefore based on comparison and oriented by constant reference to the “order of values” [158–178].

In the research process, consequently, the distinction between knowledge, evaluation and planning perspective has dissolved, since the mass of data and information that constituted the raw material of this modelling required itself to be sub-ordered to an end, not only taxonomic or, at least, cognitive, but aimed at supporting the local communities’ identity as well as facing the trend towards abandonment.

Compared to previous experiences carried out in this research field, the present one overturned the perspective, initially centripetal, i.e. from territory to city, making it centrifugal, i.e., from the network of cities towards the territory. Therefore, if earlier on the territory was intended as a semantic field around a still nebulous thematic framework, now the clarity of the issue of examining the “urban dimension” of the inner land areas, usually so far from the metropolitan lifestyle, identifies the city network of a “territorial koine” as the whole support for the re-identification of the underdeveloped territories. [179–181].

The way in which this research was intended to structure the knowledge of this territory is based on the reduction of territorial and economic information into significant units selected, compared and connected to multiply the original information base [182–189].

The differentiated availability of data that in this experience have been coordinated enriching the explanatory capacity of the model created and extended, has in several cases highlighted some limits and criticalities related to the coherence of surveys and their tabular reduction (creation of integrated databases), as well as the limit of the graphical

rendering, which is sometimes ineffective in rendering small-scale phenomena with extended study units.

The ultimate aim of supporting land planning by defining some correlations between the main strategic variables involved different layers of the analysis, thus crossing leaf, branch and root criteria as dependent and/or independent variables.

Some limitations of this analysis concerned the aggregation degree of the branch criteria and above all of the root criteria, due to the valuation pattern chosen (Multi Attribute Valuation Theory), which is of the additive type. Therefore, some significant variables may not have been considered adequately.

Nonetheless, the knowledge of the most relevant aspects of the social, economic and territorial situation of the Enna province allowed us to select the most likely correlations, thus reducing the effects of the compensation of opposite scores that could invalidate the significance of influent characteristics of some territorial units.

To improve the scientific soundness of this early research, mostly intended to create a valuative taxonomy of the territorial information, a further future study will involve the application of the Principal Component Analysis so as to aggregate and then synthesize the most relevant variables by eliminating the redundant ones.

A further novelty of this research was the use of the Geographic Information System, which in future insights and extensions will be able to overcome the aforementioned limits with the “spatial join” functions to filter and aggregate information [190–199] and network analyses to add to the official survey aspects related to accessibility; the latter, in this case, is an issue of great impact on territorial relations, in the field of real estate values and for the measurement of the criticalities affecting a less accessible town [200].

## 6. Conclusions

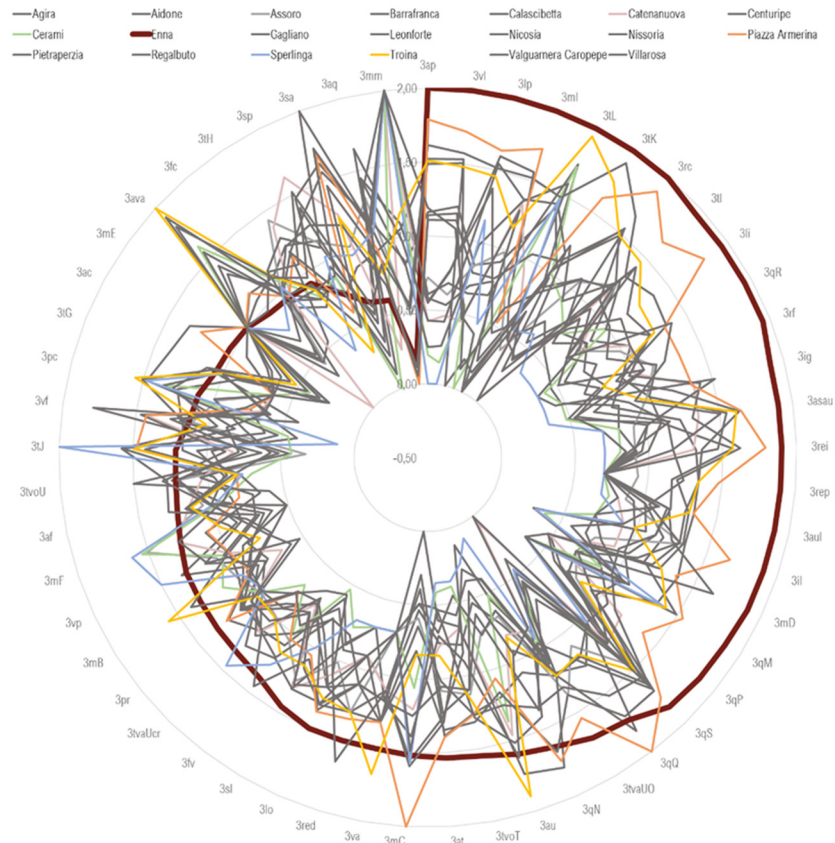
This study was motivated by the search for a coordination between evidence and decisions in the field of urban planning.

From this perspective – in the specific disciplinary field of economic-estimative evaluation – this research continues the commitment to create tools to support the motivations, methods and measurements of the harmony between preservation and transformation of the inner areas.

The contents of these studies are stratified in the accumulation of values of the existing features – natural and artificial – which are running the risk of being overwhelmed by forms of development that are indifferent and often superimposed on them.

This type of study, therefore, has purely argumentative purposes that encounter and address the complexity of territorial systems and the difficulty of representing them in the abstract, in the face of a growing interest in the concreteness of the issues of territorial imbalance, vulnerability, impoverishment and abandonment. [201–203].

From this perspective, Figure 15 represents in two complementary radar graphs the comparative synopsis of the performances of these urban and territorial systems; on the left are the 11 most populous ones, while on the right are the 9 least populated ones. This type of comparison does not provide any detailed information, nor does it describe or easily quantify the measure of the territorial, economic, or urban performance of the municipalities, but it gives an effective overview of the positioning of each municipality in a structured semantic field, represented by an impressive database based on which measurements, evaluations and interpretations have been elaborated.



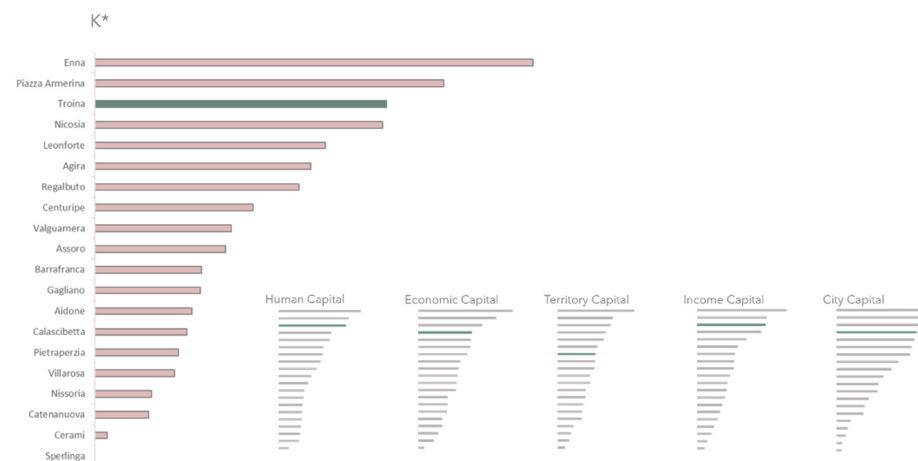
**Figure 15.** Representation of the structured comparisons between the performances of each of the twenty municipalities.

The organization and internal coherence of the model, its exportability and the possibility of comparing all components to each other by making each component the benchmark of the others have proved to be important functions to develop useful skills for structuring comparative relationships and expanding the spectrum of curiosities.

The basic hypothesis of any analysis structured in an evaluation model is that it can support choice processes between alternative actions and differently characterized (evaluated) actions from the point of view of a multiplicity of criteria representative of different languages and axiological instances. In this case, this hypothesis supports the idea that the municipalities of the province of Enna can confront each other from all points of view and, finally, a multiplicity of rankings can be drawn up.

In particular, each system of weights represents a basic strategy, therefore creating a vision that in turn supports a mission and has an implicit political-decision-making and therefore also a planning value. In this sense, a system of weighting factors attributes greater or lesser importance to the criteria, and within them to the sub-criteria, according to the prevalence of interests and values shared or deemed relevant by the decision maker. The system of weights, however wide the margins of discretion with which they are attributed may be, declares the points of view, the perspectives and the intentions both at the scientific level of the analyst and the evaluator and – even more so – at the political level of the decision maker. Some types of rankings are exemplified below, each with its own meaning and therefore with different outcomes regarding the indication of the areas of the territory or the nodes of the city network, to which greater or lesser attention should be paid in the political decision-making process (Figure 16).





**Figure 16.** Ranking of the Municipalities basing on the overall normalized score  $k^*$  and the partial valuations from the points of view of the five forms of social-economic capital asset.

Some conclusive considerations can be aimed at a basic epistemological perspective of this study, and its rooting within an unamendable and resilient matrix, namely, the thermodynamic one.

A socio-territorial system is by definition an open system both in thermodynamic terms (it exchanges matter, energy and information), and in logical terms (it adapts its cognitive apparatus to changes in the environment).

The order level of a system depends on the balance between entropic outflows and neg-entropic incoming flows [204]. Entropy has an origin and a cause:

- the origin is the natural tendency towards long-term thermodynamic equilibrium, which consists in the cancellation of differences, therefore in a condition of non-usability of the energy existing in the system, that means in a condition of molecular disorder;
- the cause is the transformation of the energy existing in the system into mechanical work that produces entropy flows, which accelerate the degradation process that must be compensated for by incoming neg-entropy flows.

The analyses and evaluations so far addressed to the urban territorial systems of the province of Enna have provided results that can be interpreted in the light of this matrix on the basis of which two opposite trends face each other:

- "being form" - in this case with reference to the five forms of capital studied and mapped - concerns organization, that is, neg-entropic or anabolic tension; capital is an economic category capable of self-reproducing and therefore of maintaining constant volume and value, or increasing these through the creation of income flows (neg-entropy), i.e. flows of wealth whose surplus is above costs (for subsistence), accumulate in capital value;
- "being shapeless", that is, not having the necessary tension to trigger dissipative processes capable of creating forms even if at an increasing entropic level.

It is also possible to point out that dissipation is a necessary but not sufficient condition for the creation of form, so if it is true that there cannot be form without dissipation, the opposite is not true, that is, dissipation guarantees order.

By transferring these simple and initial theoretical considerations to the level of the urban form, and by comparing two municipalities characterized by different and opposite combination levels of being form (aggregate value of socio-territorial-urban capital) and being formless (degree of vulnerability), the municipalities of Enna, on the one hand, and Sperlinga, on the other, which occupy the two extremes of the double ranking drawn up with reference to the decreasing values of being form (aggregate capital value), it can be considered that:

- Sperlinga records the minimum values of being form and minimum values of being shapeless; this apparent contradiction can be interpreted in the light of the minimum



entropy production theorem: “For systems close to equilibrium, the production of entropy is minimum at steady state” [205,206];

- Enna, on the other hand, records the maximum values of being form and minimum values of being shapeless; this is consistent with the third law of thermodynamics, which explains the functioning of closed systems, referred to above, and clarifies how to keep the value of capital high in all its forms. It is necessary to trigger and keep alive dissipative processes whose governance - that is, the maintenance structures that allow the transformation of energy to produce mechanical work with a high degree of energy efficiency - guarantees the maintenance of the imbalance between system and environment.

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