

A WELL-BEING MEASUREMENT APPROACH FOR RANKING ITALIAN MUNICIPALITIES¹

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1. Introduction

In recent years, the measurement of multidimensional phenomena has become increasingly important in the scientific community. Socio-economic phenomena cannot be measured by a single descriptive indicator but should be represented with multiple dimensions. Phenomena such as development, poverty, well-being, etc. require multiple dimensions in order to be measured, the "combination" of several dimensions, to be considered together as components of the phenomenon (Mazziotta and Pareto, 2013). This combination can be achieved by applying methodologies known as composite indicators (Salzman, 2003; Mazziotta and Pareto, 2011; Diamantopoulos *et al.*, 2008). The publication, in September 2009, of the Commission's report on the measurement of economic performance and social progress (Stiglitz Commission) was crucial to develop several studies on 'Beyond GDP' scenarios. The objective of the Commission was to identify the limits of GDP as an indicator of economic performance and social progress, consider what additional information might be needed for the production of more relevant social progress indicators, assess the feasibility of alternative measurement tools, and discuss how to present statistical information in an appropriate way. In Italy, the first report on "Equitable and Sustainable Well-being" (BES) of the Committee composed of Istat (Italian Institute of Statistics) and CNEL (National Council for Economy and Labour) was published in March 2013. It consists of a dashboard of 134 individual indicators distributed in 12 domains. In the three BES reports, published in December 2015, 2016, 2017, composite indicators have been calculated at regional level and over time for the 9 result domains, creating a unique precedent in official statistics at international level. The Italian Parliament approved in 2016 the reform of the Budget Law, in which the BES indicators will be included in the Economic and Financial Document (DEF). The new legislation also requires that by 15 February each year, the Parliament receives a report from the Minister of the

¹ The paper is the result of the authors' work; in particular, sections 1, 2 and 3 are written by Livia Fioroni, sections 4, 5, 6 and 7 are written by Valeria Quondamstefano.

Economy on the evolution of the BES indicators The project, from national, is becoming local and already several local authorities, despite not having legislative obligations, are studying the indicators of well-being in their territory.

With these assumptions, it seems necessary to calculate well-being measures for all Italian municipalities so that administrators and citizens can use them to understand and decide on better policies. Since current statistical surveys do not provide socio-economic indicators disaggregated to the level of municipalities (the Census is the only source, every ten years), it is necessary to use administrative sources, hopefully collected in information systems.

This paper aims to study a measure for quantifying and monitoring the well-being of the population in Italian municipalities. As known, this phenomenon can't be represented exclusively by economic components but also by dimensions that represent domains having demographic, social and ecological nature. This work considers well-being from a multidimensional point of view and wants to measure it for 7,959 Italian municipalities in order to highlight differences and similarities, also in time series, by using 6 elementary indicators. The reference period is from 2014 to 2017. The methodology is based on composite indicators since we wanted to make the complex phenomenon of well-being more readable. In particular, the Adjusted Mazziotta-Pareto Index (AMPI) method was used.

2. Data source

The integration between surveys and administrative data has become increasingly important over the years. In order to enhance the use of administrative sources, we use data from two different information systems: "A Misura di Comune" and "ARCH.I.ME.DE". "A Misura di Comune" ([http://amisuradicomune.Istat.it/aMisuraDiComune /](http://amisuradicomune.Istat.it/aMisuraDiComune/)) is a multi-source information system published by Istat in August 2018 and continuously updated. The system reports an articulated set of indicators useful for planning, programming and management of Local Authorities, making available data that represent the economic, demographic, social and environmental conditions of the Italian territory. The project "ARCH.I.ME.DE" (Integrated Archive of Economic and Demographic Micro Data) developed in 2013 by Istat - together with Sistan - has the scope to improve the range of information through the production of longitudinal and cross-sectional elementary data collections. The project collects elementary data, obtained from the integration of administrative archives, useful for territorial and sectorial planning and for the evaluation of public policies at regional and local level, with an aim to reducing costs and statistical burden.

3. Individual Indicators

Examining the set of indicators present in the portal “A misura di Comune”, it was decided to select six of them, each representative of a specific thematic dimension, describing socio-economic conditions of population in Italian municipalities for the 2014-2017 years. The six dimensions reveal individual and territorial characteristics that link material conditions (labour, economic well-being, economy on the territory, infrastructures and mobility) to quality of life (education, environment). In this case study, indicators with high data quality in terms of clarity, comparability, completeness and accuracy were chosen in a deterministic way (Daas *et al.* 2011). The description of elementary indicators and respective domain is shown below:

- (A) *Not (engaged) in Education, Employment or Training (NEET)*. Domain “Education”. Person in population municipal register of 15-29 years not engaged in education, employment or training for 100 persons in population municipal register of 15-29 years;
- (B) *Percentage of regular employed of 20-64 years on the population of 20-64 years*. Domain “Labour”. Person in population municipal register of 20-64 years with regular employment in October per 100 persons in population municipal register aged 20-64 years;
- (C) *Income gaps before tax*. Domain “Economic well-being”. Ratio between the total income equivalent owned by 20% of the population in municipal register with the highest income and the one owned by 20% of population in municipal register with the lowest income;
- (D) *Cars on the road with emissions standard lower than Euro 4 class*. Domain “Environment”. Number of cars in the Euro 0-3 class circulating for 1000 persons in population municipal register;
- (E) *Entrepreneurship rate*. Domain “Economy on the territory”. Number of companies for 1000 person in municipal population register;
- (F) *Attractiveness Index*. Domain “Infrastructures and mobility”. Ratio between the flows of individuals who work, or study inbound with respect to the total number of active in the municipality of residence.

It should be noted that administrative data not always perfectly match with data survey as there are theoretical differences. For example: the indicator of regular employment use in this study, differs from the *employment rate* measured by Labour Force Survey. This study considers only people registered in the municipalities age between 20 and 64 years old with regular employment in October. Instead, Labour Force Survey considers all employees that worked at least 1 hour on the reference week therefore, also irregular workers and people not registered at the municipality are included.

4. Composite Indicator

In order to synthesize the individual indicators into a single measure, we use the official composite indicator adopted by Istat for the BES project: The Adjusted Mazziotta-Pareto Index (AMPI) because the influence analysis demonstrates the validity compared to other methods in terms of robustness. It is a partially non-compensatory composite indicator based on a standardization of the individual indicators, at the reference time, which makes the indicators independent of the unit of measurement (De Muro *et al.*, 2011). All individual indicators are assigned equal weights and time comparisons are allowed (Mazziotta and Pareto, 2016). In fact, a downscaling of individual indicators in the range (70; 130) according to two 'goalposts', i.e. a minimum and a maximum value representing a minimum and a maximum value that represent the possible range of each variable for all time periods and all units. For the methodology and mathematical properties of AMPI see Mazziotta and Pareto (2016).

5. Descriptive data analysis

This chapter describes the exploratory analyses carried out on the matrix composed of 7,959 municipalities for the 6 domain indicators chosen from year 2014 to year 2017. In the various years, Italian municipalities have undergone territorial variations (mergers, aggregations, etc.). To overcome this problem we have considered the municipalities of the year 2017 and brought back to this geography the municipal territories of the years 2014, 2015 and 2016. With regard to the elementary indicators, where the data was missing, we proceeded to an imputation with the value of the following year for 2014, with the value of the previous year for 2017 and for an average of the immediately contiguous years for the years 2015 and 2016. Table 1 shows the results of the correlation between the 6 indicators chosen in the year 2017. The trend is the same in all years, with the highest correlation (0.69) between "Percentage of regular employed of 20-64 years on the population of 20-64 years" (B) and "Income gaps before tax" (C) in 2014 and 2015. The highest negative correlation (-0.74) is between "Income gaps before tax" (C) and "Cars on the road with emission standards lower than the Euro 4 class" (D) in 2014, 2015 and 2017. In 2016 this negative correlation, which is however the highest between the indicators in this year, is -0.73. This means that the ownership of new cars (i.e., with emission standards higher than Euro 4) depends on income and therefore on the possibility of purchasing.

Table 1 – Correlation between selected indicators, year 2017.

Year 2017	A	B	C	D	E	F
A	1.00					
B	-0.70	1.00				
C	-0.42	0.68	1.00			
D	0.48	-0.71	-0.74	1.00		
E	-0.34	0.37	0.34	-0.35	1.00	
F	-0.19	0.29	0.37	-0.37	0.53	1.00

Having chosen a formative measurement model for the analysis, the level of correlation between individual indicators is not important. In fact, for this approach, polarities and correlations are independent and individual indicators can have positive, negative or no correlations (Maggino, 2008). The latent variable is estimated by taking a weighted average (or other function) of the indicators that make up the concept (Shwartz *et al.*, 2015).

6. Analysis of the Results

The choice of a composite index was fundamental for the treatment of data. “A composite index is a mathematical combination (or aggregation as it is termed) of a set of individual indicators (or variables) that represent the different components of a multidimensional phenomenon to be measured (e.g., development, well-being or quality of life). Therefore, the composite indices are used for measuring concepts that cannot be captured by a single indicator” (Mazziotta and Pareto, 2018).

For our analysis we needed a composite indicator valid in both time and space, therefore we chose the Adjusted Mazziotta Pareto Index (AMPI).

The aim of the work is to compare the levels of well-being in the 7,959 Italian municipalities over the four years examined, to highlight the favorable points or the critical points so as to be able to provide a tool for improving the situation.

Table 2 provides the ranking of the 10 best Italian municipalities in terms of well-being according to the elementary indicators selected for the year 2017, while Table 3 shows the ranking of the 10 worst. The trend is the same in 2014, 2015 and 2016. It confirms what is shown in the map: the best 10 municipalities are located in the North-East and North-West areas, while the worst 10 range over 3 geographical areas (North-West, Centre and South). The exception is the municipality of Santo Stefano di Sessanio in 2016 (municipality in southern Italy in sixth place in the ranking of municipalities with the highest level of well-being). Santo Stefano di Sessanio was

always among the top 100 Italian municipalities in the four years examined. This anomaly can be explained by looking more directly at this municipality in the province of L'Aquila. It has been elected one of the most beautiful villages in Italy and this has given it prominence from a national tourism point of view. In fact, with a population of about 110 inhabitants it has 18 accommodation facilities, 16 bars, shops and craft workshops and 7 restaurants. For these reasons, the basic indicator "Neither in Employment or in Education or Training" is close to zero, while the basic indicators "Attractiveness index" and "Entrepreneurship rate" are very high. It is much easier to explain the presence of municipalities in the North-West of Italy among the 10 municipalities with the worst level of well-being. These are border municipalities where the inhabitants move for work reasons to neighboring countries (especially Switzerland and France). In these cases, the levels of 'Neither in Employment or in Education or Training' and 'Percentage of regular employed of 20-64 years on the population of 20-64 years' are very high.

Table 2 – *The first 10 Italian municipalities sorted by well-being, year 2017.*

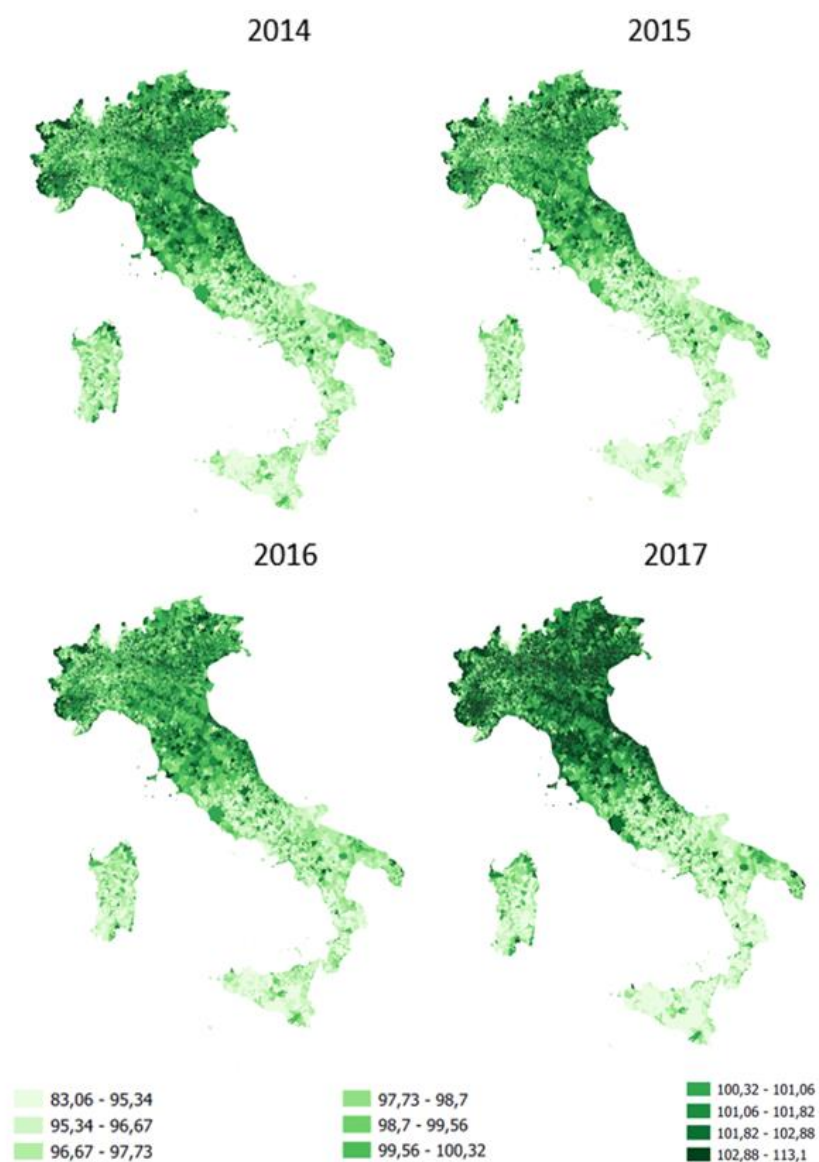
Municipality	Province	Region	Zone	AMPI	Ranking
Marmora	Cuneo	Piemonte	Nord Ovest	113.10	1
Alagna Valsesia	Vercelli	Piemonte	Nord Ovest	112.50	2
Argentera	Cuneo	Piemonte	Nord Ovest	111.85	3
Affi	Verona	Veneto	Nord Est	111.46	4
Scopello	Vercelli	Piemonte	Nord Ovest	111.31	5
Vernazza	La Spezia	Liguria	Nord Ovest	111.14	6
Limone sul Garda	Brescia	Lombardia	Nord Ovest	110.92	7
Castelmagno	Cuneo	Piemonte	Nord Ovest	110.65	8
Ceresole Reale	Torino	Piemonte	Nord Ovest	110.51	9
Gressoney La Trinité	Aosta	Valle d'Aosta	Nord Ovest	110.13	10

Table 3 – *The last 10 Italian municipalities sorted by well-being, year 2017.*

Municipality	Province	Region	Zone	AMPI	Ranking
Cavargna	Como	Lombardia	Nord Ovest	84.52	7,959
Val Rezzo	Como	Lombardia	Nord Ovest	84.67	7,958
Casalattico	Frosinone	Lazio	Centro	86.57	7,957
Giffone	Reggio di Calabria	Calabria	Sud	86.57	7,956
San Benedetto in Perillis	L'Aquila	Abruzzo	Sud	87.22	7,955
Gurro	Verbano Cusio Ossola	Piemonte	Nord Ovest	87.42	7,954
Verbicaro	Cosenza	Calabria	Sud	88.47	7,953
Nardodipace	Vibo Valentia	Calabria	Sud	88.60	7,952
Sciara	Palermo	Sicilia	Isole	89.04	7,951
Limina	Messina	Sicilia	Isole	89.33	7,950

Figure 1 shows the mapping of Italy for the years 2014, 2015, 2016 and 2017 according to the level of well-being.

Figure 1 – Italian municipalities by value of well-being calculated by AMPI, years 2014, 2015, 2016, 2017.



The municipalities with the highest level of well-being are shown in dark green, while those with the lowest level of well-being are shown in light green. The proposed scale is given by the deciles measured in the four years. Comparing the situation over the four years, a fairly similar trend can be seen. Municipalities with a high level of well-being are concentrated in the North of Italy, along the Via Emilia, the Adriatic coast of the Marche and in upper Tuscany, those with an average level of well-being in the rest of central Italy and those with a low level of wellbeing in the South. The maps show an increase in the level of well-being from 2014 to 2017 at national level, but also a growth in the gap between municipalities with high and low levels of well-being.

The analysis of the composite indicator for all municipalities should be a starting point both for micro studies, but also for macro studies, such as measuring the correlation with other variables/indicators available at this territorial level. Considering the correlation of the composite indicator with the size of the municipality's population, it can be seen that the size of the municipality is not as decisive as geographical location. There is no factor linked to the size of the municipality that can determine the socio-economic condition, and vice versa: these two information contributions do not influence each other. This is certainly a strength of the composite index that can explain a multidimensional phenomenon that is independent of an important variable, especially in Italy, such as the size of the municipality.

Figure 2 shows the best node for all four years under review (corresponding to the best node in 2017). In particular, it is the node corresponding to the 70 municipalities belonging to the provinces of Trento, Verona, Padua, Forlì-Cesena and Ravenna (belonging to the North-Eastern Zone, and to the Trentino Alto Adige, Veneto and Emilia Romagna Regions) with a population between 10,000 and 500,000 inhabitants (excluding the two population classes 40,000-50,000 and 65,000-80,000).

Figure 2 – The best node of the regression tree.

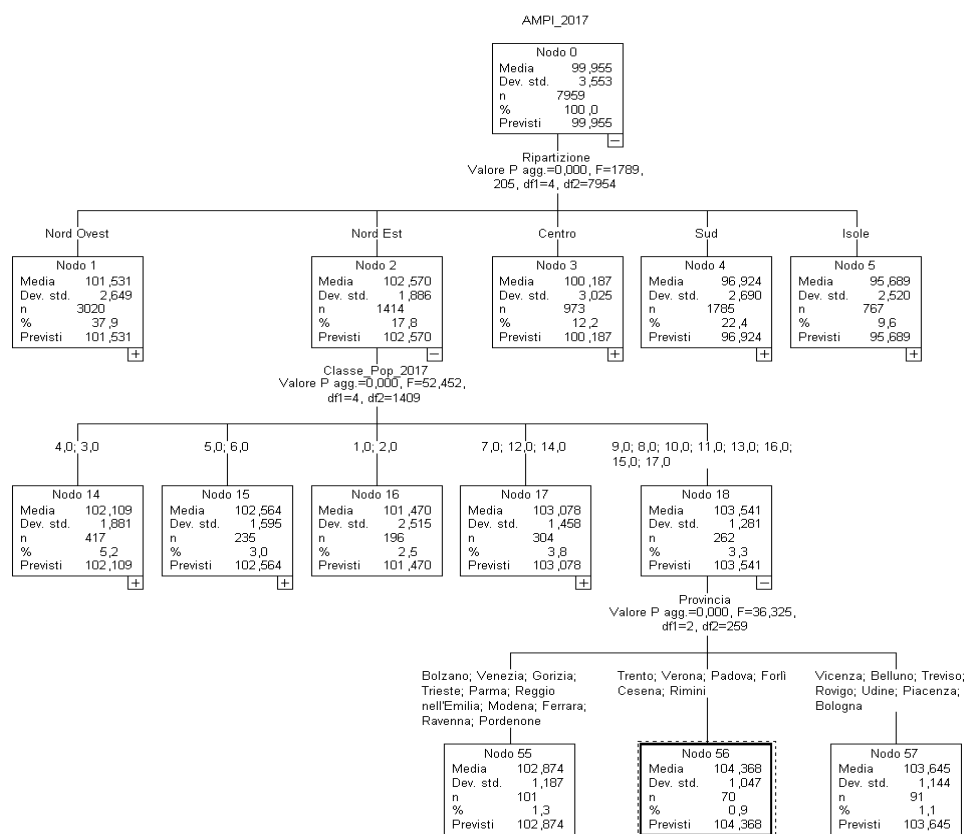
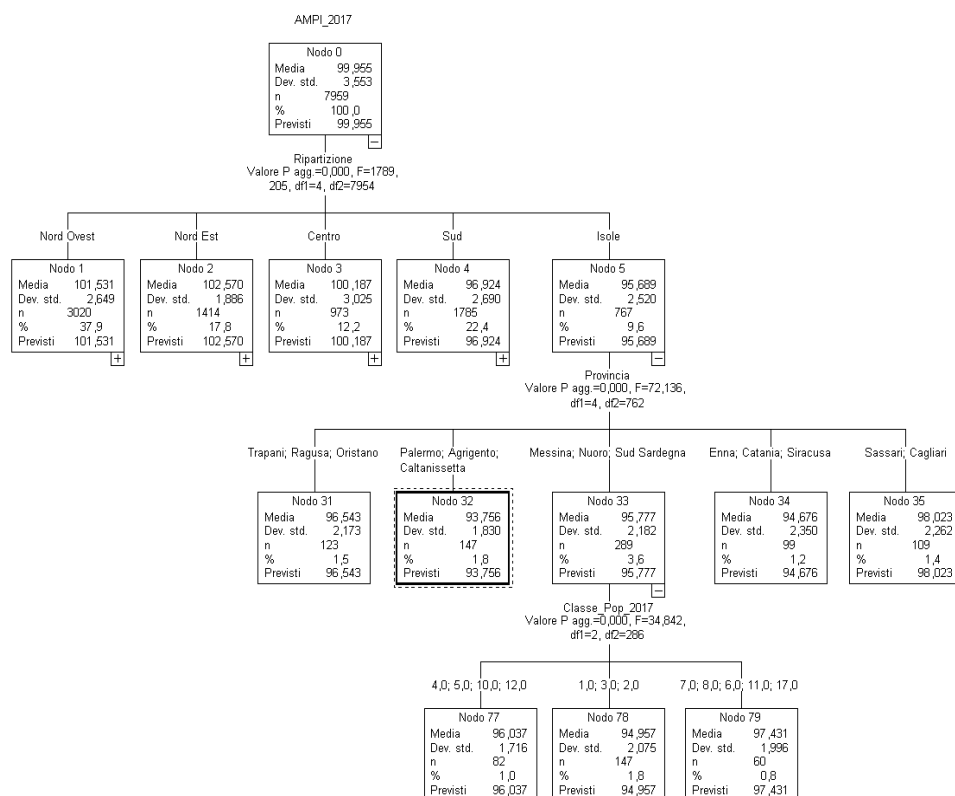


Figure 3 shows the worst node for all four years under review (corresponding to the worst node in 2017). In particular, it is the node corresponding to the 147 municipalities belonging to the provinces of Palermo, Agrigento and Caltanissetta (belonging to the South Zone, and to the Sicily Region) whatever population size.

Figure 3 – The worst node of the regression tree.



The method of sorting the municipalities by AMPI is interesting and can provide information on the evidence of the phenomenon. However, a more systematic approach is needed that can classify municipalities taking into account the well-being composite indicator as a function of some covariates. In this perspective, a good classification method is the regression tree, called CHAID (Chi-squared Automatic Interaction Detector). The dependent variable is the composite indicator of the well-being of the Italian municipalities; the independent variables are the three territorial levels (Zone, Region and Province) and the population size. The goal is to classify the well-being of the municipalities according to the localization on the territory and the population size (divided into 18 size classes).

7. Conclusion and next steps

The proposal of this work can be considered innovative because it considers the development over time of a composite indicator calculated on experimental statistics from administrative data at the highest possible level of disaggregation (municipal level). Moreover, this analysis has a double objective: in fact, these values can be very useful for the evaluation of the intervention's policies by local administrators and for the assessment of the administrators themselves by the citizens. This means that one of the most important phases of the research is the best practice for publishing these results so that everyone can have easy access in order to better understand the socio-economic context and decide independently through data recognized as impartial by the Community. The composite index calculated on all Italian municipalities draws a well-known geography of social and economic conditions. In fact, the peninsula seems to be divided into four parts with the conditions getting worse going south. The North-East seems to be a little better off than the North-West and the Centre-North better off than the Centre-South. The South, at the bottom of the list, lags far behind the Centre. The trend is similar in the years 2014 to 2017 (with an increase in the level of AMPI), but the gap between the best and worst municipalities is increased.

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SUMMARY

A well-being measurement approach for ranking Italian municipalities

This paper analyses a measure capable of quantifying and monitoring the well-being of the population in Italian municipalities. This phenomenon can't be represented exclusively by economic components but also by dimensions that represent domains having demographic, social and ecological nature. This work considers well-being from a multidimensional point of view and wants to measure it for 7,959 Italian municipalities in time series, from 2014 to 2017, by using 6 elementary indicators. The methodology is based on composite indicators. In particular, the Adjusted Mazziotta-Pareto Index (AMPI) method was used. The composite index calculated on all Italian municipalities draws a well-known geography of social and economic conditions. In fact, Italy seems to be divided into parts with the conditions getting worse going south. The North-East seems to be a little better off than the North-West and the Centre-North better off than the Centre-South. The South, at the bottom of the list, lags far behind the Centre. The trend is similar in the years 2014 to 2017 (with an increase in the level of AMPI), but the gap between the best and worst municipalities is increased. These values can be very useful for the evaluation of the intervention's policies by local administrators and for the assessment of the administrators themselves by the citizens. In fact, one of the best practices for publishing these results is the follow: everyone can have access in order to better understand the socio-economic context and decide independently through data recognized as impartial by the Community.

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