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Measuring Social Sustainability of NUTS-1 Level Regions in Turkey

Kara Y[1], Köne A. Ç.[2]

1 Department of International Trade and Finance, Assistant Professor, Muğla, Turkey
2 Department of Economics, Professor, Muğla, Turkey

ykara@mu.edu.tr

Measuring Social Sustainability of NUTS-1 Level Regions in Turkey

Kara Y. and Köne A. Ç.

Abstract

While the concept of sustainable development generally refers to achieving a balance among the environmental, economic, and social pillars of sustainability, the social pillar has had less attention than economic and environmental sustainability. However, in recent years, social sustainability has become an important concept for policy makers and scholars. The measurement and assessment of social sustainability is also gaining importance in this context. The objective of this study is to develop a tool in order to measure social sustainability of Turkish regions for NUTS-1 level and examine each region's social sustainability performance. To this aim, an Analytic Hierarchy Process (AHP) model is proposed since AHP is an efficient tool for integrating indicators with different units of measurement. SuperDecisions software v.2.4.0 was used for the analysis and the model is applied to 12 NUTS-1 regions for the 2008-2013 period. NUTS-1 regions were ranked according to a set of six criteria namely, education, health, poverty, unemployment, safety and illiterate women. The results indicate that regions have shown relatively low performance between 2008 and 2011. However in 2012 and 2013 all regions got highest social sustainability performance scores. TRB (Ortadoğu Anadolu), TR3 (Ege), TR7 (Orta Anadolu), TR8 (Batı Karadeniz) and TR9 (Doğu Karadeniz) regions got scores of highest social sustainability in 2012 and TR1 (İstanbul), TR2 (Batı Marmara), TR4 (Doğu Marmara), TR5 (Batı Anadolu) and TR6 (Akdeniz) in 2013. TRA (Kuzeydoğu Anadolu) region has shown the best social sustainability performance in 2008 and TRC (Güneydoğu Anadolu) region in 2011. None of the regions in 2009 and 2010 performed well compared to other years. Specifically in 2009 TRC (Güneydoğu Anadolu), TR2 (Batı Marmara), TR3 (Ege), TR4 (Doğu Marmara), TR5 (Batı Anadolu), TR6 (Akdeniz), TR7 (Orta Anadolu) have shown the lowest performances. In 2010 TRA (Kuzeydoğu Anadolu), TRB (Ortadoğu Anadolu), TR8 (Batı Karadeniz) and TR9 (Doğu Karadeniz) regions have shown the lowest performances.

Keywords: Sustainability, Social Sustainability, Regional Development, Analytic Hierarchy Process, Multicriteria Analysis

JEL classification: Q01, P25, P48, C44

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1. INTRODUCTION

Ever since the sustainability defined in Brundtland Report as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (World Commission, 1987), the term is discussed in a wide range of literature. However social sustainability as one of the components of sustainability has started to receive academic interest after 1990's (Wang et al, 2014) and has gained increasing attention in recent years. But the ambiguity in the definition of sustainability (Kates, Parris and Leiserowitz, 2005) is also questioning for social sustainability too (Vallence, Pekins and Dixon, 2011; Litting and Griessler, 2005). It is widely accepted that social sustainability is still not theorized both in terms of definition and criteria (Landorf, 2011). Assessment of measuring social sustainability not well developed as well (Veldhuizen et al, 2015). There is a gap in the literature.

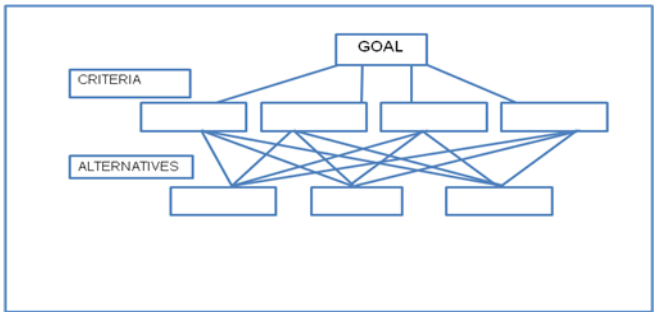
Social sustainability is simply about creating and sustaining strong communities. McKenzie (2004) defined social sustainability as "a life-enhancing condition within communities and a process within communities that can achieve that condition". When the capacity of current and future generations enhanced to create healthy and liveable communities the social sustainability occurs (McKenzie, 2004). Three dimensions of social sustainability identified by Landorf (2011); social equity, social cohesion and satisfaction of basic needs. Social sustainability can be enriched by strengthening social policy at the core of government actions (Hardi and Zdan, 1997) and active participation of stakeholders to the decision making processes.

The objective of this study is to measure and compare social sustainability performances of 12 regions in Turkey between 2008 and 2013. With this aim, an Analytic Hierarchy Process (AHP) model proposed since AHP is an efficient tool for integrating indicators with different units of measurement.

2. METHODOLOGY

The Analytic Hierarchy Process (AHP) was developed by Saaty (1980) as a mathematical based decision support tool to solve complex multi criteria decision making problems. The AHP method has been widely applied in a wide range of study fields. The AHP is an effective method for evaluating the complexity by decomposition problem into criteria and attributes hierarchically (See Fig. 1).

Figure 1. Graphic representation of AHP



The basic principles of AHP can be summarized as defining and determining the problem; decomposing the problem in a hierarchy from top through the intermediate levels; constructing a set of pair wise comparison matrices; testing the consistency index; synthesizing the hierarchy to find out the ranks of the alternatives (Saaty and Kearns 1985). AHP makes use of pair wise comparisons to simplify the judgment process and to create the comparison matrix with 1-9 ratio scaling developed by Saaty (2000) (see Table 1). Even though different scales are developed 1-9 ratio is widely accepted (Ramanathan, 2001) since the approval of the method.

Table 1. The Pairwise Comparison Scale

Intensity of importance	**Definition**	**Explanation**
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favour one activity over another
5	Strong importance	Experience and judgment strongly favour one activity over another
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2,4,6,8		Intermediate values

Source: Saaty (2000)

AHP is based on pairwise comparison of the elements belongs to the same hierarchy level using the 1-9 scale. A comparison matrix is generated from the set of pairwise comparisons. Where *n* is the number of elements and (A_1, A_2,…A_n) is any set of n elements than a sample of square matrix can be produced as below. In the comparison matrix (a_{ij}) is the representative of each (A_i, A_j) judgement.

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

When (w_1, w_2, …w_n) are the elements of the corresponding weights, the dominance of an element in the row over the element in the column represented as w_i/w_j. The general form of comparison matrix of AHP is given in matrix A below;

$$A = \begin{pmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} \\ \vdots & \vdots & & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_n} & \cdots & \frac{w_n}{w_n} \end{pmatrix}$$

In this step of the analysis the problem turns in to general process to calculate the largest eigenvalue related to eigenvector to calculate the consistency index. We can calculate consistency index with the help of equation 1 and equation 2 below where A is the matrix, x is the eigenvector and λ is the eigenvalue. When we divide consistency index by the random consistency number which was constituted by Saaty (1980) the final value must be less than 0.10 (Saaty, 1999).

$$Ax = \lambda x \qquad (1)$$

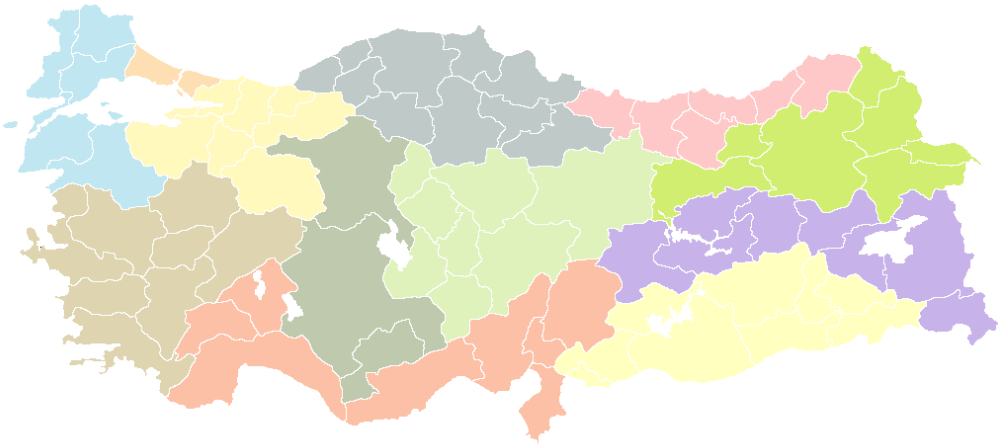
$$C.I. = \frac{\lambda_{\max} - n}{n-1} \qquad (2)$$

If all judgements are consistent, synthesizing the hierarchy to find out rankings for the alternatives comes as the last step of the analysis. Since evaluating and measuring social sustainability is a complex problem, the AHP method employed in this study to solve this complexity.

3. HIERARCHY

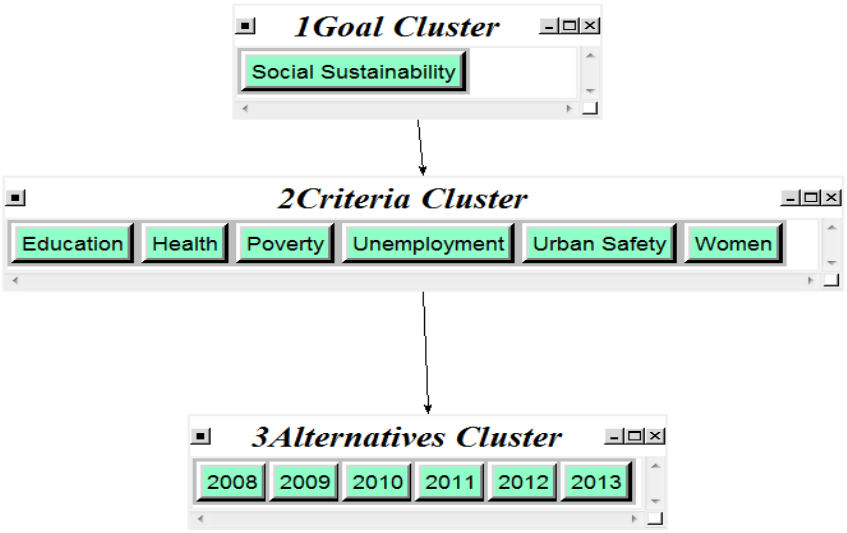
In Turkey, regional classification consisted of seven regions was adapted to European Union (EU) NUTS (nomenclature of territorial units for statistics) (Eurostat, 2011) geographic areas classification system in 2002. Since the attendance to the European NUTS classification, the conventional geographical statistic units which had been used since 1950's have lost their relevance. According to the new NUTS classification system Turkey has 12 NUTS-1 regions (See Fig. 2), 24 NUTS-2 sub-regions and 81 NUTS-3 provinces. This classification was based on the sizes of population by regarding to social, economic and geographical factors (TUIK, 2006).

Figure 2. NUTS-1 Classification of Turkey



The goal of this study is measuring each 12 NUTS-1 level regions' social sustainability performances for the period of 2008 and 2013.In order to assess the performances a hierarchy tree is developed and presented in Figure 3.

Figure 3. Hierarchy Tree of the Analysis



At the top of the hierarchy (Level 1) there exists the goal of the problem. There is a set of criteria presented as the second level of the hierarchy. The suggested set of indicators comprises six social indicators which are education, health, poverty, unemployment, safety and illiterate

women (Table 2). These indicators has been choosen to represent the key elements of regional social sustainability. Also the number of indicators are limited with six by the reason of "magic number seven, plus or minus two" rule of the AHP method. Saaty and Özdemir (2003) demonstrated that the number of elements to compare in a level of hierarchy shouldn't exceed seven (plus or minus two).

For the measurement of education and health the number of students per classroom and the number of citizens per doctor were choosen. The percentage of poverty, percentage of unemployment in uninstitutional population and percentage of illiterate women implicated in the hierarchy to represent poverty, unemployment and illiterate women respectively. The safety indicator was adapted from Mega and Petersen (1998) to express the percentage of people suffer from lack of safety. The safety indicator was calculated as a percentage of population affected by crime and traffic accidents. It is assumed that, each criteria in the second level of hierarchy contribute to social sustainability equally. Therefore criteria clusters are connected to the goal and equal weights are assigned for the second level of the hierarchy. Finally, the third and the last level represents the alternatives of the hierarchy. Level 3 comprises 6 years starting from 2008 to 2013.

Table 2. Definition of Indicators

Theme	**Indicator**	**Unit**	**Source**
Education	Number of students per classroom	Students	TURKSTAT
Health	Number of citizens per doctor	Citizens	TURKSTAT
Poverty	Poverty rate	%	TURKSTAT
Unemployment	Unemployment rate	%	TURKSTAT
Safety	Percentage of population affected by crime and traffic accidents	%	Calculated
Women	Percentage of illiterate women	%	TURKSTAT

4. RESULTS

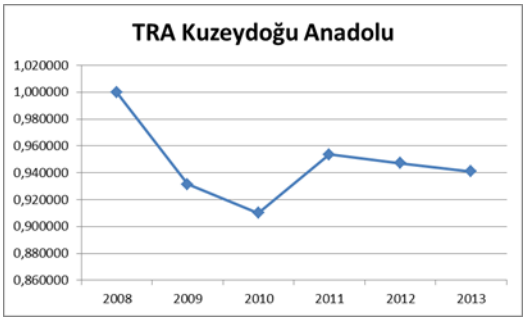
Table 3. Results of the Analysis

TRA Kuzeydoğu Anadolu				TRB Ortadoğu Anadolu				TRC Güneydoğu Anadolu			
	Ideals	Normals	Raw		Ideals	Normals	Raw		Ideals	Normals	Raw
2008	1	0,17595	0,087975	2012	1	0,176192	0,088096	2011	1	0,17357	0,086785
2011	0,953587	0,167784	0,083892	2013	0,992515	0,174873	0,087437	2010	0,976112	0,169424	0,084712
2012	0,947261	0,166671	0,083335	2011	0,956385	0,168507	0,084254	2012	0,975962	0,169398	0,084699
2013	0,940901	0,165552	0,082776	2008	0,932033	0,164217	0,082108	2008	0,950261	0,164937	0,082469
2009	0,931506	0,163898	0,081949	2009	0,903303	0,159155	0,079577	2013	0,935855	0,162437	0,081218
2010	0,910176	0,160146	0,080073	2010	0,891391	0,157056	0,078528	2009	0,923164	0,160234	0,080117
TR1 İstanbul				TR2 Batı Marmara				TR3 Ege			
	Ideals	Normals	Raw		Ideals	Normals	Raw		Ideals	Normals	Raw
2013	1	0,179696	0,089848	2013	1	0,184311	0,092155	2012	1	0,181586	0,090793
2012	0,95343	0,171327	0,085664	2012	0,991318	0,182711	0,091355	2013	0,992918	0,1803	0,09015
2011	0,949589	0,170637	0,085319	2011	0,93102	0,171597	0,085798	2011	0,954379	0,173302	0,086651
2008	0,896836	0,161158	0,080579	2008	0,848061	0,156307	0,078153	2008	0,865732	0,157205	0,078602
2010	0,890905	0,160092	0,080046	2010	0,839063	0,154648	0,077324	2010	0,85782	0,155768	0,077884
2009	0,874204	0,157091	0,078545	2009	0,816161	0,150427	0,075214	2009	0,836189	0,15184	0,07592
TR4 Doğu Marmara				TR5 Batı Anadolu				TR6 Akdeniz			
	Ideals	Normals	Raw		Ideals	Normals	Raw		Ideals	Normals	Raw
2013	1	0,176873	0,088436	2013	1	0,178419	0,08921	2013	1	0,175321	0,087661
2012	0,998688	0,176641	0,08832	2012	0,986757	0,176056	0,088028	2012	0,998322	0,175027	0,087514
2011	0,974835	0,172422	0,086211	2011	0,978096	0,174511	0,087256	2011	0,973863	0,170739	0,08537
2010	0,910364	0,161019	0,080509	2010	0,907599	0,161933	0,080967	2008	0,938364	0,164515	0,082258
2008	0,899167	0,159038	0,079519	2008	0,867563	0,15479	0,077395	2010	0,920416	0,161369	0,080684
2009	0,870724	0,154007	0,077004	2009	0,864764	0,15429	0,077145	2009	0,872845	0,153028	0,076514
TR7 Orta Anadolu				TR8 Batı Karadeniz				TR9 Doğu Karadeniz			
	Ideals	Normals	Raw		Ideals	Normals	Raw		Ideals	Normals	Raw
2012	1	0,177311	0,088656	2012	1	0,175331	0,087666	2012	1	0,173333	0,086666
2013	0,980183	0,173798	0,086899	2013	0,976668	0,17124	0,08562	2013	0,97145	0,168384	0,084192
2011	0,952345	0,168862	0,084431	2011	0,971602	0,170352	0,085176	2009	0,970756	0,168264	0,084132
2008	0,927332	0,164427	0,082213	2008	0,933768	0,163719	0,081859	2011	0,955507	0,165621	0,08281
2010	0,902655	0,160051	0,080025	2009	0,92838	0,162774	0,081387	2008	0,949864	0,164643	0,082321
2009	0,87728	0,155552	0,077776	2010	0,893078	0,156584	0,078292	2010	0,921671	0,159756	0,079878

After constructing hierarchy tree, the basic steps of AHP was applied for 12 NUTS-1 regions via SuperDecisions software v.2.4.0. Since the consistency ratios were less than 0.10, the pairwise comparison matrices were accepted consistent for each region. Table 3 provides calculated social sustainability performances of the regions between 2008 and 2013 and also

containes both raw, normals and idealized results. Idealized results for each region drown as line graphs below to interpret and compare the performances of the regions.

Figure 4. Social Sustainability of TRA Region



According to Figure 4, TRA region has shown the best social sustainability performance in 2008 and score decreased in 2009 and 2010. Eventhough the score rose in 2011, it inclined to fall in 2012 and 2013. In 2013 the region was socially less sustainable compared to the first year of the analysis.

Figure 5. Social Sustainability of TRB Region

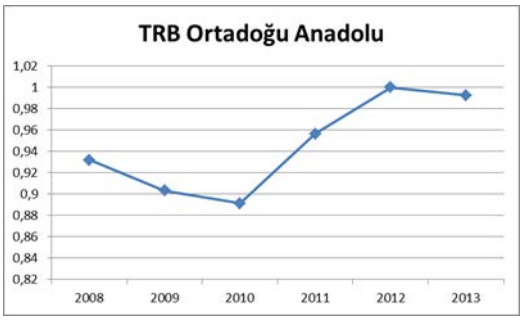


Figure 6. Social Sustainability of TR8 Region

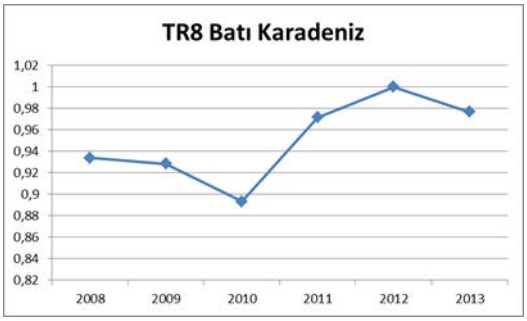


Figure 5 and Figure 6 provide the social sustainability trends of TRB and TR8 regions. Although the decrease trend did not occurred at the same rate social sustainability scores have shown a downward trend between 2008 and 2010. Despite this decline the direction of the trend

rose dramatically after 2010. Even though the degree of social sustainability reduced in 2013 both regions improved their social sustainability compared to the initial years of the analysis.

Figure 7. Social Sustainability of TRC Region

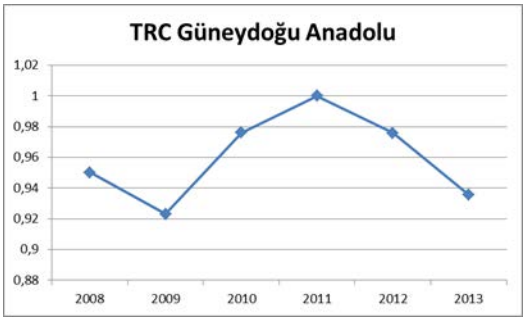


Figure 7 shows the results for TRC region. Although the sustainability score decreased in 2009 the region has shown the upward trend in 2010 and 2011. The region has reached the highest social sustainability degree in 2011. But it couldn't sustain this upward trend and social sustainability score of the region reduced.

Figure 8. Social Sustainability of TR1 Region

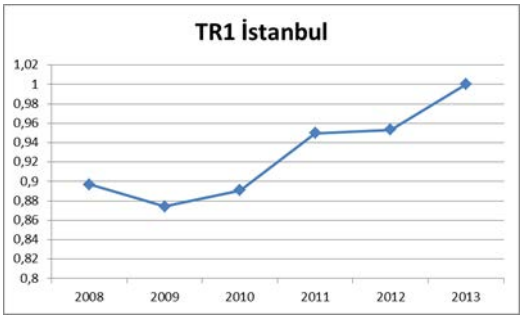


Figure 9. Social Sustainability of TR4 Region

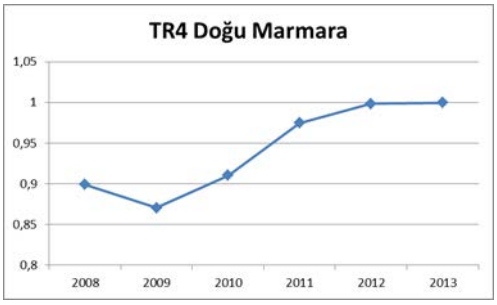


Figure 10. Social Sustainability of TR5 Region

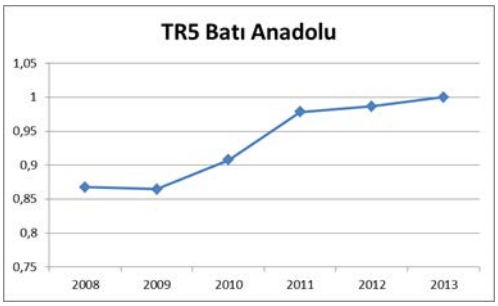


Figure 11. Social Sustainability of TR6 Region

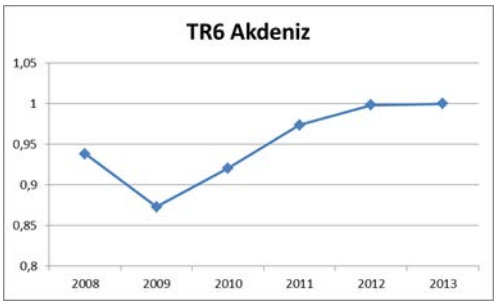


Figure 8, Figure 9, Figure 10 and Figure 11 provide the graphics for TR1, TR4, TR5 and TR6 regions. Even the percentage of reductions and increases are different the general view of trends for regions are same. Social sustainability scores decreased in 2009 and rose steadily with an upward trend until 2013.

Figure 12. Social Sustainability of TR2 Region

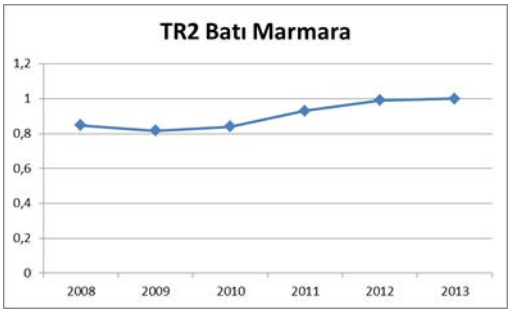


Figure 12 shows the social sustainability trend for TR2 region. Social sustainability level for TR2 region did not show a huge variation with dramatic increases and decreases between 2008 and 2013. The region has had a stable upward trend when it is compared with other regions.

Figure 13. Social Sustainability of TR3 Region

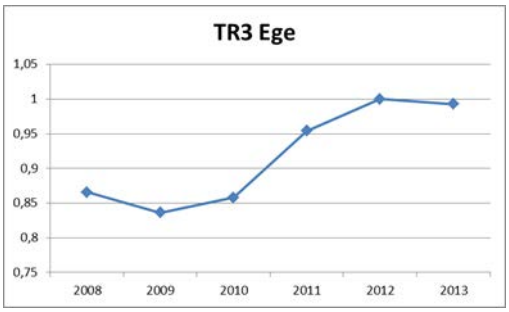
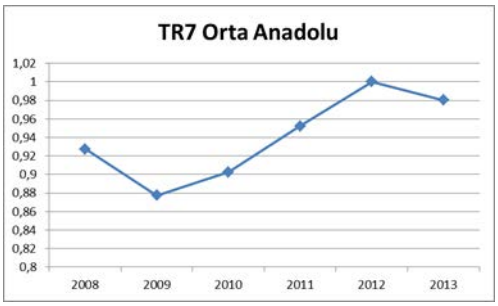
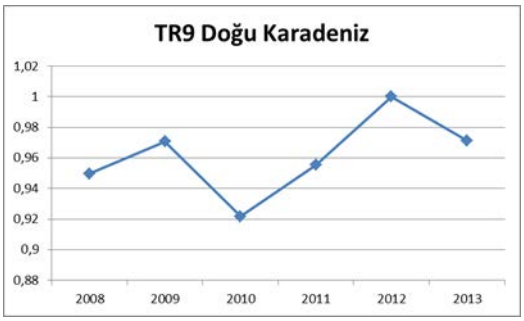


Figure 14. Social Sustainability of TR7 Region



Social sustainability trends for TR3 and TR7 can be found in Figure 13 and Figure 14 respectively. Scores for both regions have declined in 2009 and then scores have shown upward trend. Best performed year for the regions was 2012. Figure 15 provides the social sustainability trend for TR9 regions. The region has followed a fluctuating trend.

Figure 15. Social Sustainability of TR9 Region



5. CONCLUSIVE REMARKS

Since the general acceptance of the concept, sustainable development was evaluated with three pillars; economic, environmental and social. Compared with economic and environmental dimensions social sustainability is relatively new growing research field. As well as other pillars improving social sustainability contributes to sustainable development. In this context it is essential to evaluate the current state and the trend of social sustainability. In this paper a multiple criteria decision making model is presented to rank each NUTS-1 level regions' social sustainability performances between 2008 and 2013. With this aim, an Analytic Hierarchy Process (AHP) model proposed since AHP is an efficient tool for integrating indicators with different units of measurement. Social sustainability of the regions is examined with 6 basic social sustainability criteria and equal weights are assigned. Here are the some findings of the analysis;

- Compared to the 2008, in 2013 TRA (Kuzeydoğu Anadolu) and TRC (Güneydoğu Anadolu) regions reduced social sustainability performances while other regions provided increased performances,
- Regions have shown relatively low social sustainability performances in 2009 and 2010,
- 2012 and 2013 are relatively well performed years,
- Although the percentage of reductions and increases are not occurred with the same rates TRB (Ortadoğu Anadolu) and TR8 (Batı Karadeniz) regions, TR1 (İstanbul), TR4 (Doğu Marmara), TR5 (Batı Anadolu) and TR6 (Akdeniz) regions and finally TR3 (Ege) and TR7 (Orta Anadolu) regions have shown common trends,
- TR2 (Batı Marmara) region has had a stable upward trend instead of a fluctuating trend compared with other regions.

The analysis presented here can be applied to different spatial units. Furthermore, analysis can be repeated by choosing different criteria weights or different indicators. These are remained for further studies.

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