Rivista di Economia Agraria, Anno LXXII, n. 3, 2017: 267-287

Carmelina Prete, Mario Cozzi, Mauro Viccaro, Severino Romano, Gennaro Ventura

School of Agricultural, Forestry, Food and Environmental Sciences, Università degli Studi della Basilicata - Italy

Well-being and rurality: a spatial tool for rural development programs evaluation

Keywords: quality of life, capability approach, non-compensatory method, rural/inland areas, rural development programs

Jel Code: C43, I31, R58

Improving the quality of life of populations is one of the priorities of rural development policies. Based on the *capability* approach, the aim is to realise a *Quality of Life* (*QoL*) index measuring territorial disparities. The *QoL* index, aggregated by a non-compensatory method, is compared with rural and inland areas of the study area, Basilicata region. The analysis shows a clear relationship between features of *QoL* and rurality/peripherality degree and a global *QoL* below the regional average for 61% of municipalities. In these areas, as expected, the high level of environmental protection is offset by lower socio-economic opportunities but, the possibility to evaluate them through an index over time can help policymakers to address rural policies and evaluate their effects.

1. Introduction

There is currently a great interest in the studies and research that assess well-being going beyond economic growth-based analyses. Many authors (Frey and Stutzer; 2002; Boarini *et al.*, 2006; Giovannini *et al.*, 2007) argue that conventional measures based on income, wealth and consumption, are not sufficient to assess human well-being, as they exclude a wide range of key factors, such as environment, state of health, social inclusion, etc. In particular, Stiglitz report (2009) has laid the bases for a multi-dimensional approach to the estimate of well-being vs quality of life. The *Quality of Life* (*QoL*) is similar to the concept of well-being (in the broadest sense). Some authors (Daly and Cobb, 1989; Gigliarano *et al.*, 2014; Kubiszewski *et al.*, 2015) mean the *QoL* as the economic well-being measured by traditional indicators of economic performance, such as the adjusted GDP, but they include non-marketable societal and environmental goods and services. Other authors (Dasgupta, 2001; Stiglitz *et al.*, 2009) emphasise that the *QoL* can be maintained only if the whole of resources are used in a sustainable manner. Different studies are being conducted to calculate – following different routes – a quality of life index based on the potential of the area concerned (Nuvolati, 2003; Buettner

DOI: 10.13128/REA-22803
ISSN (print): 0035-6190
ISSN (online): 2281-1559

and Ebertz, 2009; Brereton *et al.*, 2011) with a growing interest to compiling composite indicators of well-being on the local scale (Costanza *et al.*, 2004; Pulselli *et al.*, 2006; Bleys, 2013; Gigliarano *et al.*, 2014; Chelli *et al.*, 2015). In this context, it could be very interesting and useful evaluate a *QoL* index in areas with a high level of vulnerability, such as rural areas and inland areas (characterized by a predominantly rural connotation). The lack of economic opportunities, social isolation, and the difficulties in delivering services typical of such areas, could generate a process of self-reinforcement called "downward spiral", which is difficult to reverse without a sufficient population density or in the absence of factors and specific resources (Cagliero *et al.*, 2011). These issues are of growing weight for the European Union which has decided to include the theme of quality of life among the priorities of the new rural development policy 2014-2020 (reg. 1305/13 art. 20 *Basic services and village renewal in rural areas*).

In the light of the above considerations, the present research is aimed at implementing a spatial decision support tool able to define the geography of the *QoL* on the micro-territorial scale and to identify the endogenous disparities linked to the quality of life in rural areas. The knowledge and integration of data in building information is an essential tool for policymakers. The ability to synthesise complex information is important to compare the state of various geographical contexts and their evolution over time.

To test the significance of the model, it was applied to the Basilicata region, a rural lagging region in southern Italy, comparing the different degrees of *QoL* obtained whit the rural degree of region.

However, since the entire region is classified as rural region according both to European and national classification, without any distinction at local level, we have decided to correlate the *QoL* index with the rural degree obtained by the method developed by Romano *et al.* This method allows to calculate a rural index on a local scale based on the socio-economic and environmental characteristics of a given territory.

The degree of peripherality of inland areas is also considered, based on the definition provided by the National Strategy for Inland Areas (SNAI), a strategy born in 2012 with the aim of supporting the economic and employment growth of these areas and, in cascade, reversing the negative demographic trend (IFEL, 2015).

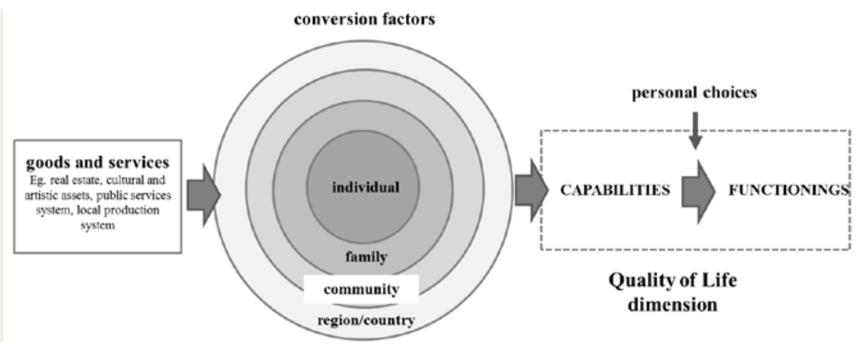
2. Concept of quality life and theoretical approach for measuring

The concept quality of life in literature is strongly rooted in the thinking about health. There are several models which refer to health as an indicator of livability, while in other models quality of life is treated as the determinant of health (Van Kamp *et al.*, 2003). In a schematic model formulated by RIVM (2000) health and livability are, instead, paralleled as two separate dimensions of quality of life.

Mitchell *et al.* (2001) assert «there is no agreement yet on quality of life, in terminology nor in construction methods or the criteria that comprise quality of life». In spite of this Mitchell *et al.* (2001) did try to use its different components. In his approach quality of life consists of health, physical environment, natural resources, personal development and security. In this model the domain of economy is lacking, while others view this as one of the three major pillars (or dimensions) of quality of life with society and environment (Stiglitz, 2009).

According to Sen (1985) the central idea to assess the quality of life is that a process of improvement is not only understood in economic terms but as an extension of the opportunities. In other words, in the language that characterizes the capability approach, material well-being, limited in the standard economic vision to the simple availability of resources, is replaced by the idea of "well-being", understood as a condition that includes "what the individual can or can do" from the resources and means available and in relation to individual conditions (sex, age, natural predisposition, level of education), but also depends on the place where they live (family, social and territorial conditions) (Biggeri and Chiappero, 2010). The set of these potentially achievable (capability set) or actually accomplished (functioning) goals contributes, overall, to determine the individual quality of life. With equal resources, people may have different chances of transforming these resources to achieve certain results. In particular, we want to focus the attention on the territorial factor at community level (Fig. 1).

Fig. 1. Capability approach for measuring quality of life



3. Materials and methods

3.1 Model setting and analysis of set of indicators

The assumed model is based on the relationship between the level of quality of life of the individuals living in the *i-th* municipality (QoL_i) and the level of existing opportunities in a given area (t_r), including the services s_r provided in the *i-th* area.

The basic assumption is that the individual well-being may be expressed as:

$$QoL_i = f(\bar{y}, t_r) \tag{1}$$

where: $t_r = f(s_r)$

$\bar{y}$ is the vector of individual conditions (employment, gender, etc.) that result to be exogenous to the model.

The indicators that most contribute to defining varying levels of *QoL* are important to emphasise the territorial disparities in well-being (Boncinelli *et al.*, 2015), depending on the availability of data at the level of detail required, which is quite high in the present analysis. Essential factors, such as criminality or social exclusion, are missing.

The dataset applied to develop the model includes a set of basic indicators derived from different sources (ISTAT, property market Observatory, regional technical map, ISPRA, river basin authority, etc..) that have been grouped in thematic areas and further categorised based on the relevant dimensions (economic, social and environmental) (Appendix Tab. A.1).

The indicators relating the economic dimension concern the number of bank branches and the average estate prices as *proxy* of the economic well-being and of the economic opportunity of an area. Indeed the assumption is that the number of bank branches in a municipality is proportionate to the population and to the amount of operating volumes (loans and deposits). The average estate prices of the last five years reflect the economic dynamism of an area and depend, for instance, on population trends and on the level of the "services and quality" provided (Rosen, 1974).

As for the social dimension, the study included the spread and proximity to services/structures/activities that exercise a decisive influence not only on the everyday life organisation of a community, but also on its mobility and degree of external dependence. The presence of healthcare settings is an essential condition influencing citizens' security, or their possibility to receive preventive care services and appropriate treatment. These services are widespread, although access to them may vary for the citizens of different municipalities.

Other factors were included, such as the spread and proximity of education services, recreational facilities (camping sites, sports structures, playgrounds) and cultural activities (libraries, cinema, museums, theatres, etc.), non-decentralised departments (courts, chambers of commerce, etc.). To take into account proximity, the travel time to reach different services was calculated by the isochrones method, via the Network Analysis, using the GIS (Wang *et al.*, 2012). Among daily trips that influence the organisation of everyday life, those related to work or study were shown to be prevailing, so they were used to derive the home-work mobility rate and the mean journey time.

In relation to the environmental dimension, which is meant as the ability to supply essential goods and services for human well-being, the analysis included population equivalents (ISTAT, 2016) that reflect the estimated pollutant load produced by domestic and economic activities; the proximity to waste dumps and industrial areas that may affect the environmental health; the availability and extent of areas characterised by high ecological-nature value; and the presence of factors of environmental risk (hydro-geological and seismic risks).

To capture accurately the relationships among the basic indicators and to identify if the indicators are able to discriminate disparities in quality of life within rural and/or inland areas, a Pearson correlation test was applied. This comparison has been made possible using the Rural Areas classification (RAc) of the region into eight areas characterised by a different rurality level proposed by Romano *et al.* (2016) and the Inland Areas classification (IAc) of the region into five areas proposed by Agency for territorial cohesion (2014).

3.2 Aggregation of indicators by a non-compensatory method

Quality of Life measurement is an ambitious and complex objective that poses many problems of theoretical, empirical and methodological nature. It is a multidimensional phenomenon that is not directly measurable, the evaluation of which depends largely on arbitrary choices of the researcher: selection of elementary indicators, standardization, weight allocation, choice of aggregation function, presentation of results, etc. In fact, the idea of summarizing complex phenomena into single numbers is not straightforward, with a series of pros and cons (Zhou and Ang, 2008); in particular, it involves the risk of losing valuable information that is evidently characterizing the geographic areas. It involves both methodological assumptions that need to be assessed carefully to avoid producing results of dubious analytic rigour (Saisana *et al.*, 2005).

Despite methodological limits, synthetic indexes are widely used by many international bodies to measure economic, environmental and social phenomena (UNDP, 2001; OECD, 2008 UNDP, 2010; Annoni and Kozovska, 2010) and for this they are a very modern and evolving tool.

The literature on synthetic indicators offers a wide variety of aggregation methods (Bandura, 2008; Wu and Barnes, 2011; Cozzi *et al.*, 2014; Cozzi *et al.*, 2015b, Cozzi *et al.*, 2015c). The possible choices to reach a synthetic index are numerous and range from descriptive statistics tools to multivariate analysis techniques, as Principal Component Analysis[1] (automatic weighting) (Dunteman, 1989), from the adoption of distance measurements (taxonomic method of Wroclaw) to the application of linear and non-linear functions. The most used are additive methods that range from summing up unit ranking in each indicator (equal weighting) to aggregating weighted transformations of the original indicators (expert weighting). In particular, additive methods that give explicit weights to each indicator and sum the product of each indicator and its weight, assume a full compensability among the different dimensions (eg. a good standard of living can compensate for any educational deficit and vice versa), but it is often not de-sirable to compensate for the main components of the phenomenon. To overcome these difficulties, some authors have proposed multiplicative aggregation methods, such as the geometric mean; for example, in 2010, the Human Development Index - HDI formula has changed from an arithmetic average to a geometric mean (UNDP, 2010). However, the geometric mean assumes that the syn-thesis sum is of multi-plicative nature, rather than additive, and assigns a higher weight to the lower values and cannot be calculated in the presence of negative or null values, eg. in our case the number of bank branches.

For this reason, an alternative synthetic index is proposed which, starting from a linear aggregation, introduces a penalty for municipalities with "unbalanced" values of the indicators compared to the average.

The method of the coefficient of variation penalty (Mazziotta and Pareto, 2015) was applied in order to develop the composite indicator. This method enables building of a synthetic measure of quality of life for each territorial unit x_i, assuming that each component of the *QoL* is non substitutable or is only partially substitutable. This approach requires a balanced supply of all basic components.

The method involves standardising indicators using a transformation criterion to release them from their units of measurement and variability (Delvec-

---

[1] The PCA is a multivariate statistical method of synthesis that follows a compensatory approach, starting from a large number of individual indicators, allows us to identify a small number of composite indices (factors or components) that explain most of the variance observed. The composite indicex so obtained are a linear combination of the individual indicators with weights that maximize the variation in the aggregated index values, over all possible choices of weights.

chio, 1995). Therefore, basic indicators have been corrected so as to be ranged within the same scale, by transforming each indicator in a standardised variable with an average of 100 and a mean square deviation of 10; the values obtained will be approximately comprised within a range 70-130.

Thus, once the matrix of n rows (territorial units) and m columns (basic indicators) was constructed, the next step was the matrix $Z = \{z_{ij}\}$:

$$z_{ij} = 100 \pm \frac{\left(x_{ij} - M_{x_j}\right)}{S_{x_j}} 10 \tag{2}$$

where $M_{x_j} = \frac{\sum_{i=1}^{n} x_{ij}}{n}$ is the average and $S = \sqrt{\frac{\sum_{i=1}^{n}\left(x_{ij} - M_{x_j}\right)^2}{n}}$ is the mean square deviation.

Then the aggregation function, Mazziotta-Pareto Index (MPI) was "corrected" by a penalty coefficient that depends, for each territorial unit, on the degree of variability of indicators from the mean value ("horizontal variability").

$$MPI_i^{+/-} = M_{z_i} \pm S_{z_i} cv_i \tag{3}$$

The arithmetic mean (M_{zi})of standardised indicators is corrected by subtracting an amount (the product $S_{zi}cv_i$) proportional to the mean square deviation, and is direct function of the coefficient of variation.

This variability, measured by the coefficient of variation (cv_i), penalises the scoring of the units with the highest imbalance between the values of indicators and, hence, an imbalanced supply. The use of standardised deviations (S_{zi}) enables a robust measure that is not influenced by the elimination of a single basic indicator (Mazziotta and Pareto, 2015). The main disadvantage lies in the possibility of making only 'relative' comparisons of the values of units over time, with respect to the average.

The method has been applied to calculate the *QoL* for each dimension, economic dimension (*EcQoL*), social dimension (*SocQoL*), environmental dimension (*EnvQoL*) and then to calculate a global *QoL* (*TotQoL*) that takes into account all basic indicators.

4. Results and discussion

The study has provided an initial response to the following questions: Is there a relationship between indicators of quality of life? How do the rural and inland areas differ relative to indicators, such as education, healthcare, work-life balance, etc.? Is it useful the use of a composite indicator to evaluate disparities in quality of life within these areas?

The Pearson's r data analysis revealed for $-0.7<P_{XY}<-0.3$: a negative correlation of PPR with TTH (r=-0.32) and TTS (r=-0.30), a negative correlation for BBN with TTH (r=-0.48), TTS (r=-0.37) and TTA (r=-0.31); a negative between IET and AHE (r=-0.31).

The Pearson's r data analysis revealed for $0.3<P_{XY}<0.7$: a positive correlation of PPR with PSp (r=0.38), PFT (r=0.34). and a positive correlation of BBN with PEd (r=0.58), PSp (r=0.53), PFT (r=0.50) and LR[2] (r=0.35); a positively correlation of PEd with PSp (r=0.45) and PFT (r=0.51); IET and LR (r=-0.37).

The Pearson's r data analysis revealed for $P_{XY}>0.7$: a positive correlation between BBN and IET (r=0.82), for IET with PSp (r=0.78) and PFT (r=0.71), between Psp and PFT (r=0.94).

The other indicators: MDWS, PDWS, TTC, TTG, PAI, DI, DL and SR are weakly correlated (Appendix Tab. A.2).

The correlation analysis shows a relevant aspect: economic opportunities are positively correlated with increased presence and accessibility of basic services, but also sporting services and free time. It means that if one of the QoL features decreases tend to decrease other features as well, but where more features are significantly scarce, it is easy to verify the risk of social and economic marginalization (par. 1). This highlights the need to aggregate these factors and therefore supports the proposal to use composite indicators.

The Pearson correlation test shows that indicators have a similar correlation between rural e inland areas classifications, but never strong: PPR (r_{RAc}=-0.32; r_{IAc} =-0.15) and BBN (r_{RAc}=-0.50; r_{IAc}=-0.70) have a negative correlation, which are then characterized by more limited economic opportunities; longer travel times to reach health and educational facilities (TTH – r_{RAc}=-0.43; r_{IAc}=-0.31), (TTS – r_{RAc}=-0.36; r_{IAc}=-0.14) and less school infrastructures[3] (Ped – r_{RAc}=-0.11; r_{IAc}=-0.30); also for cultural and sports-recreational opportunities there are longer travel (TTC – r_{RAc}=0.19; r_{IAc}=-0.21, TTG – r_{RAc}=0.13; r_{IAc}=0.06) times and less widespread facilities (PSp, r_{RAc}=-0.32; r_{IAc}=-0.35 , PFT – r_{RAc}=0.21; r_{IAc}=-0.29).

As to the environmental dimension, there is a significant difference in terms of pollutant load produced by domestic and economic activities (IET - r_{RAc}=-0.57; r_{IAc}=-0.58), and higher environmental health, mainly due to re-

[2] The positive correlation of LR with BBN and PEd is influenced by the municipality of Potenza characterised by a high risk of landslides and high percentage of Bank Branches Number and Education services.

[3] 89% of these infrastructures are nurseries and secondary schools.

moteness of industrial areas and waste dumps ((DI - r_{RAc}=0.19; r_{IAc}=0.21; DL - r_{RAc}=0.31; r_{IAc}=-0.18) in rural and inland areas. Additionally, there are more areas with a high ecological and conservation value (AHE – r_{RAc}=0.56; r_{IAc}=0.28). On the other hand, it would cause possible major risks for landslides (LR[4] – r_{RAc}=0.18; r_{IAc}=-0.24) and earthquakes (SR - r_{RAc}=0.16; r_{IAc}=0.14), which also affect the quality of road infrastructures. MDWS and PAI are unrelated (0.0_) (Tab. 1).

The analysis has made it possible to deepen the knowledge about the endogenous dynamics within rural/inland areas, which are affected by the same issues in relation to indicators such as education, healthcare, work-life balance, etc., and has validated the consistency in identifying the indicators (chosen on a bibliographic basis) to the study area and respect to the target.

From a methodological point of view, mapping data has also enabled the identification of macro-areas characterized by similar conditions relative to some indicators, revealing marginalized contexts, some distinctive examples of which are mentioned below. As to the percentage distribution of school facilities (0-43% range), there is a macro-area North-West of the region's chief town, where the rate is <7%. On the other hand, there are 45 municipalities mostly concentrated in the inland part of the region, with an average population density of 29 inhab./km^2, where there are no bank branches.

The model, applied to the Basilicata region, assumes a *TotQoL* variable in a range of values comprised between 93 and 105 (Tab. 2), with 61% of municipalities characterized by a *TotQoL* below the average (=100). At the regional level, there is a low percentage (39%) of municipalities with a *TotQoL* above the regional average (=100) (Fig.2; Graph 1a); moreover, there is a significant difference between the municipalities in the province of Potenza (PZ) and those in the province of Matera (MT), with values of respectively 31% and 65% above the regional average.

The *EcQoL* (91–130) is characterized by a wide variation range (St. Dev. = 5.9) with a max value that is considerably spaced from the average (Tab. 2), but with 53% of municipalities characterized by a value of EcQoL below the average (Fig. 2). This means that these values, although high, affect very few municipalities in relation to the general condition that appears to be below the regional average or otherwise around the mean. The SocQoL (88–113) is characterized by a less wide variation range (St. Dev. = 4.1) with min and max that are almost equally distanced (Tab. 2), with 60% of municipalities characterized by a SocQoL below the average (Fig. 3). The EnvQoL (73–109) is charac-

[4] LR reveals a different correlation between RAc and IAc, respectively weakly positive and negative, probably beacause RAc classification includes the average altitude.

Tab. 1. Comparison of basic indicators with rural areas and internal areas classification with Pearson correlation test

Elementary indicators	Acronym	Pearson r	
		RAc*	IAc**
Average Purchase Prices of Real estate	PPR	-0.319817	-0.149603
Bank Branches Number	BBN	-0.497384	-0.690117
Mobility rate Domicile-Work/Study	MDWS	0.043947	0.089247
Proximity rate Domicile-Work/Study	PDWS	-0.108996	-0.137296
Travel Time to reach Hospital structures	TTH	0.427522	0.314290
Travel Time to reach Secondary schools	TTS	0.356735	0.142477
Percentage of Education services	PEd	-0.109025	-0.301323
Travel Time to reach Administrative offices	TTA	0.055945	0.395281
Travel Time to reach Cultural activities	TTC	0.193830	0.211334
Travel Time to reach Green spaces	TTG	0.133139	0.057621
Percentage of Sport facilities	PSp	-0.324291	-0.348279
Percentage of Free Time facilities	PFT	-0.211271	-0.290176
Percentage of Population coverage with Access to Internet between 2 Mbps e 20 Mbps	PAI	-0.087996	0.019062
Inhabitant Equivalent Total	IET	-0.568086	-0.579699
Distance from Industrial areas	DI	0.192221	0.214515
Distance from Landfills	DL	0.307542	0.178390
Areas percentage with High Ecological-naturalistic value	AHE	0.559761	0.281918
Landslide risk	LR	0.180781	-0.238521
Seismic risk	SR	0.158237	0.136672

Note: * Rural Areas classification; ** Inland Areas classification
With: $P_{XY}>0$ positive correlation; $P_{XY}=0$ no correlation; $P_{XY}<0$ negative correlation; $0<|P_{XY}|<0.3$ weak correlation; $0.3<|P_{XY}|<0.7$ moderate correlation; $|P_{XY}|>0.7$ strong correlation.
Source: our processing.

terized by a slightly wider variation range than the SocQoL (St. Dev. = 4.5), but with a min that is considerably spaced from the average (Tab. 2); 56% of municipalities are characterized by an EnvQoL below the average (Graph 1a).

The analysis of the data reveals a significant difference between the two provinces, partly related to the morphological diversity of the territory: the province of Potenza is characterized by a mainly mountainous (Apennines)

Tab. 3. Descriptive statistics on *EcQoL*, *SocQoL*, *EnvQoL* and *TotQoL*

Statistics	*EcQoL*	*SocQoL*	*EnvQoL*	*TotQoL*
Min	91	88	73	93
Max	130	113	109	105
Average	100	100	100	100
St Dev	2.5	4.1	4.5	2.5

Source: our processing.

Fig. 2. Spatial distribution of TotQoL

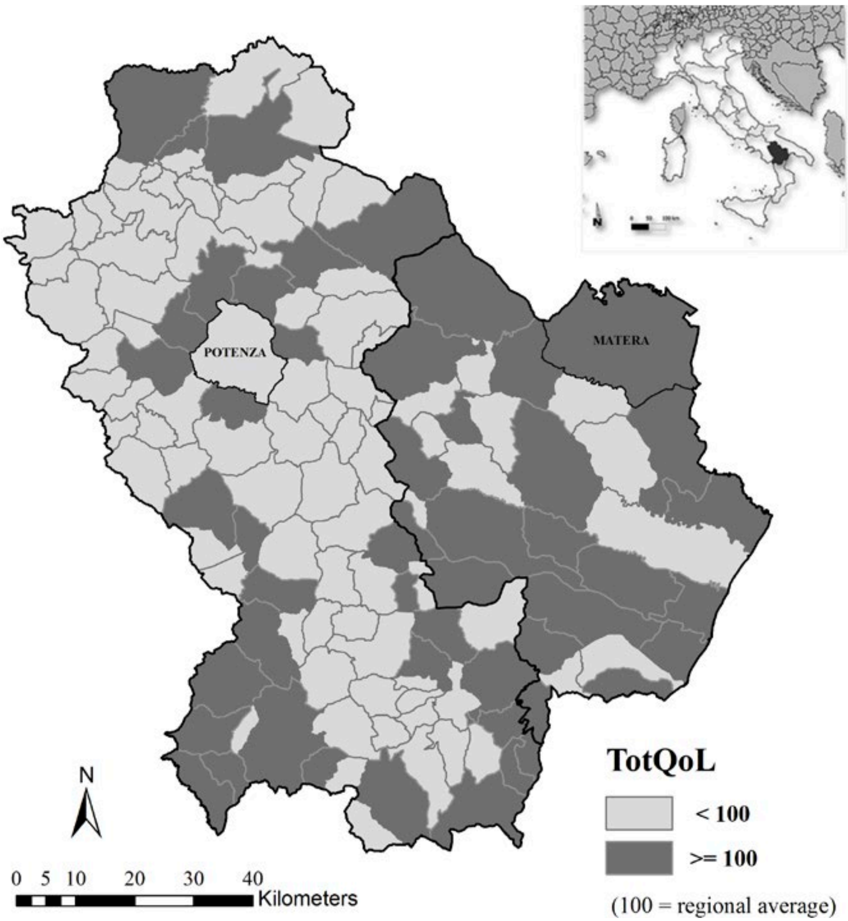
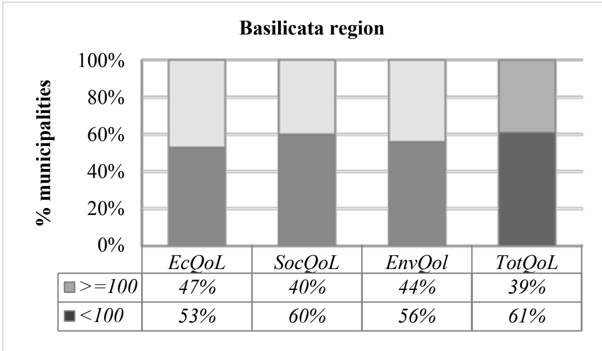
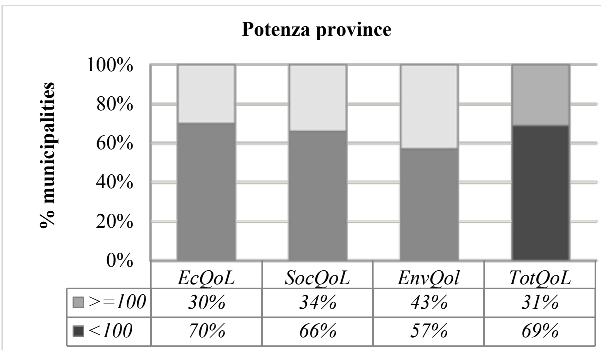


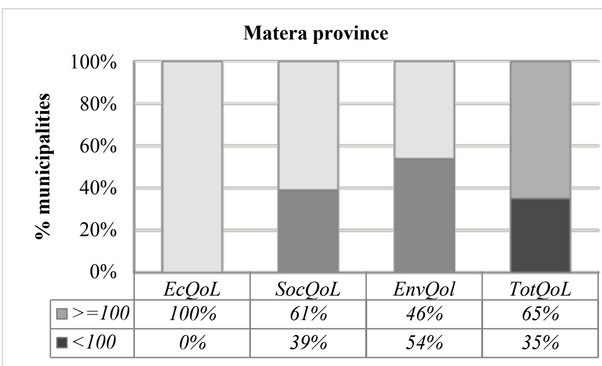
Fig. 3. QoL at regional level (a) and provincial level (b, c)



a)



b)



c)

and hilly territory (clay soils in 45.13% of the region, subject to erosion resulting in landslides), while the flat part (8% of the region) is concentrated in the province of Matera along the Ionian coast.

Considering that the regional population is mostly concentrated in large centres, the distribution in percentage is the following: 56% live in the 12 largest towns in the region, 27% live in medium-sized centres, namely those between 5,000 and 9,999 inhabitants, and the remaining 17% live in small towns, which are mostly concentrated in the province of Potenza (82 municipalities out of 100 are below 5,000 inhabitants, 52 of which below 2,000 inhabitants).

By comparing the national classification of Inland Areas based on their peripherality from essential services, the variables identified for calculating the *QoL* allow a more complete and accurate reading of the sub-regional territory. Different areas can actually have a positive or negative connotation in relation to the general context, depending on the dimension concerned. The factors considered, in fact, allow to discriminate in a more precise manner the imbalances on the territory, highlighting, for example, the areas that have developed autonomously, in terms of many important services, even though – or maybe simply because – they are distant from the hubs. Moreover, it includes not only weaknesses, but also territories that may be less “attractive” in relation to the level of services offered; they also involve strengths, related to their still unexploited potentials (this is the case of the areas of great natural value that could offer important opportunities for tourism, recreation and gastronomy) (Prete *et al.*, 2017).

5. Conclusions

Currently, the Common Framework for Monitoring and Evaluation (European Commission, 2016) does not provide a definition of the concept of quality nor the size to be investigated to determine the impacts produced by rural development programs. So, the proposed methodology offers the possibility to use a series of appropriately aggregated indicators that allow to define for an overall picture compared to the overall objective (improving the quality of life within rural areas) in order to identify the situations of marginality.

From a metrological point of you the paper proposes a model to determine multidimensional levels (economic, social and environmental) of quality of life linked to the territory, adopting capability approach.

Innovative element is the use of a non-compensatory synthetic indicator which lies in the possibility of “awarding” the territorial units characterized by a balancing of all indicators. Moreover is important to highlight that this work, overcoming the classical urban-rural comparison, proposes a tool that offers a new reading key capable of grasping endogenous disparities within rural/inland areas.

Results show that there are areas with different levels in quality of life indicating marginalized situations. In addition to the physical and demographic characteristics of the territory, the provision of basic but also of leisure services results to be differentiated. On average, to have access to different services provided at the local level, the populations of most rural and inland municipalities use more time (and resources) as compared to less rural and inland municipalities, where those services are more common for a higher concentration of resident population.

The *policy makers* should thus pay special attention to the problems related to the accessibility of these services, and should try to maintain them locally. The possibility of ensuring ubiquity of services would help reduce the abandonment of these areas, starting from marginal ones. Within the framework of rural development policy, the abandonment of these areas would jeopardise the "maintenance" of the territory by reducing "non-market" services (ecosystem services). The smallest municipalities are the most sensitive, so they would need greater attention. For example, forms of association between municipalities could be encouraged (d.gls 267/2000), also envisaged in the SNAI.

Although the methodology is applied successfully, it would be useful to make more detailed evaluations in spatial terms, taking into account the time factor in order to determine increasing/decreasing trends. In this sense a limitation could be the availability of data, although national and international statistical offices provide more and more helpful information to improve and derive realistic indicators.

In conclusion, the proposed framework, applied to the Basilicata region and repeatable in other territorial contexts, can present a useful tool in the current political context in the implementation of actions aimed at gradually reducing regional disparities in terms of quality of life, that follow these goals:

- address of interventions, which should take into account balanced growth of the (economic, social and environmental) dimensions of quality of life: the observation of the constituent components of the index makes it possible to define more specific addresses on which to focus the attention and resources available, the latter being made up of Community funds managed by the Regions (for market intervention) and resources specifically intended from Laws of Stability 2014 and 2015 (for action on citizenship). In addition, all Rural Development Programs have taken into consideration the objective of the National Strategy for Domestic Areas to a different extent from Region to Region;
- ex-ante and ex-post effects evaluation of the carried out interventions, as a synthetic "measure" of achievements in terms of improving the quality of

life; global *QoL* provides an overall idea, a "meter" to measure delta compared to the regional average and hence the endogenous disparities in the quality of life of rural and inland areas;
- finally identification and, if necessary, redistribution of the areas that need priority interventions and resources.

References

Agency for Territorial Cohesion (2014). Classification of Italian Municipalities according to the methodology for the definition of the Inland Areas. Available at: http://www.agenziacoesione.gov.it/it/arint/OpenAreeInterne

Annoni P., Kozovska K. (2010). EU regional competitiveness index 2010 (JRC Scientific and Technical Reports). Luxembourg: Publications Office of the European Union. DOI: 10.2788/88040

Bandura R. (2008). A survey of composite indices measuring country performance: 2008 update. A UNDP/ODS working paper. New York, NY: United Nations Development Programme, Office of Development Studies.

Biggeri M., Chiappero E. (2010). Sviluppo Umano Sostenibile, Capability Approach e Cooperazione Internazionale in Biggeri M., Canitano G., *Temi avanzati di economia e politica della cooperazione internazionale allo sviluppo*, FrancoAngeli, Milano.

Bleys B. (2013). The regional index of sustainable economic welfare for Flanders, Belgium. *Sustainability*, 5(2): 496-523. DOI:10.3390/su5020496

Boarini R., Johansson Å., d'Ercole M.M. (2006). Alternative measures of well-being. *OECD Social, Employment and Migration Working Papers*, No. 33, OECD Publishing. DOI: 10.1787/713222332167

Boncinelli F., Pagnotta G., Riccioli F., Casini L. (2015). The Determinants Of Quality Of Life In Rural Areas From A Geographic Perspective: The Case Of Tuscany. *Review of Urban & Regional Development Studies*, 27(2): 104-117. DOI: 10.1111/rurd.12035

Brereton F., Bullock C., Clinch J.P., Scott M. (2011). Rural change and individual well-being the case of Ireland and rural quality of life. *European Urban and Regional Studies*, 18(2): 203-227. DOI: 10.1177/0969776411399346

Buettner T., Ebertz A. (2009). Quality of life in the regions: results for German Counties. *The annals of regional science*, 43(1): 89-112. DOI: 10.1007/s00168-007-0204-9

Cagliero R., Cristiano S., Pierangeli F., Tarangioli S. (2011). Evaluating the Improvement of Quality of Life in Rural Areas. In 122nd EAAE Seminar *Evidence based agricultural and rural policy making: methodological and empirical challenges of policy evaluation*, pp. 17-18.

Chelli F.M., Ciommi M., Emili A., Gigliarano C., Taralli S. (2015). Comparing Equitable And Sustainable Well-Being (Bes) Across The Italian Provinces. A Factor Analysis-Based Approach. *Rivista Italiana di Economia Demografia e Statistica*, 69(3): 61-72. Available at: http://www.sieds.it/listing/RePEc/journl/, (accessed 24 April 2016).

Costanza R., Erickson J., Fligger K., Adams *et al.* (2004). Estimates of the genuine progress indicator (GPI) for Vermont, Chittenden County and Burlington, from 1950 to 2000. *Ecological Economics*, 51(1): 139-155. https://doi.org/10.1016/j.ecolecon.2004.04.009

Cozzi M., Di Napoli F., Viccaro M., Fagarazzi C., Romano S. (2014). Ordered weight averaging multicriteria procedure and cost-effectiveness analysis for short rotation forestry in the Basilicata Region, Italy. *International Journal of Global Energy Issues*, 37(5-6): 282-303. https://doi.org/10.1504/IJGEI.2014.067671

Cozzi M., Persiani G., Viccaro M., Riccioli F., Fagarazzi C., Romano S. (2015a). A geostatistical multicriteria approach for classifing of rural areas: from the European perspective to local implementation. *Aestimum*, 67: 97-110. http://dx.doi.org/10.13128/Aestimum-17941

Cozzi M., Romano S., Viccaro M., Prete C., Persiani G. (2015b) Interactions wildlife-agriculture, spatial analysis and trade-off between environmental sustainability and risk of economic damage in: Vastola, A.P. (Ed.), *The Sustainability of Agro-Food and Natural Resource Systems in the Mediterranean Basin*. Springer International Publishing, pp. 209-224. DOI: 10.1007/978-3-319-16357-4_14

Cozzi M., Viccaro M., Di Napoli F., Fagarazzi C., Tirinnanzi A., Romano S. (2015c). A spatial analysis model to assess the feasibility of short rotation forestry fertigated with urban wastewater: Basilicata region case study. *Agricultural Water Management*, 159: 185-196. DOI: 10.1016/j.agwat.2015.06.010

Daly H.E., Cobb J. (1989). *For the Common Good: Redirecting the Economy Towards Community, the Environment, and a Sustainable Future*, pp. 482. Boston: Beacon Press.

Dasgupta P., Mäler K.G. (2001). *Wealth as a criterion for sustainable development*. Beijer international institute of ecological economics.

Delvecchio F. (1995). *Scale di misura e indicatori sociali*. Bari: Cacucci editore.

Dunteman G.H. (1989). Principal components analysis. Newbury Park, CA: Sage.

European Commission (2016). Common monitoring and evaluation framework. Available at: http://ec.europa.eu/agriculture/rurdev/eval/guidance/ (accessed 11 maggio 2016).

Frey B.S., Stutzer A. (2002). What can economists learn from happiness research? *Journal of Economic literature*, 40(2): 402-435. https://doi.org/10.3929/ethz-a-004374069

Gigliarano C., Balducci F., Ciommi M., Chelli F.M. (2014). Going regional: An index of sustainable economic welfare for Italy. *Computers, Environment and Urban System*s, 45: 63-77. DOI: 10.1016/j.compenvurbsys.2014.02.007

Giovannini E., Hall J., d'Ercole M.M. (2007). Measuring well-being and societal progress. In Conference *Beyond GDP-Measuring progress, true wealth, and the well-being of nations*, European Parliament, Brussels, pp. 19-20.

IFEL (2015). I Comuni della Strategia Nazionale Aree Interne. Studi e Ricerche, prima edizione. Available at: http://www.fondazioneifel.it/documenti-e-pubblicazioni/item/4650-i-comuni-della-strategia-nazionale-aree-interne-prima-edizione-2015.

ISTAT (2016). Estimates of the pollutant load of urban waste water. Available at: http://www.istat.it/it/archivio/41920 (accessed 11 maggio 2016).

Kubiszewski I., Costanza R., Gorko N.E., Weisdorf M.A., Carnes A.W., Collins C.E., Franco Carol, Gehres L.R., Knobloch J.M., Matson G.E., Schoepfer J.D. (2015). Estimates of the Genuine Progress Indicator (GPI) for Oregon from 1960–2010 and recommendations for a comprehensive shareholder's report. *Ecological Economics*, 119: 1-7. DOI: 10.1016/j.ecolecon.2015.08.004

Mazziotta M., Pareto A. (2015). Methods for Constructing Non-Compensatory Composite Indices: A Comparative Study. *Forum for Social Economics*, 45(2-3): 213-229. Routledge. DOI: 10.1080/07360932.2014.996912

Mitchell G., Namdeo A., Kay D. (2000). A new disease-burden method for estimating the impact of outdoor air quality on human health. *Science of the Total Environment*, 246(2): 153-163. DOI: 10.1016/S0048-9697(99)00455-6

Nuvolati G. (2003). Resident and non-resident populations: quality of life, mobility and time policies. Journal of Regional Analysis and Policy, 33(2): 67-84. Available at: http://www.

jrap-journal.org/pastvolumes/2000/
OECD (1994). Creating Rural Indicators for Shaping Territorial Policy Organisation for Economic Co-operation and Development. OECD Publications and Information Centre, Paris, pp. 93.
Prete C., Cozzi M., Viccaro M., Romano S. (2017). Quality of Life and Social Inclusion of Inland Areas: A Multidimensional Approach to Performance Policies and Planning Assessment. *International Conference on Computational Science and Its Application*. pp. 485-500. Springer, Cham.. DOI: 10.1007/978-3-319-62407-5_34
Pulselli F.M., Ciampalini F., Tiezzi E., Zappia C. (2006). The index of sustainable economic welfare (ISEW) for a local authority: A case study in Italy. *Ecological Economics*, 60(1): 271-281. DOI: 10.1016/j.ecolecon.2005.12.004
Rete Rurale 2014-2020 (2016). Zoning and Cartography. Available at: http://www.reterurale.it/areerurali
RIVM (2000). De Hollander A.E.M., *et al.* 5e Nationale Milieu Verkenningen. RIVM, 2000. National Outlook, Summary in English, ISBN: Check.
Romano S., Cozzi M., Viccaro M., Persiani G. (2016). A geostatistical multicriteria approach to rural area classification: from the European perspective to the local implementation. *Agriculture and Agricultural Science Procedia*, 8: 499-508. https://doi.org/10.1016/j.aaspro.2016.02.055
Rosen S. (1974). Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of political economy* 82(1): 34-55. Available at: http://www.journals.uchicago.edu/doi/abs/10.1086/260169?journalCode=jpe
Royuela V., Suriñach J. & Reyes M. (2003). Measuring quality of life in small areas over different periods of time.*Social Indicators Research*, 64(1): 51-74.
Saisana M., Saltelli A., and Tarantola S. (2005). Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators. *Journal of the Royal Statistical Society*, A168, 307–323. DOI: 10.1111/j.1467-985X.2005.00350.x
Sen A. (1985). *Commodities and capabilities*. Amsterdam: North Holland.
Stiglitz J.E., Sen A.K., Fitoussi J. (2009). Report by the commission on the measurement of economic performance and social Progress. Available at: http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf. (accessed 26 April 2016).
Unione Europea (2016). Regolamento (UE) 1305/2013 del Parlamento europeo e del Consiglio del 17 dicembre 2013, sul sostegno allo sviluppo rurale da parte del Fondo Europeo Agricolo per lo Sviluppo Rurale (FEASR) e che abroga il Regolamento (CE) 1698/2005 del Consiglio. GU L, 347. Available at: http://eur-lex.europa.eu/legal-content/it/ALL/?uri=CELEX%3A32013R1305 (accessed 27 April 2016).
United Nations Development Programme (2001). Human development report 2001. New York, NY: Oxford University Press.
United Nations Development Programme (2010). Human development report 2010. New York, NY: Palgrave Macmillan.
Van Kamp I., Leidelmeijer K., Marsman G., De Hollander A. (2003). Urban environmental quality and human well-being: towards a conceptual framework and demarcation of concepts; a literature study. *Landscape and urban planning*, 65(1): 5-18. DOI: 10.1016/S0169-2046(02)00232-3
Wang Z.J., Shi P.J., Li W. (2012). Study of Central Cities Service Scope Based on Time Accessibility in Gansu Province. In *Advanced Materials Research*, vol. 524, pp. 2854-2860. Trans Tech Publications.
Wu C., Barnes D. (2011). A literature review of decision-making models and approaches for

partner selection in agile supply chains. *Journal of Purchasing and Supply Management*, 17(4): 256-274. DOI: 10.1016/j.pursup.2011.09.002.

Zhou P., Ang B.W. (2008). Comparing MCDA Aggregation Methods in Constructing Composite Indicators Using the Shannon-Spearman Measure. *Social Indicators Research,* 94(1): 83–96. DOI: 10.1007/s11205-008-9338-0.

Appendix

Tab. A.1 List of indicators included in the model

Dimensions	Thematic areas	Correlation with QoL	Indicators	Calculation method	Unit of measure	Data source	Reporting year
Economic dimension	Economic opportunities of the territory	+	Average Purchase Prices of Real estate (PPR)	-	€	Italian Real estate market monitor	2010-2014
		+	Bank Branches Number (BBN)	-	number	Bank of Italy	2015
Social dimension	Proximity to places of work/study	-	Mobility rate Domicile-Work/ Study (MDWS)	(Individuals number who move to onother town/ residents number)*100	%	Elaboration on ISTAT data – Census population 2011	2011
		+	Proximity rate Domicile-Work/Study (PDWS)	(Individuals number who emply <15 minutes to reach work/study/ residents number)*100	%	Elaboration on ISTAT data – Census population 2011	2011
	Spread and proximity to health and educational facilities	-	Travel Time to reach Hospital structures (TTH)	-	minutes	Our GIS processing - CTR	2015
		-	Travel Time to reach Secondary schools (TTS)	-		Our GIS processing - CTR	2015
		+	Percentage of Education services (PEd)	(School number/ population density)*100	%	Our GIS processing - CTR	2015
	Proximity to non-decentralized services	-	Travel Time to reach Administrative offices (TTA)	-	minutes	Our GIS processing - CTR	2015

Dimensions	Thematic areas	Correlation with QoL	Indicators	Calculation method	Unit of measure	Data source	Reporting year
Social dimension	Cultural and recreational facilities	-	Travel Time to reach Cultural activities (TTC)	-	minutes	Our GIS processing - CTR	2015
		-	Travel Time to reach Green spaces (TTG)	-	minutes	Our GIS processing - CTR	2015
		+	Percentage of Sport facilities (PSp)	-	%	Our GIS processing - CTR	2015
		+	Percentage of Free Time facilities (PFT)	-	%	Our GIS processing - CTR	2015
	Broadband access	+	Percentage of Population coverage with Access to Internet between 2 Mbps e 20 Mbps (PAI)	Individual number coverage with access to internet between 2 Mbps e 20 Mbps/resident number)*100	%	www.Infratelitalia.it	2015
Environmental dimension	Environmental health	-	Inhabitant Equivalent Total (IET)	1 inhabitant equivalent = 60 grams od Bod5	inhabitants	ISTAT	2009
		+	Distance from Industrial areas (DI)	-	meters	Our GIS processing - CTR	2015
		+	Distance from Landfills (DL)	-	meters	Our GIS processing – CTR	2015
	Nature conservancy	+	Areas percentage with High Ecological-naturalistic value (AHE)	(High ecological-naturalistic areas/ municipal areas)*100	%	ISPRA	2010
	Risk factors	-	Landslide risk (LR)	Landslide risk areas (R1, R2, R3, R4)/municipal areas)*100	%	Basin Authority	2015
		-	Seismic risk (SR)	-	Classes	www.utsbasilicata.it	2012

Source: our processing

Tab. A.2 Pearson correlation matrix for basic indicators

COR. MATRIX	PPR	BBN	MDWS	PDWS	TTH	TTS	PEd	TTA	TTC	TTG	PSp	PFT	PAI	IET	DI	DL	AHE	LR	SR
PPR	1																		
BBN	0.16161	1																	
MDWS	0.02954	-0.00331	1																
PDWS	-0.05372	-0.03696	0.063943	1															
TTH	-0.32465	-0.47543	0.02215	-0.03079	1														
TTS	-0.30185	-0.37313	0.00317	-0.01856	0.29910	1													
PEd	0.17527	0.57604	0.13254	0.014802	-0.19636	-0.21209	1												
TTA	-0.10105	-0.31176	0.02818	-0.10887	0.07829	0.19447	-0.25692	1											
TTC	-0.01868	-0.17004	0.052824	-0.18155	0.04160	0.16431	-0.03308	0.00504	1										
TTG	-0.08548	-0.13941	-0.07657	-0.04841	0.14483	0.21487	-0.06980	0.18121	0.06749	1									
PSp	0.38396	0.52941	0.06676	-0.20904	-0.27917	-0.25605	0.45015	-0.01651	0.08565	-0.07971	1								
PFT	0.34418	0.49739	0.06748	-0.23846	-0.20820	-0.19657	0.50607	-0.02759	0.04757	-0.13992	0.94495	1							
PAI	0.07049	0.13058	-0.00686	0.08241	-0.03365	-0.04777	0.170819	0.00994	-0.15398	0.03190	0.11936	0.13308	1						
IET	0.24285	0.81826	0.09317	-0.11917	-0.45248	-0.39506	0.43476	-0.1035	0.01019	-0.14400	0.77814	0.70703	0.12417	1					
DI	-0.11166	-0.08467	0.02357	0.00954	-0.18135	-0.02897	-0.01589	-0.14438	-0.00103	-0.04958	-0.15464	-0.11358	0.05919	-0.15018	1				
DL	-0.22580	-0.22313	0.00019	-0.02495	0.19262	0.38681	-0.24776	0.16635	0.03837	0.02880	-0.16253	-0.09739	0.00748	-0.20646	0.04787	1			
AHE	-0.05304	-0.20116	-0.03411	-0.10259	0.12367	0.06287	-0.16868	-0.17757	0.19019	0.05768	-0.17498	-0.14149	-0.06701	-0.30819	0.29632	0.20316	1		
LR	0.00294	0.35309	0.00149	0.09054	0.05063	-0.05026	0.37098	-0.35296	0.03544	0.03074	0.00144	0.04036	-0.10109	0.10761	-0.04193	-0.07027	0.14403	1	
SR	0.26158	0.12356	-0.05058	-0.06514	-0.05607	-0.11851	0.15833	-0.29504	0.08572	-0.01829	0.23269	0.23829	0.02159	0.18461	-0.05812	-0.23138	-0.13577	0.08048	1

Note: $P_{XY}>0$ positive correlation; $P_{XY}=0$ no correlation; $P_{XY}<0$ negative correlation; $0<|P_{XY}|<0.3$ weak correlation; $0.3<|P_{XY}|<0.7$ moderate correlation; $|P_{XY}|>0.7$ strong correlation.