



Can Rural Development Be Measured? Design and Application of a Synthetic Index to Portuguese Municipalities

I. Abreu¹ · J. M. Nunes² · F. J. Mesias¹

Accepted: 15 April 2019 / Published online: 22 April 2019
© Springer Nature B.V. 2019

Abstract

Starting the discussion about the framework 2021–2027, and regarding the increasing importance given to rural areas by the European Union, multifunctionality of agriculture and its positive externalities can be the leverage factor to a sustainable rural development. It is therefore crucial to identify the success issues in these territories where public investment can more effectively influence the private sector. Despite the existence of many indices of development, none of them is specifically designed for the evaluation of rural areas. This lack of rural development measures hampers the process of assessing the impact of public policies applied in a particular territory, or, in an ex-ante perspective, the identification of the areas where the use of public funds would be more effective. This work hence proposes the design of a Rural Development Index which would cover the defining characteristics of each region's development. The index has been constructed based on four dimensions: population, social, economic and environmental, with each of them being composed of different indicators. The index is finally applied it to 15 municipalities in a Portuguese NUT III region (North Alentejo) using the most recent data available from the 2011 Portuguese Census. The use of the index has allowed a comparative analysis of values of each territorial unit in different years, producing some conclusions on the effectiveness of the implementation of public policies. It was also possible to identify the dimensions in which the public development policies can improve their results, and how these dimensions contribute to different development levels of the territories.

Keywords Rural development · Index · Public funds · Effectiveness · Alentejo · Portugal

✉ F. J. Mesias
fjmesias@unex.es

¹ Department of Economics, University of Extremadura, Avda. Adolfo Suarez, s/n, 06007 Badajoz, Spain

² Departamento de Ciências Agrárias e Veterinárias, Escola Superior Agraria de Elvas, Edifício Quartel do Trem, Avenida 14 de Janeiro, 21, 7350-092 Elvas, Portugal

1 Introduction

Rural areas have some characteristics—such as a predominantly agricultural activity—that have typically allowed their definition and identification. However, nowadays their current economic structure and distribution of working population by sector are no longer so different from that of non-rural areas—although the weight of the agricultural sector is still clearly higher than in the cities (Abreu 2014). Nevertheless, rural areas present constraints such as lack of access to services and technology or remoteness from the main population centres, which can limit their development and jeopardize their persistence.

Until the beginning of the twentieth century, agriculture was the main and almost exclusive means of development of the rural population. The rural world was then viewed from a purely agricultural, productivity perspective, with no concerns for social issues or the development of other activity sectors in these areas. However, in the last decades deep transformations in rural areas took place, with the shift from a subsistence agricultural economy to a service economy and with a drastic reduction of agricultural labour, who moved to cities looking for more rewarding jobs. These migration processes have led to a depopulation of rural areas, together with an increasing aging of rural population which adds even more difficulties to those areas.

In fact, the different levels of development of rural and non-rural areas have become increasingly pronounced, with rural regions tending to lag behind non-rural areas in a number of socioeconomic indicators such as: a higher risk of poverty or social exclusion (25.5% vs. 22.1% for those living in towns and suburbs, according to 2015 data), less highly-educated people (27.9% vs. 48.1% among city-dwellers) and the lowest proportion of people making use of the internet on a daily basis (EUROSTAT 2017). Although the reasons for this “urban bias” are numerous, one the most important is that rural populations are generally less represented and mobilized, with urban elites dominating political discourse and institutions and organizations which deal with urban concerns.

Hence, rural spaces, populations and practices have been neglected both in development theories and practices as well as in the historical studies on development (Jones and Corbridge 2010). This is even more remarkable if we consider that until quite recently most of the world’s population lived in rural areas and depended on agriculture. Nowadays 44% of the world population live in rural areas, a figure even more significant in the case of developing countries, where it amounts up to 55% (Caruso et al. 2016), although rural problems persist in many parts of the world: poverty, little or no access to basic needs and resources, and lack of representation.

Once accepted the fact that rural areas face great and increasing disadvantages compared with urban areas—the so called, farm problem—the concept of rural development starts to be coined as the set of actions designed to try to compensate those shortcomings and therefore improve life quality and economic welfare in rural areas. It is a complex and sometimes vague concept which should be implemented through the so called “rural development policies” which would be the tool to maintain population and activity in those regions that are lagging behind more prosperous and active places.

The traditional approach to rural development and rural development policies was focused on agriculture and agri-food activities, a logical line considering that they were the main source of jobs and income in rural areas. For example, in the EU not only the starting initiatives in rural development were closely linked to the Common Agricultural Policy (CAP), but this relationship can also be found in the last proposals regarding the design of the CAP (European Commission 2017).

This emphasis, however, is no longer valid as rural areas are more and more defined not by their dependence on agriculture, but by their under-urbanization and their alienation from the current urban economic flow. Although this can be a positive aspect for many of their inhabitants, it entails specific problems such as difficult access to services, low implementation of business initiatives or lack of generational renewal of their residents. In this context, rural development policies must be broad and diverse so that they can answer the various problems that may be met. But in addition, they should be monitorable in order to determine if the objectives of improving the living conditions of rural areas and their population are being reached. It is therefore needed to develop tools capable of measuring the rural development of different areas, which is the objective this paper deals with through the creation of a rural development synthetic index.

The importance of an index especially directed to rural areas is twofold: (1) these areas have major asymmetries which hamper the assessment of their level of development, and, (2) in Europe more than 91% of the territory is classified as rural areas, where more than 56% of its population live.¹

Since, so far, there is no tool to support the policy makers' decisions at various levels, the Rural Development Index proposed in this paper (RDI_{Abreu}) is now trying to fill a gap felt by those who work in rural development. Fully understanding of the main determinants of economic and social growth of rural areas remains one of the chief policy issues (Bryden 2002), and given the multiple dimensions of rural development, there is a huge interest among policy makers to learn more about the magnitude and trends in the overall welfare in rural regions (Michalek and Zarnekow 2012a). Nevertheless, the structure of RDI_{Abreu} allows its applicability to any territorial dimension region of the world with minimal adaptations. Hence, in this paper the RDI_{Abreu} is applied to 15 Portuguese rural municipalities to test its applicability. The objective of this paper is therefore to provide a tool that can be used by those involved in the different levels of Rural Development policies and that would allow assessing the impact of public policies applied to a particular territory and the identification of the areas where the use of public funds would be more effective.

2 Theoretical Framework

Within the various indexes that have been created to measure development in a broad sense, the Gross Domestic Product (GDP) (World Bank 1997) has become for years *the* indicator to measure the economic activity of a region or country. However, GDP presents serious limitations to measure rural development (RD), as this concept goes thus much beyond the measurement of economic growth, and although there are other indexes that could be used for this task, such as the UN Human Development Index (HDI) (UNDP 2016), the Social Development Framework (Davis 2004) or the Multidimensional Poverty Index (Oxford Poverty and Human Development Initiative 2010) none of them is specifically designed for the evaluation of the rural areas. So, it's difficult to assess the impact of public policies applied to a particular region or, in an *ex-ante* perspective, the identification of the areas, or types of investment, where the use of public funds will be more effective. Furthermore, some additional challenges must also be considered, such as the scarce

¹ https://ec.europa.eu/agriculture/statistics/indicators/rd-2013/c2_en.pdf.

availability of reliable development indicators and the cost of collecting and analysing data (Horsley et al. 2015).

In this context, this paper proposes a Rural Development Index which is intended to be as comprehensive as possible, including not only economic and demographic aspects but also social and environmental ones. Even if it is easy to identify these four aspects as those concerning rural development policy, overcoming rural areas' constraints through precise targeting of policy interventions has proven to be a complex policy task. This is mostly due to their local/regional specificity as well as complex links among individual growth components and their constraints (Michalek and Zarnekow 2012b).

In order to construct an aggregate rural development index, several methodological issues must be taken into account as it is demonstrated by various empirical studies on this matter: selection of appropriate variables/coefficients and balancing between objective versus subjective indicators; weighting the variables/indicators according to their relative importance; using unbiased aggregation techniques; making the index useful for policy purposes (i.e. in programme evaluation) (Berger-schmitt and Noll 2000; Black and Henderson 1999; Kaufmann et al. 2007).

Ideally, the composite should measure multi-dimensional concepts that cannot be captured by partial indicators alone, and should therefore embrace all the most important rural development domains, e.g. economic output (including agriculture, food industry, rural tourism, etc.), investment, employment, poverty, education, health, housing conditions, crime, environment, urbanization and land use, etc. (DEFRA 2004).

With this concerns and based on the OECD assumptions for the definition of rural areas and their basic indicators,² Kageyama proposed a Rural Development Index, which will be the working base for the Rural Development Index here presented (Kageyama 2008). Kageyama's Rural Development Index has four different dimensions or sub-indexes: demography (Population Index), economy (Economic Development Index), social welfare (Social Welfare Index) and environment (Environment Index)—in order to classify the territorial units according to their Rural Development. Selecting some indicators representing these four areas, the sub-indexes are then joined by a simple arithmetic average of four dimensions:³

$$RDI_{\text{Kageyama}} = \frac{POP + SOC + ECO + ENV}{4}$$

Kageyama's index varies in a range from 0 to 1, meaning that the closer it is to 1, the higher is the rural development level of the territory in question. The strengths of Kageyama's index are mainly related to the inclusion not only of the economic and demographic pillars—which are the basis of the above mentioned indexes—but of the social and environmental aspects that are also very relevant regarding the development of rural areas. An example of its application was the evaluation of the effectiveness of public policies in Brazil (Haag 2009).

However, its design presents serious weaknesses, mainly due to its additive nature. Unbalanced rural development is not the solution to the problems of rural areas, and therefore, an index which allows fully compensation among the different pillars of development will not provide a sound and realistic measurement. It is therefore necessary to design a new tool that

² Regions are classified as Predominantly Rural if the share of population living in rural local units (with population density below 150 inhabitants per square kilometre) is higher than 50% (OECD 2010).

³ Where necessary, the variables were standardized.

can overcome those shortcomings, delivering adequate information to both policy makers and stake holders and allowing the implementation of more accurate policies.

3 Materials and Methodology

3.1 Construction of the Rural Development index RDI_{Abreu}

The Rural Development Index here proposed (RDI_{Abreu}) is based on Kageyama's proposal, although its construction evolved in a differentiated way, especially regarding the variables included within each pillar:

- Population—introducing the Demographic Dependency Index which reflects the relationship between the total and the working population (weighing the future in Rural Development);
- Social—The importance of Education has been strengthened with two variables, assuming that this issue is as important as the lack of basic health and sanitary conditions, for example (this is also the interpretation of the Human Development Index from UNO, also with 2 education variables);
- Economy—introducing the Employment Rate as an important contributor to the RDI value;
- Environment—although it's not very easy to get environmental data, 4 variables were selected as the increase of income and productivity normally lead to agricultural modernization, but then also to environmental degradation.

The detailed descriptions of the variables included in the index, together with their relative importance within each pillar are presented in Table 1.

Although the number of variables included within each dimension is smaller than that found in other indexes such as the Genuine Progress Indicator (GPI) (Bagstad and Shammin 2012), it was considered that the design of RDI_{Abreu} offers a more balanced approach, with more dimensions and a number of variables whose data can be easily obtained.

The Index here proposed uses a geometric mean within each dimension (population, social, economy and environment) in order to gather the variables, instead of the arithmetic mean, avoiding a substitute effect. With the geometric mean, a territory with significantly lower values in a dimension will have its RDI significantly penalized, instead of having the final result biased by extreme values (as when we use the arithmetic mean)—in fact, this is the same reason why, in 2010, the geometric mean replaced the use of the arithmetic mean in HDI (UNDP 2010). The underlying concept is that one region cannot be considered to have a high level of development if it has a poor performance in one of the dimensions of development, for what RDI_{Abreu} considers that the four dimensions (Population, Social, Economy and Environment) with equal importance in the evaluation of a territory's Rural Development. This is a particularly important characteristic as we consider that all the chosen variables should have the same weight/contribution for the final Index.

The Rural Development Index is thus obtained by the equation below:

$$RDI_{Abreu} = \sqrt[4]{POP} \times \sqrt[4]{SOC} \times \sqrt[4]{ECO} \times \sqrt[4]{ENV}$$

Table 1 Description of the variables included in the index, together with their relative importance within each of the pillars of Rural Development

	Abbreviation	Weight
<i>Population</i>		
Population density (inhab/km ²)—the intensity of population settlement expressed as the ratio between total population and surface area. A more developed territory is more attractive. The higher is its value, the lower the isolation of territories, therefore increasing the RDI value	PopDens	0.25
Rate of natural increase (%)—the difference between the number of live births and the number of deaths occurring during a given period, usually a calendar year divided by the mid-year population of that period	NatInc	0.25
Net migration (No.)—the difference between immigration into and emigration from the country or region during a given period, reflects the attractiveness capacity of each territory. It is assumed that a higher development will lead to a higher capacity on attracting populations	NetMig	0.25
Demographic Dependency Index (%)—the ratio of the elderly (ages 65 and older) plus the young (under age 15) to the population in the working ages (ages 15–64). Changes in the dependency ratio provide an indication of the potential social support requirements resulting from changes in population age structures	DmgDep	0.25
<i>Social</i>		
Literacy (%)—being education one of the most undisputed variables of development, the literacy rate is its base. Although we are in the twenty-first century, illiteracy rates are still significant in some rural areas	Lit	0.25
Proportion of resident population with at least the lower secondary education 3rd. cycle completed (%)—proportion of resident population with 15 and more years old with at least the lower secondary education 3rd. cycle completed. While literacy can be seen as a condition for minimum integration in society, compulsory education can be seen as a minimum condition to ensure employability. Not only a more developed society has the means for its youth to follow compulsory education, but higher levels of education also lead to higher productivity and living conditions	Educ	0.25
Physicians (No.) per 1000 inhabitants—this variable introduces the dimension of basic health conditions in the territory under study	Phys	0.25
Proportion of conventional dwellings of usual residence (%) with installation existence (electricity, water, toilet, bath/shower and heating)—to include dwellings quality in rural areas	Instal	0.25
<i>Economy</i>		
Proportion of family agricultural population with remunerated activity outside agricultural holding (%)—introducing the concept of activities diversification in the agricultural environment	OthRem	0.25
Average monthly earnings (€)—assessing the differences in labour remuneration between the various municipalities of the territory under study	Earn	0.25

Table 1 (continued)

Abbreviation	Weight
PurcPw	0.25
EmpIR	0.25
<i>Environment</i>	
EnvExp	0.25
WaterW	0.25
UrbW	0.25
Natura	0.25

Per capita purchasing power—Translation of the daily purchasing power expressed in per capita terms with reference to the national value (Portugal = 100). For the inclusion of other forms of household income beyond remuneration

Employment rate (%)—ratio between the employed population and the working age population (population aged 15 years old and over). It's one of the most significant variables for the economic sustainability of a territory

Environment

Environmental expenditure of municipalities per inhabitant (€/inhab)—with limited measures of environmental quality, public expenditure may be seen as a proxy. The higher is the expenditure per capita in areas as waste management, protection of biodiversity and landscape, the higher is assumed to be the environment quality

Proportion of wastewater treated (%)—the larger the volume of wastewater treated, the less the contamination of natural resources, thus increasing the environment quality

Proportion of urban waste selective collected (%)—waste subject to separate deposition by the holder in order to be recycled, what contributes in a positive way to the conservation of natural resources and to the environmental quality

Proportion of Natura 2000 Network area (%)—Natura 2000 is the European ecological network of special conservation areas which aims to ensure biodiversity through the conservation and restoration of natural habitats and flora. It can be seen as a proxy to environmental quality of a given territory

Source: own elaboration, from Instituto Nacional de Estatística de Portugal

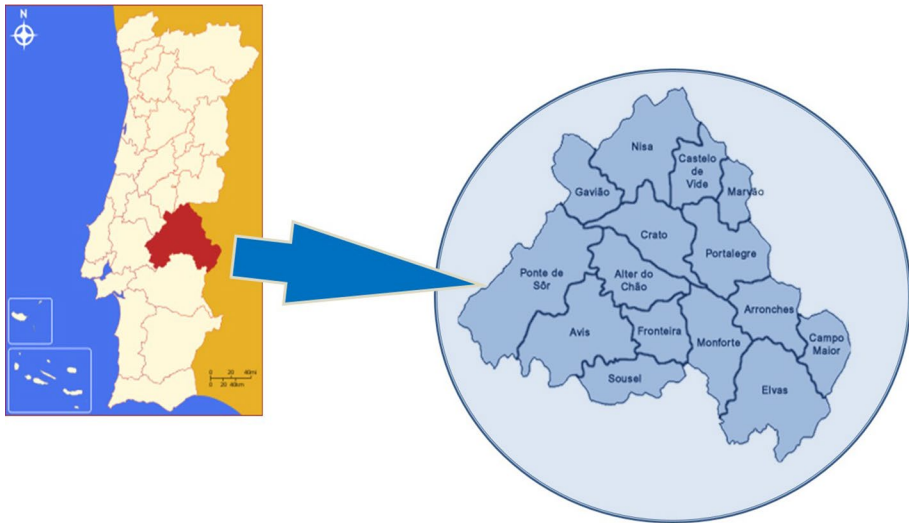


Fig. 1 Portugal, Alto Alentejo and its municipalities. *Source:* own elaboration

The nature of the values used to calculate the Index (standardized data) provides index values between 0 and 1.

3.2 Data Collection

In order to test the designed index, it was decided to select a less-favoured region, where Rural Development Policies have been and are currently being applied. It was considered that the adequate level of detail would be Local Administrative Unit (LAU), as it will allow the collection of the requested data, while at the same time providing an appropriate level of disaggregation of the results. It is also the smallest geographical dimension to which public policies are applied and it has also been also used in other studies about rural development (Mitică et al. 2017; Sánchez-Zamora et al. 2014). Therefore, the usefulness of the RDI_{Abreu} to support policy making, namely the decisions of public expenditure, is most adequate at this level. The RDI_{Abreu} is then applied to the NUTS III Alto Alentejo, Portugal (Central East Portugal, Fig. 1), at a municipality level (LAU). We have used the most recent data available for the whole set of variables (2011) from the Portuguese National Statistics Institute (Instituto Nacional de Estatística de Portugal 2012, 2018).

Alto Alentejo is a rural territory located in the inner board with Spain, with 6043 km², 118,506 inhabitants (Instituto Nacional de Estatística de Portugal 2012) and where almost 80% of the people live in rural areas (in fact, only 4 parishes⁴ of the whole district are not considered rural by the OECD definition—with more than 150 inhabitants/km²) (OECD 2010). The index here presented was applied to the 15 municipalities (LAU) of Alto Alentejo. The municipalities selected (Fig. 1) reflect the different types of villages that can be found the Eastern Portugal, regarding their population, services, economic development,

⁴ Corresponding to the former LAU 2.

Table 2 Values for each indicator for the 15 municipalities analysed

LAU	Population				Social				Economy				Environment			
	Pop-Dens (%)	NatInc (%)	NetMig (%)	DmgDep (%)	Lit (%)	Educ (%)	Phys Instal (%)	OthRem (%)	Earn (€)	PurePw (%)	EmpIR (%)	EnvExp (€)	WaterW (%)	UrbanW (%)	Natura (%)	
Alter-do-Chão	9.8	-1.2	11	79.1	87.6	35.8	1.4	93.6	34.1	808.8	70.15	34.3	132.0	85.0	24.0	3.2
Arronches	10.1	-2.4	33	79.4	83.5	34.5	2.2	92.8	22.3	743.7	68.06	34.9	61.0	100.0	11.0	78.7
Avis	7.5	-1.0	35	72.8	86.7	34.7	0.9	94.1	28.0	870.3	69.35	33.8	53.0	91.0	24.0	39.0
Campo Maior	34.2	-0.3	-18	59.3	90.3	45.0	6.4	94.8	36.9	1073.5	90.00	38.8	66.0	98.0	12.0	99.9
Castelo de Vide	12.9	-1.3	-7	76.2	86.9	41.8	2.4	93.9	16.1	796.5	76.08	35.2	50.0	100.0	19.0	94.3
Crato	9.3	-2.2	0	80.5	86.7	31.7	0.5	94.9	27.3	749.1	68.57	33.5	64.0	100.0	33.0	0.5
Elvas	36.6	-0.2	-173	60.2	91.8	47.3	4.8	93.9	27.5	828.8	84.87	36.0	20.0	95.0	17.0	33.7
Fronteira	13.7	-1.0	-27	69.5	87.3	38.3	1.2	95.0	35.9	808.1	71.96	37.2	36.0	96.0	17.0	0.0
Gavião	14.0	-1.8	-13	97.8	84.7	28.5	0.5	94.2	27.6	743.3	63.36	27.1	136.0	77.0	14.0	0.0
Marvão	22.7	-1.1	-8	74.0	86.8	34.3	2.0	89.6	21.6	711.6	61.23	34.7	44.0	100.0	19.0	99.9
Monforte	7.9	-0.6	-12	76.6	82.7	33.6	1.5	92.8	26.5	888.8	63.95	33.4	78.0	100.0	26.0	7.2
Nisa	12.9	-1.7	-22	90.1	87.2	34.1	1.4	94.7	19.0	792.8	67.43	31.0	70.0	100.0	16.0	56.5
Ponte de Sor	19.9	-0.8	-61	61.4	87.8	37.8	1.7	94.5	28.2	909.0	80.64	35.0	55.0	100.0	17.0	22.4
Portalegre	55.8	-0.7	-214	57.1	92.3	51.5	4.5	94.0	23.6	941.3	102.01	40.0	32.0	96.0	26.0	51.0
Sousel	18.2	-1.3	-15	78.0	86.0	37.3	1.2	94.9	30.0	756.4	66.06	36.0	35.0	98.0	12.0	0.0

Source: own elaboration, from Instituto Nacional de Estatística de Portugal

Table 3 *Alto Alentejo's* municipalities values for the Rural Development Index and its dimensions

	POP	SOC	ECO	ENV	RDI
Campo Maior	0.592	0.869	0.903	0.589	0.723
Portalegre ^a	0.448	0.874	0.749	0.530	0.628
Elvas	0.461	0.821	0.535	0.348	0.515
Ponte de Sor	0.429	0.512	0.555	0.450	0.484
Alter do Chão	0.508	0.430	0.477	0.484	0.474
Castelo de Vide	0.475	0.536	0.307	0.642	0.473
Avis	0.501	0.398	0.433	0.469	0.449
Fronteira	0.458	0.505	0.566	0.309	0.449
Crato	0.393	0.384	0.331	0.596	0.415
Monforte	0.525	0.247	0.386	0.563	0.410
Nisa	0.498	0.454	0.205	0.556	0.400
Sousel	0.505	0.456	0.402	0.272	0.398
Arronches	0.398	0.307	0.291	0.535	0.372
Marvão	0.535	0.232	0.215	0.643	0.362
Gavião	0.552	0.263	0.173	0.284	0.291

Source: OWN elaboration

^aPortalegre is the capital city of this NUTS III (which is also designated, from the administrative point of view, as Portalegre District)

etc. Data were produced in 2011 and were directly collected from the official website of INE (www.ine.pt). Table 2 shows the values for each indicator for the 15 municipalities analysed.

4 Results and Discussion

Taking as a starting point the data by municipality shown above, and using the RDI_{Abreu} , the values of the different dimensions of the rural development index have been calculated by municipality, together with the final value of the index (Table 3).

From an initial analysis, it can be observed that the most developed municipalities according to RDI_{Abreu} are those with the highest population density—which are also the most populated (Portalegre and Elvas) or more industrialized (Campo Maior). The latter is an especially significant case because although is a small municipality (less than 9000 inhabitants), it holds the main factory of an international company—with local origins—which employs more than 1600 workers, many of them natives of Campo Maior. As it has been stated by different authors (Black and Henderson 1999), economic activity makes the cities the drivers of economic growth and therefore of rural development. Furthermore, the economic dependence of rural areas on agricultural activities decreases when other sources of economic activity are present, as is the case of the biggest municipalities and Campo Maior. As it has been stated by different authors, those areas with more diversified economies are more resilient and therefore will suffer less in the event of a shock—such as the economic crisis of 2010–2014 (Christopherson et al. 2010; Sánchez-Zamora et al. 2014).

It is also possible to analyze these results more in depth from several perspectives, looking for any correspondence between in the characteristics of the different territories and its RDI values. For example, with an analysis at municipalities with similar RDIs, it's

Table 4 RDI_{Abreu} values for the municipalities of Alto Alentejo's NUTS III (2001 and 2011)

	2001	2011	% increase
Alter do Chão	0.360	0.474	32
Arronches	0.287	0.372	30
Avis	0.359	0.449	25
Campo Maior	0.650	0.723	11
Castelo de Vide	0.469	0.473	1
Crato	0.318	0.415	31
Elvas	0.517	0.515	0
Fronteira	0.350	0.449	28
Gavião	0.211	0.291	38
Marvão	0.264	0.362	37
Monforte	0.334	0.410	23
Nisa	0.321	0.400	25
Ponte de Sor	0.379	0.484	28
Portalegre	0.629	0.628	0
Sousel	0.159	0.398	150

Source: own elaboration

possible to identify the dimensions in which the public development policies can improve the results, while with an analysis of each variable we could see how the different dimensions contribute to different territories development levels.

However, it has been considered that a first analysis should involve the evolution over time of the RDI_{Abreu}, comparing the current data with those of 2001 (year of the previous Portuguese Census) (Table 4).

Comparing the values for two periods (2001 and 2011), we can see all municipalities have increased its Rural Development Index values, although the smaller villages in a more significant way (like Sousel and Gavião). Regarding the causes of this evolution, it can be observed that both municipalities were those with the lower RD indexes in 2001, and therefore their increase has been more marked. The present figures for Sousel and Gavião are not easy to explain, but according to Table 2 it can be observed that Gavião presents the highest Demographic Dependency Index while in Sousel the increases in Average monthly earnings and Per capita purchasing power were relatively significant with the settlement of a regional slaughterhouse where many locals work. Gavião still relies on agriculture, and its employment rate is the lowest of the analysed municipalities—even though this figure could also be related to the aging process reflected by the Demographic Dependency Index. These findings are in line with other studies (Mítrică et al. 2017) that have found that the socio-economic development of rural areas is positively related to positive natural increases in local population and negatively linked to aging populations. Regarding the different dimensions of the index (Population, Social, Economy and Environment), Figs. 2, 3, 4 and 5 show their evolution between 2001 and 2011, in order to delve in the study.

Regarding the Population dimension, it can be highlighted that in most of the studied municipalities the values have increased in the analysed period, although the two biggest cities (Portalegre and Elvas) have shown substantial reductions. These findings can be mainly explained by a reduction in net migration to these cities during the economic crisis, as the disappearance of jobs in the industry and service sectors affected to a higher degree the most urban areas. However, the smaller municipalities, more

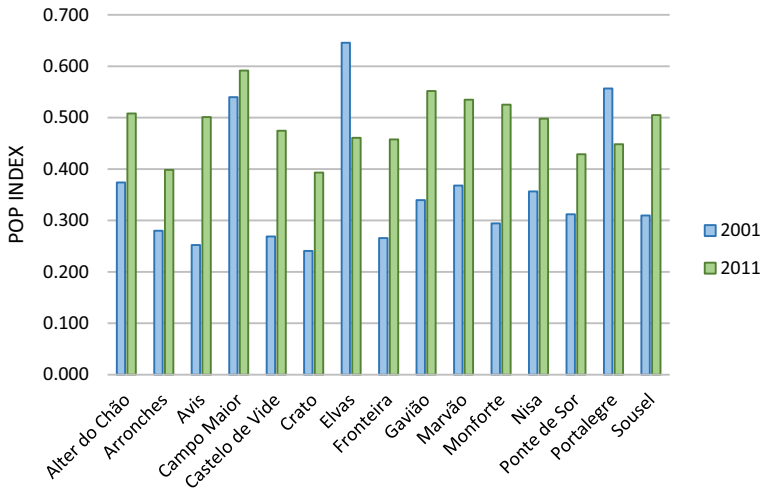


Fig. 2 Evolution the population dimension for each municipality between 2001 and 2011. *Source:* own elaboration

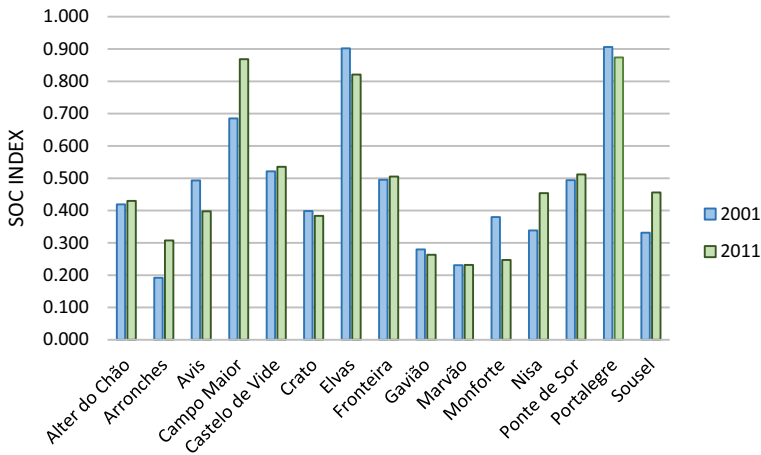


Fig. 3 Evolution the Social dimension for each municipality between 2001 and 2011. *Source:* own elaboration

dependent on agriculture, where also more resilient in those troubled times, and then presented a less negative evolution on variables like Net migration and Demographic Dependency Index. These results highlight the role of agriculture as a source of resilience in rural areas, acting as a buffer to generate jobs and income in times when other economic activities are expelling workers. This can be a positive fact in certain times—as described above—but that can also become an obstacle for changes and evolution of these regions when rural stakeholders are not able to adapt to their new socio-economic environment (Lebel et al. 2006; Schouten et al. 2012).

Figure 3 shows the changes in the Social dimension of the RDI_{Abreu} for Alto Alentejo’s municipalities.

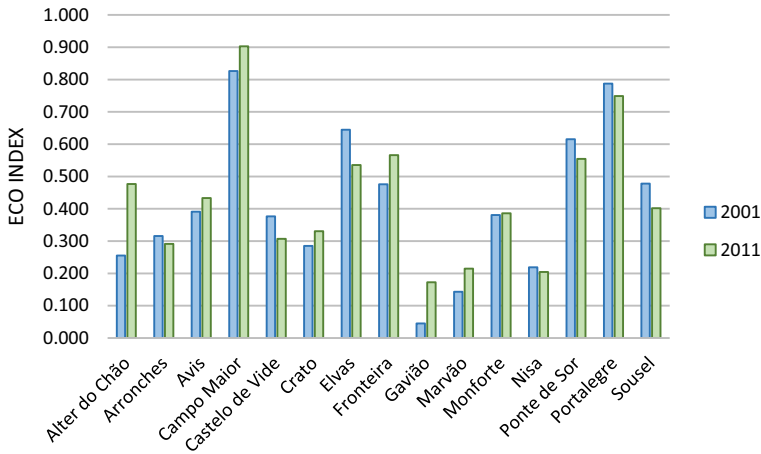


Fig. 4 Evolution the economic dimension for each municipality between 2001 and 2011. *Source:* own elaboration

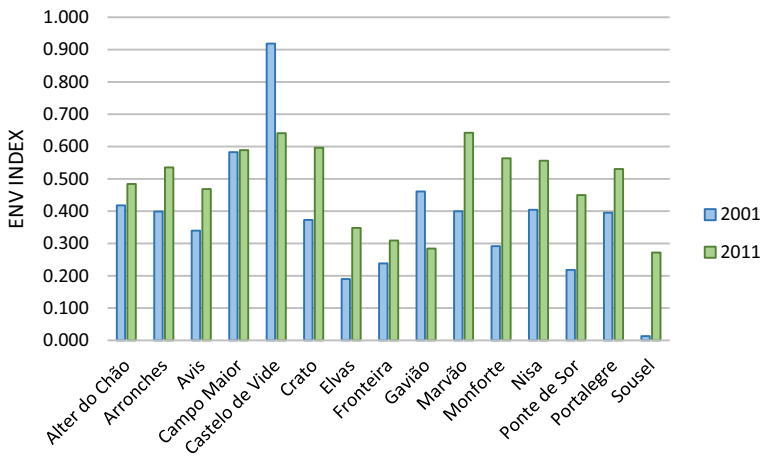


Fig. 5 Evolution the Environmental dimension for each municipality between 2001 and 2011. *Source:* own elaboration

Regarding the Social pillar of rural development, it should be expected that all the variables included in this dimension would have increased as a natural trend in a developed country (the general levels of education and literacy increase steadily in western societies). Obviously, these changes are less noticeable in the biggest cities (Portalegre and Elvas) which had the highest levels already in 2001. For example, both cities had Higher Education Institutions, dating from the 1980s–1990s. The other interesting result in this dimension is the evolution of Campo Maior, a town where a Portuguese coffee roasting and packaging firm is headquartered and that become Portugal’s coffee market leader for the past two decades, hiring nowadays more than 3000 highly qualified people and with a strong relationship with its birth place. Accordingly, it has been found a relationship between education and development in the context of specialization, which is less relevant in large and already diversified urban areas (Portalegre, Elvas and Campo Maior) but which can be an

impossible alternative in the most small, rural and isolated towns, where simple lack of enough resources—educated people—can block the development generated by new economic approaches (McCann and Ortega-Argilés 2015; Naldi et al. 2015). There is therefore a need to change the traditional focus of education networks, including as a new variable the specific needs of rural areas.

The evolution of the Economic indicators is shown in Fig. 4 and can be traced down to the world economic crisis, with increasing unemployment rates, reduction of the family budgets and decreasing consumption from both individuals and institutions.

Nevertheless, there are some exceptions, specially again Campo Maior—whose evolution has already been explained—but also Alter do Chão and Fronteira, both small towns with major changes in their historical heritage between 2001 and 2011. The development of Alter do Chão Stud Farm at a tourist and pedagogical level (with the implementation of its professional school of rural development), and a major remodelling of a facility of a sulphurous spa in 2007 in Cabeço de Vide (Fronteira) were facts that leveraged the local employment and economies. These examples are in line with other research (Hashemi and Ghaffary 2017) where tourism in rural areas has been seen as an opportunity for development while also highlight the role of education that was previously stated.

Finally, and regarding the Environmental pillar (Fig. 5), the general upward trend is clearly linked with the growing environmental concerns of citizens and—reluctantly sometimes—politicians, which is reflected in increasing expenditure in environmental-related works and a reduction in the tolerance towards polluting activities. This findings are in accordance with other research showing the positive impact of Rural Development policies for the environment (Gottero and Cassatella 2017).

However, it can be observed that in two of the analysed municipalities (Castelo de Vide and Gavião) the value of this component has declined sharply. In Castelo de Vide municipality it was observed that the expenditure in environmental protection has declined by more than half from 2001 to 2011, a behaviour not matching that of Portuguese regions, which devote more than 50% of their rural development budget to environmental actions (Uthes et al. 2017). On the other hand, Gavião is the only municipality between the 15 in study that has decreased the proportion of wastewater treated.

Finally, Table 5 presents data regarding expenditure from LEADER Programme⁵ in the different municipalities between 2007 and 2013 in order to check for relationships between the evolution of RDI_{Abreu} and EU initiatives in rural development.

Although UE recognizes that integrated local approaches are more effective than sectorial subsidies/support to generate endogenous rural development growth (Nuñez 2008), the integration of the Community Initiative LEADER as a mainstreaming policy took away its flexibility and the possibility to support innovative projects since 2007. What it seemed to be a good idea made LEADER loose autonomy and flexibility, increased the amount of bureaucracy, and reduced its innovative nature by avoiding risk taking in the projects supported.

⁵ LEADER (Liaison Entre Actions de Développement Rural) was a Community Initiative launched in 1991, based on the idea that rural development strategies are more effective and efficient when designed and implemented by local actors at a local level (a bottom-up approach). Its success led LEADER to be “mainstreamed” in national rural development programmes since 2007.

Table 5 Investment and expenditure from LEADER Programme in Alto Alentejo

	Public expenditure (only from LEADER Programme) (euros)	Jobs created by the Programme (no.)	Total investment (euros)	Expenditure/ inhabitant (€/inhab)
Alter do Chão	815,942.84	2.0	1,260,887.86	235.69
Arronches	764,563.67	6.0	1,238,668.89	246.63
Avis	1,905,255.75	22.0	3,214,968.00	422.92
Campo Maior	1,209,194.91	8.0	1,960,911.35	144.55
Castelo de Vide	1,031,500.29	9.0	1,664,780.73	317.58
Crato	908,663.61	6.0	1,468,918.83	258.00
Elvas	1,075,097.82	14.0	2,091,681.72	48.33
Fronteira	945,382.67	6.0	1,644,388.50	293.41
Gavião	752,745.51	12.0	1,225,400.89	194.36
Marvão	1,634,273.01	16.5	2,728,054.17	484.09
Monforte	266,650.79	0.0	429,089.70	82.61
Nisa	1,223,781.00	9.0	2,083,637.71	174.35
Ponte de Sor	1,329,642.15	17.5	2,034,610.05	82.16
Portalegre	1,443,181.99	22.5	2,450,423.50	60.35
Sousel	292,132.73	3.0	463,266.28	59.95
	15,598,008.74	153.5	25,959,688.18	

Source: own elaboration

5 Conclusions

Although RDI_{Abreu} has been developed taking into consideration the Portuguese rural world and the data available there, it can be used in any region of the world with minimal adaptations, thus providing an interesting tool for researchers and policy makers.

Despite the existence of many indices of development, none of them is specifically designed for the evaluation of the rural areas. This lack of rural development measures hampers the process of assessing the impact of public policies applied in a particular territory, or, in an ex-ante perspective, the identification of the areas where the use of public funds would be more effective. As none of the existing indexes solves the problem of the applicability to small territories (e.g. at a municipal level) or considers the particularities of the rural areas, RDI_{Abreu} can become a useful tool for national and local policy makers. RDI_{Abreu} is therefore an index especially conceived for the rural areas, where there are major asymmetries which hamper the assessment of their levels of development, and it tries to fill a gap felt by those who work in the rural development by generating results and allowing analysis not available until now.

The application of RDI_{Abreu} to Alto Alentejo municipalities has allowed to highlight some factors with special relevance for Rural Development, such as the buffer role of agricultural activities—which can help to soften the impact of economic crisis—or the link between specialized education and development. The index proposed here might be improved in the future for example with the inclusion of new variables, although the information provided by the National Statistics Institutes will always be a constraint. It may also be interesting to make a comparative analysis of the RDI values of each municipality in different years allowing some conclusions on the effectiveness of the

public policies implementation. This comparison is certainly a strong argument in an attempt to convince the decision-makers to use the RDI when considering which type of public investment is more suitable for each territory.

With the increasing importance of rural areas as a potential way of facing global economic crisis, the multifunctionality of agriculture and its positive externalities can be a leverage factor for sustainable rural development. Rural and agriculture are no longer synonyms, and the positive externalities generated by the multifunctionality of agriculture are unanimously recognized, supporting other economic activities and promoting the development of the region (with rural tourism being a good example). However, the fact that the rural world is composed of a wide range of small territorial units with their own specificities, leads to difficulties in finding adequate metrics for rural development, which should always allow to take into account the particularities of the different territories under study.

References

- Abreu, I. (2014). *Construção de um índice de desenvolvimento rural e sua aplicação ao Alto Alentejo*. Instituto Politécnico de Portalegre.
- Bagstad, K. J., & Shammin, M. R. (2012). Can the genuine progress indicator better inform sustainable regional progress? A case study for Northeast Ohio. *Ecological Indicators*, 18, 330–341. <https://doi.org/10.1016/j.ecolind.2011.11.026>.
- Berger-schmitt, R., & Noll, H. (2000). Conceptual framework and structure of a European system of social indicators. Mannheim: Centre for Survey Research and Methodology.
- Black, D., & Henderson, J. V. (1999). A theory of urban growth. *The Journal of Political Economy*, 107(2), 252–284. <https://doi.org/10.1086/250060>.
- Bryden, J. M. (2002). Rural development indicators and diversity in the European union. In: *Conference on "Measuring Rural Diversity"*, Washington, DC. http://srdc.msstate.edu/trainings/presentations_archi ve/2002/2002_bryden.pdf. Accessed 6 May 2018.
- Caruso, D., Contò, F., & Skulskis, V. (2016). The implementation of measure 121 of the rural development program: Comparative analysis between Italy and Lithuania. *Intellectual Economics*, 9, 102–107. <https://doi.org/10.1016/j.intele.2016.02.001>.
- Christopherson, S., Michie, J., & Tyler, P. (2010). Regional resilience: Theoretical and empirical perspectives. *Cambridge Journal of Regions, Economy and Society*, 3(1), 3–10. <https://doi.org/10.1093/cjres/rsq004>.
- Davis, G. (2004). *A history of the social development network in the World Bank, 1973–2002*. Washington, DC: Social Development.
- DEFRA. (2004). *Regional quality of life counts-2003. Regional versions of the headline indicators of sustainable development* (4th ed.). London: Department for Environment, Food and Rural Affairs.
- European Commission. (2017). *The future of food and farming*. Brussels. https://ec.europa.eu/agriculture/sites/agriculture/files/future-of-cap/future_of_food_and_farming_communication_en.pdf. Accessed 1 June 2018.
- EUROSTAT. (2017). *Statistics in rural areas in the EU*. https://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_rural_areas_in_the_EU%0D. Accessed 31 Jan 2019.
- Gottero, E., & Cassatella, C. (2017). Landscape indicators for rural development policies. Application of a core set in the case study of Piedmont Region. *Environmental Impact Assessment Review*, 65, 75–85. <https://doi.org/10.1016/j.eiar.2017.04.002>.
- Haag, A. (2009). *Performance of the national program for strengthening family agriculture in the State of Rio Grande do Sul*. Universidade Federal do Rio Grande do Sul.
- Hashemi, N., & Ghaffary, G. (2017). A Proposed Sustainable Rural Development Index (SRDI): Lessons from Hajji village, Iran. *Tourism Management*, 59, 130–138.
- Horsley, J., Prout, S., Tonts, M., & Ali, S. H. (2015). Sustainable livelihoods and indicators for regional development in mining economies. *Extractive Industries and Society*, 2(2), 368–380. <https://doi.org/10.1016/j.exis.2014.12.001>.
- Instituto Nacional de Estatística de Portugal. (2012). *Censos 2011. Resultados Definitivos*. censos.inec.pt/xportal/xmain?xpgid=censos2011_apresentacao&xpid=CENSOS%0D. Accessed June 1 2018.

- Instituto Nacional de Estatística de Portugal. (2018). *Base de dados*. https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_base_dados. Accessed 6 Jan 2018.
- Jones, G. A., & Corbridge, S. (2010). The continuing debate about urban bias: The thesis, its critics, its influence, and implications for poverty reduction. *Progress in Development Studies*, 10(1), 1–18. <https://doi.org/10.1177/146499340901000101>.
- Kageyama, A. (2008). *Desenvolvimento rural: Conceitos e aplicação ao caso brasileiro*. Porto Alegre: UFRGS Editora.
- Kaufmann, P., Stagl, S., Zawalinska, K., & Michalek, J. (2007). Measuring quality of life in rural Europe—A review of conceptual foundations. *Eastern European Countryside*, 13(2017), 5–27.
- Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., et al. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, 11(1), 1–19.
- Mccann, P., & Ortega-Argilés, R. (2015). Smart specialisation, regional growth and applications to Eu Cohesion Policy. *Regional Studies*, 49(8), 1291–1302. <https://doi.org/10.1080/00343404.2013.799769>.
- Michalek, J., & Zarnekow, N. (2012a). Construction and application of the Rural Development Index to analysis of rural regions. Luxembourg: European Commission.
- Michalek, J., & Zarnekow, N. (2012b). Application of the Rural Development Index to analysis of rural regions in Poland and Slovakia. *Social Indicators Research*, 105(1), 1–37. <https://doi.org/10.1007/s11205-010-9765-6>.
- Mitrică, B., Mocanu, I., Dumitrașcu, M., & Grigorescu, I. (2017). Socio-economic disparities in the development of the Romania's border areas. *Social Indicators Research*, 134(3), 899–916. <https://doi.org/10.1007/s11205-016-1462-7>.
- Naldi, L., Nilsson, P., Westlund, H., & Wixe, S. (2015). What is smart rural development? *Journal of Rural Studies*, 40, 90–101. <https://doi.org/10.1016/j.jrurstud.2015.06.006>.
- Núñez, J. (2008). *The evolution and impact of the EU regional and rural policy*. <https://www.ceps.eu/publications/evolution-and-impact-eu-regional-and-rural-policy>. Accessed 15 June 2018.
- OECD. (2010). *Organisation for Economic Co-operation and Development (OECD) regional typology*. doi:<http://dx.doi.org/10.1787/region-data-en>. Accessed 15 June 2018.
- Oxford Poverty and Human Development Initiative. (2010). *Multidimensional Poverty Index*. <https://ophi.org.uk/mpi-2010-one-page-summary/>. Accessed 31 Jan 2019.
- Sánchez-Zamora, P., Gallardo-Cobos, R., & Ceña-Delgado, F. (2014). Rural areas face the economic crisis: Analyzing the determinants of successful territorial dynamics. *Journal of Rural Studies*, 35, 11–25. <https://doi.org/10.1016/j.jrurstud.2014.03.007>.
- Schouten, M. A. H., van der Heide, C. M., Heijman, W. J. M., & Opdam, P. F. M. (2012). A resilience-based policy evaluation framework: Application to European rural development policies. *Ecological Economics*, 81, 165–175. <https://doi.org/10.1016/j.ecolecon.2012.07.004>.
- UNDP. (2010). *Human development report 2010*. United Nations Development Programme.
- UNDP. (2016). *Human development report 2016*. United Nations Development Programme. eISBN: 978-92-1-060036-1.
- Uthes, S., Li, F., & Kelly, E. (2017). Does EU rural expenditure correspond to regional development needs? *Land Use Policy*, 60, 267–280. <https://doi.org/10.1016/j.landusepol.2016.10.016>.
- World Bank. (1997). *Expanding the measure of wealth. Indicators of environmentally sustainable development*. Washington, DC: World Bank.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.