Multidimensional Analysis of Regional Development 2012

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Methodology

The goal of the multidimensional analysis of regional development is to review and analyze the common socio-economic development of the regions in the 2008-2010 period, using a wide variety of indicators, grouped in seven categories: economy, infrastructure, demographics, education, healthcare, environment, social environment. The "business environment" category has been excluded from the analysis since it only contains data on the final year of the period in question.

In order to be able to assess the development of the regions on the basis of these categories (each of which contains a different number of primary indicators, over 50 altogether), a complex indicator has been developed for each of them.

Thus it is possible to assess the complex socio-economic development on the basis of a wide variety of indicators, which allow for a most comprehensive analysis of development. The method chosen to achieve this is neural networks – Cohonen Self-Organizing Maps (SOM), to be precise.

Two "fake regions" have been established for the purpose of this analysis. One is a "perfect" region, which scores best (has the highest marks) on all indicators at the same time (i.e., it has the highest complex values of all complex indicators for all three years). The other one is a "worst" region, which scores worst (has the lowest marks). These "fake regions" are used as reference points and benchmarks for assessing the development of the 28 regions during this period. The current state and development of all 28 regions is assessed as positive or negative in comparison to these benchmarks.

One should note that on the maps of the different categories the best-developed territory does not necessarily coincide with the "perfect region", neither the worst-developed territory coincides with the "worst region". This happens because the "best" and the "worst" region are defined as such on the basis of all categories at the same time and are therefore fake and do not really exist. Empirical data shows that some regions score high in some categories and low in others.

After the analysis, the districts have been grouped into clusters, formed by Cohonen's self-organizing maps. The results are represented by two separate methods:

The clusters are presented through the so-called "unified distance matrix" (U-matrix). The dark zones represent the borders of the clusters, the light ones – the clusters themselves. The darker the border between the clusters, the more they differ from each other and vice versa.

Each zone on the Cohonen map is characterized by a certain level of development, achieved during the period (low or high) based on the different categories – from economy to social environment. The rankings in the different categories are also represented visually on the different maps, with the more saturated color representing high ranking, while a less saturated – low ranking.
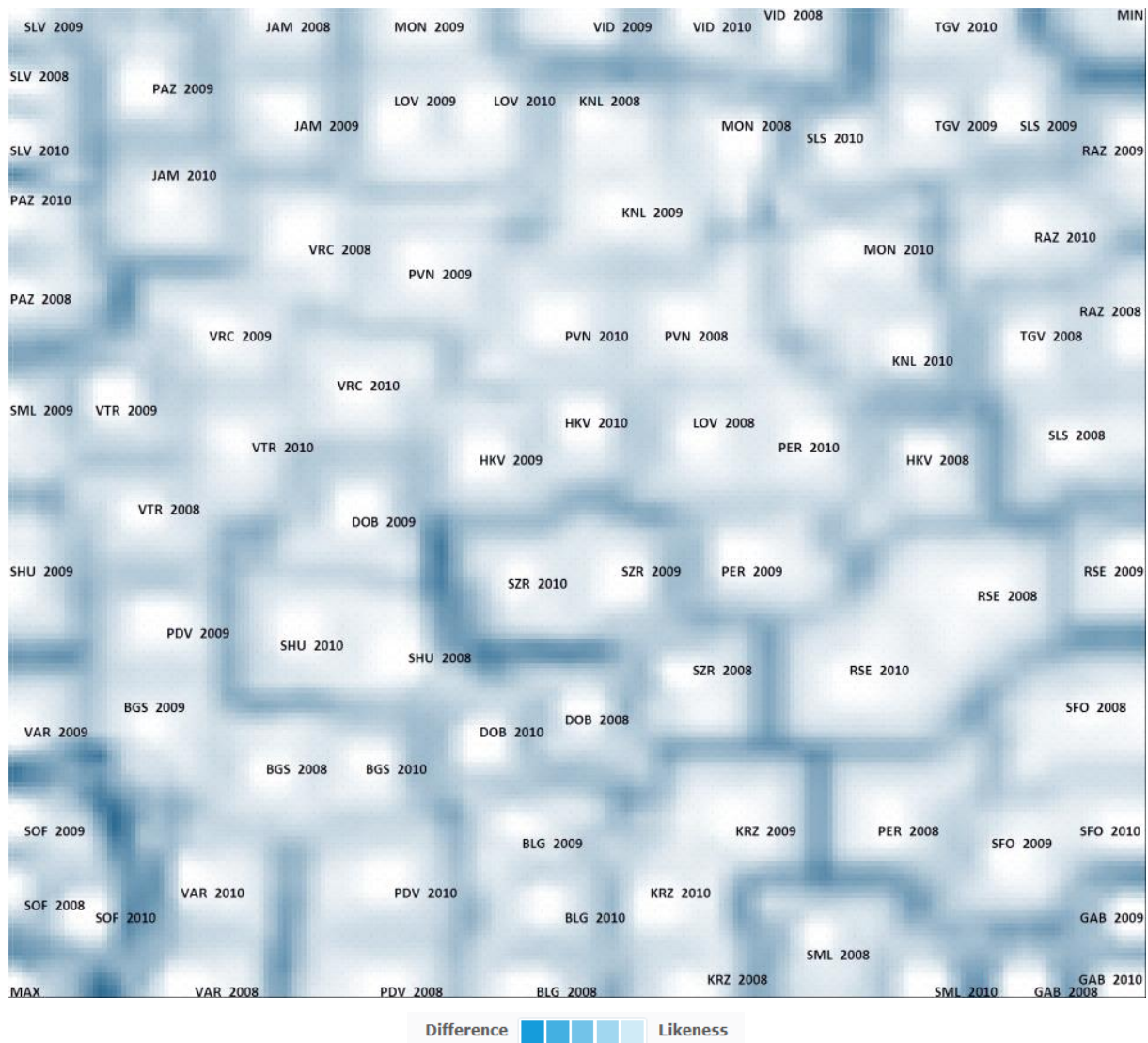
The results thus represented in the Cohonen maps allow us to study the development of all regions for the entire period at the same time, visualizing:

- ➲ Difference levels – how much do certain regions differ from the others during one or all years of the period;
- ➲ Development directions – whether the development of the regions shows a positive or a negative trend;

⮂ Speed of development – what is the pace of growth or decline;

⮂ Development trajectory–is the re cohesion between the regions, or – even better – an approach towards the "perfect region".

Regional Development

This graphic shows the visual clusters according to the complex socio-economic development and state of the regions during the period. Every region has the year of its development attached to it. The lower left corner of the map shows the fake "perfect region", the lower right one – the "worst region".

SLV 2009   JAM 2008   MON 2009   VID 2009   VID 2010   VID 2008   TGV 2010   MIN

SLV 2008

PAZ 2009

LOV 2009   LOV 2010   KNL 2008

JAM 2009   MON 2008   TGV 2009   SLS 2009

SLV 2010   SLS 2010   RAZ 2009

JAM 2010

PAZ 2010   KNL 2009

VRC 2008   MON 2010   RAZ 2010

PVN 2009

PAZ 2008   RAZ 2008

VRC 2009   PVN 2010   PVN 2008   TGV 2008

KNL 2010

VRC 2010

SML 2009   VTR 2009   HKV 2010   LOV 2008   SLS 2008

VTR 2010   PER 2010   HKV 2008

HKV 2009

VTR 2008

DOB 2009

SHU 2009   SZR 2009   PER 2009   RSE 2009

SZR 2010   RSE 2008

PDV 2009   SHU 2010   SHU 2008

SZR 2008   RSE 2010

BGS 2009   SFO 2008

VAR 2009   DOB 2008

DOB 2010

BGS 2008   BGS 2010

SOF 2009   KRZ 2009   PER 2008   SFO 2010

BLG 2009   SFO 2009

VAR 2010   PDV 2010   KRZ 2010

SOF 2008   GAB 2009

SOF 2010   BLG 2010

SML 2008

KRZ 2008   GAB 2010

MAX   VAR 2008   PDV 2008   BLG 2008   SML 2010   GAB 2008

Difference ■■■□□ Likeness

The analysis of the cluster map has a few different aspects:

1) The ranking of each region (for a certain year) on the map shows its overall socio-economic state for the year in question. The regions which are close to the "perfect" have the best socio-economic state, those closest to the upper right corner – the worst one. For instance, Sofia (capital) is obviously the most developed region, since it is the one closest to the "perfect region". If a region ranks "best" in each of the categories – from economy to social environment, it should match the "perfect" one or be very close to it. In reality, none such exists, so the regions are located all over the map. The reasons for their location can be seen in the analysis of the different categories.

2) Varna, Burgas and Plovdiv regions are also close to the lower left corner; however, they are further away from the "perfect region". Moreover, despite their relatively good state in comparison to the rest of the regions, they fall far behind Sofia (capital). This is illustrated by the color of the boundary between the Sofia (capital) cluster and those of the three regions – highly saturated color, demonstrating big differences.

3) The "motion" of the regions on the map during the three-year period shows their development trend – either negative or positive. Ideally, if a region has a positive development trend, between 2008 and 2010 it should have moved towards the lower left corner. And, if the trends are negative, its motion should be directed to the upper right corner.

4) Negative or positive development trends can also be assessed on the basis of similarity or dissimilarity. For instance, if we take Burgas, the borders of the clusters for the last three years are rather light. This shows a slow pace of development, since the degree of difference is low.

5) The change of direction demonstrates the presence or lack of sustainable development. For instance, Sofia (capital) features unsustainable development, because in 2009 it moves away from the "perfect region" in comparison to 2008, but in 2010 the capital moves back towards it.
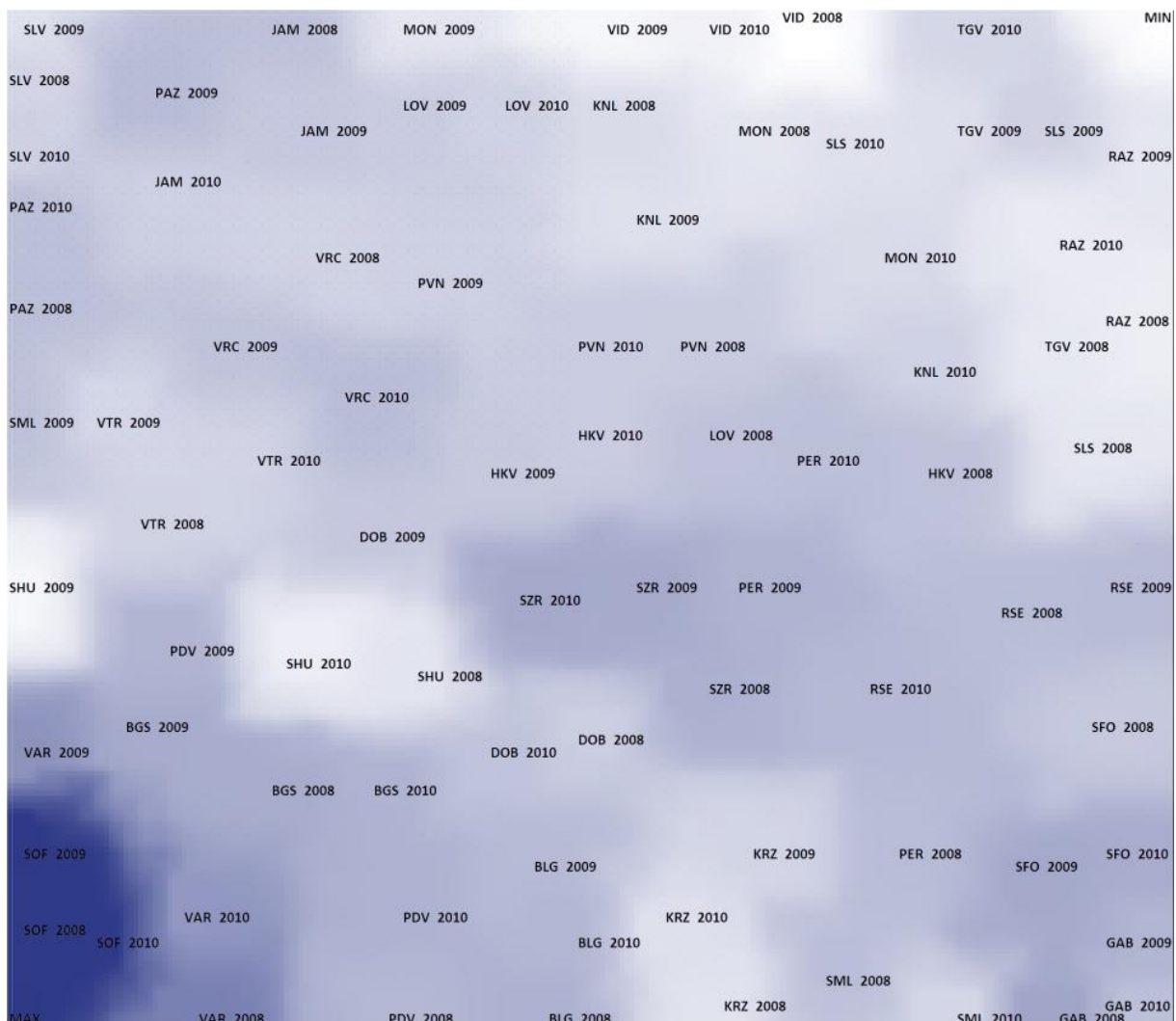
Economy

This map shows the state and development of the economy of the regions during the three-year period. The saturated color in the lower left corner, where Sofia (capital) is located, shows that it is the most developed region in this respect. Varna is the second-ranking region in this respect.

The worst-developed regions when it comes to the economy are Silistra, Razgrad, Vidin and Shumen, since the color of the map is the least saturated in their zone.

Sofia (region) has a relatively high development rate, demonstrated by the difference of the color saturation in 2008 and that in 2009 and 2010 – the saturation increases.

Shumen is quite an interesting region, because, despite its rather low level of economic development, it is not located near the other underdeveloped regions. The reasons for this should be sought in the maps depicting the other criteria.
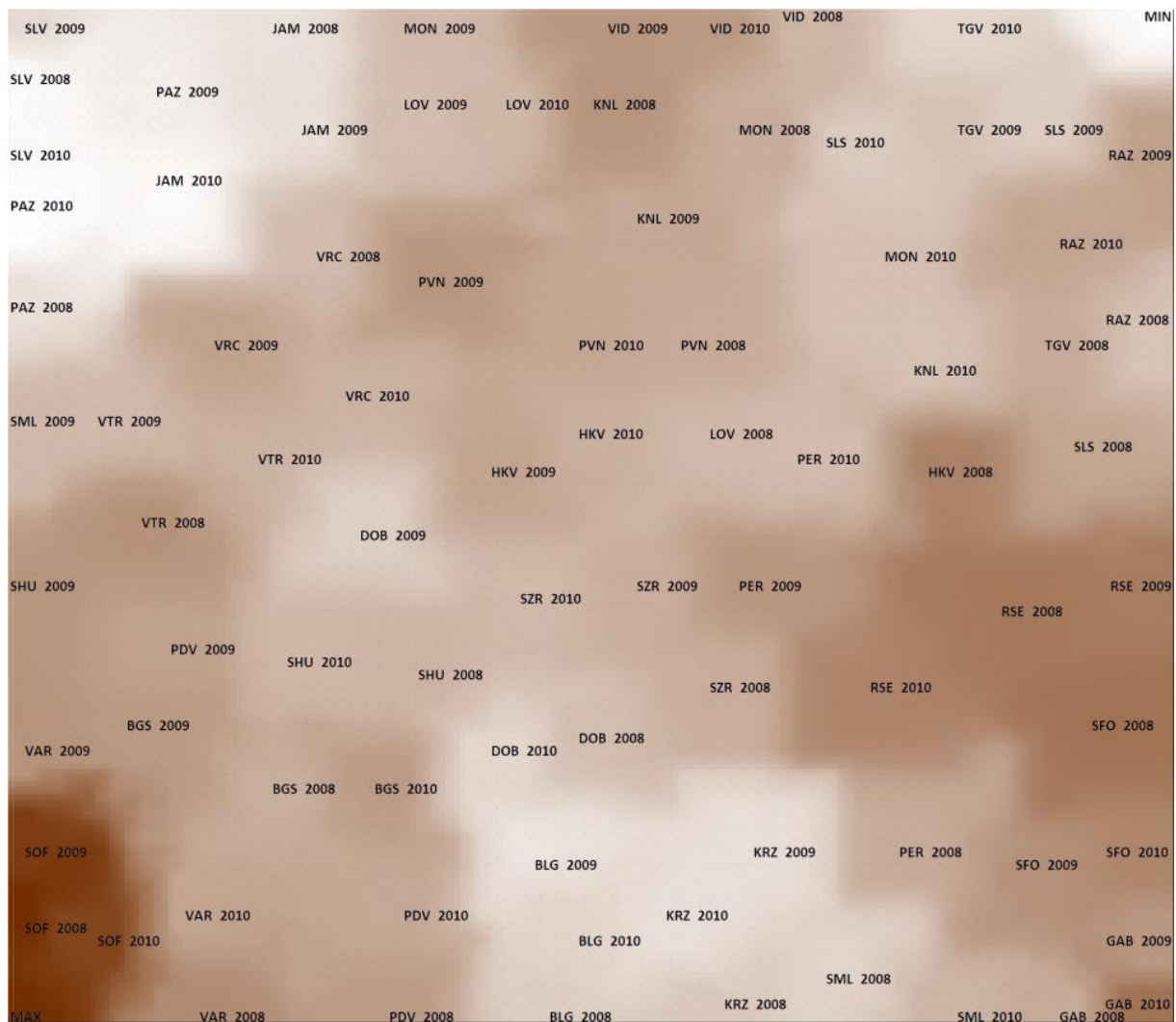
Infrastructure

This map shows the state and development of the economy of the regions during the three-year period.The saturated color in the lower left corner shows that Sofia (capital) is the most developed region when it comes to infrastructure. Ruse (in 2008 and 2009) and Sofia (district) (2008) also score high in this category. The latter has a negative development trend for the last two years of the period, demonstrated by the dropping saturation on the map.

Gabrovo is the most dynamically developing region in this respect – in 2010 its portion of the map is highly saturated in comparison with 2008.

Sliven (2008 and 2010), Yambol (2010) and Pazardzik (2010) have the least-developed infrastructure, and show negative trends during the entire period.
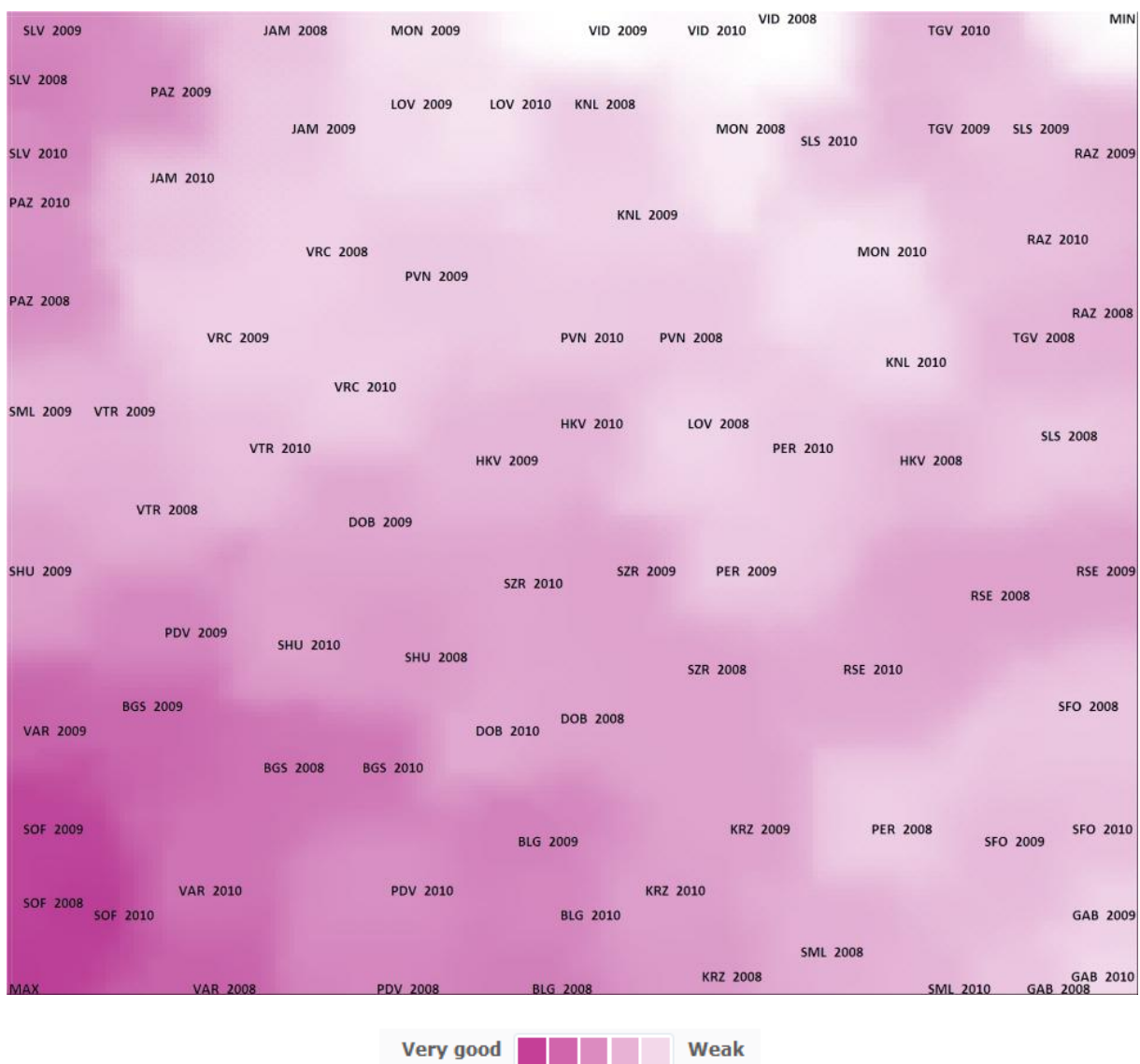
Demographics

This map shows the state and development of the demography of the regions during the three-year period.

Sofia (capital) has the best demographic state and dynamics (highly saturated color), followed by Varna and Burgas. Plovdiv shows an unstable demographic dynamics – its state is worsening in 2009, but in 2010 it returns to its levels in 2008.

Sliven and Pazardzhik have relatively good demographic conditions in comparison with the rest of the regions, depicted by the saturated color in the zones on the map occupied by the regions during the entire period.

Vidin, Lovech and Montana have the worst demographic state during the three-year period, and therefore the least-saturated color on the map.

Gabrovo demonstrates pronounced worsening trends during the period in question.
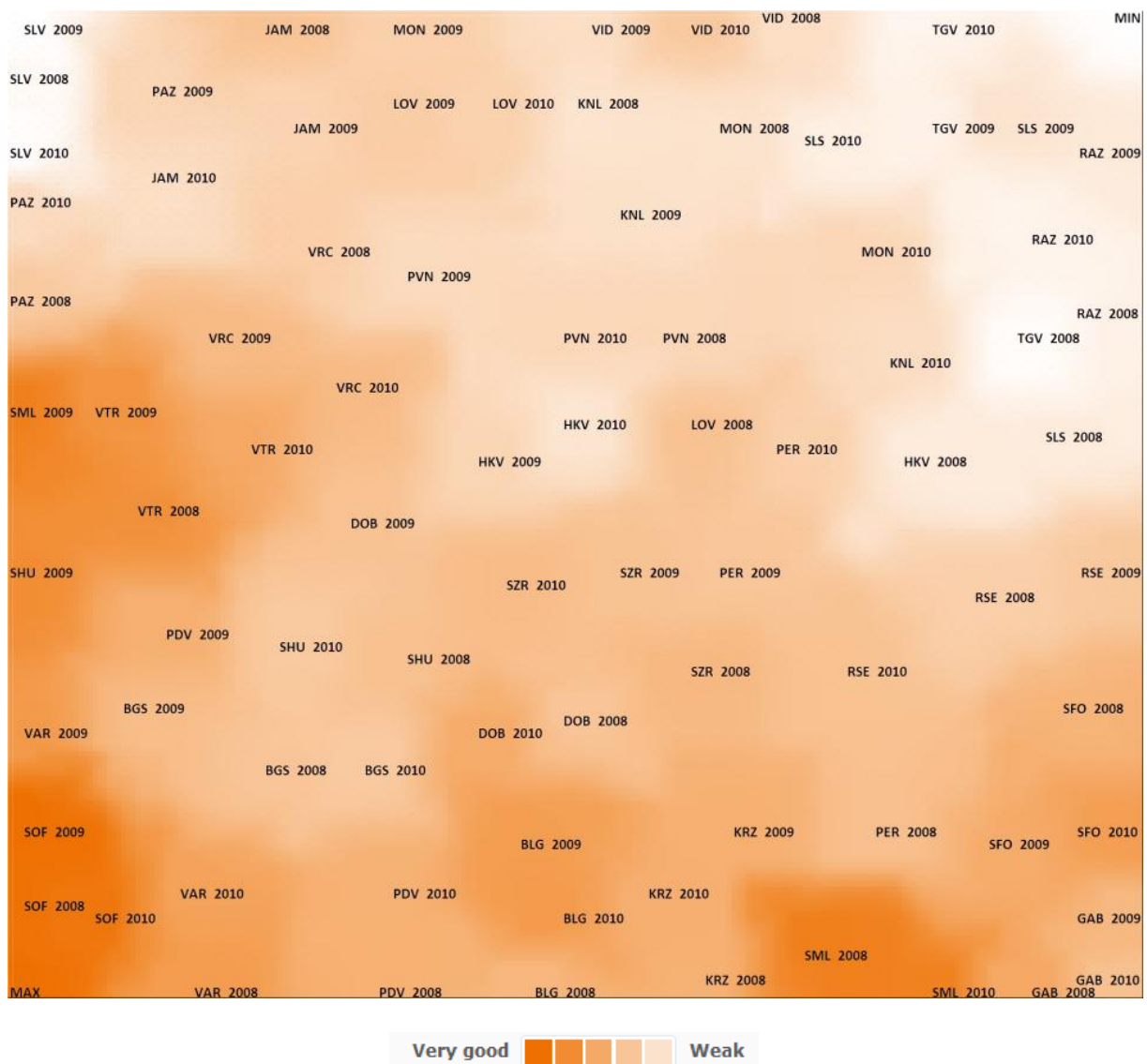
Education

This map shows the state and development of education in the regions during the three-year period. Sofia (capital), Blagoevgrad, Varna and Smolyan have well-developed education systems, as demonstrated by the saturated color of the zones on the map occupied by the regions during the entire period.

The regions with worst-developed education systems are Sliven, Targovishte, Razgrad and Silistra (and, therefore lowest color saturation on the map).

Gabrovo, Veliko Turnovo and Yambol have the worst dynamics of educational development during the period, demonstrated by their transition from high color saturation in 2008 to a much lower saturation in 2010. Despite the similar dynamics, the three regions start and end in very different "positions" at the end of the period. Despite the negative trends, even in the end of the period Gabrovo and Veliko Tarnovo have a relatively better education systems than Yambol in the beginning of the period.
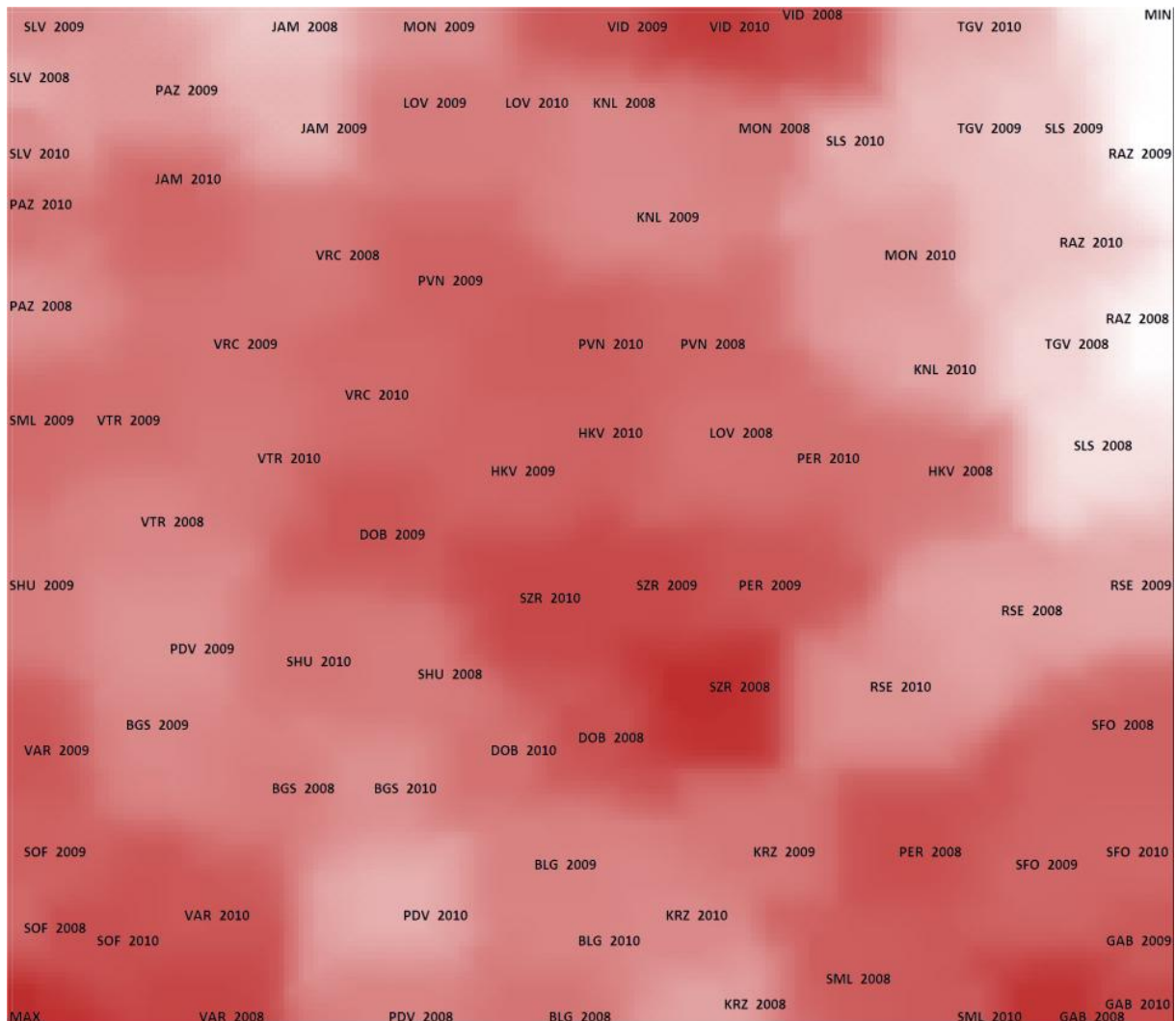
Healthcare

This map shows the state and development of healthcare in the regions during the three-year period. The low-saturated zones on the map show that Razgrad and Targovishte have the worst state of the healthcare system during the entire period. Silistra also has a bad state of the healthcare system in 2008, but it demonstrates a positive development trend in the next years (the color of their zones on the map becomes more saturated in 2009 and 2010)

Vidin, Stara Zagora (in 2008), Gabrovo and Sofia (capital) have the best healthcare systems.

Healthcare in Plovdiv shows one of the worst dynamics during the three-year period – in 2008 its color on the map is highly saturated, and its saturation drops in 2010.
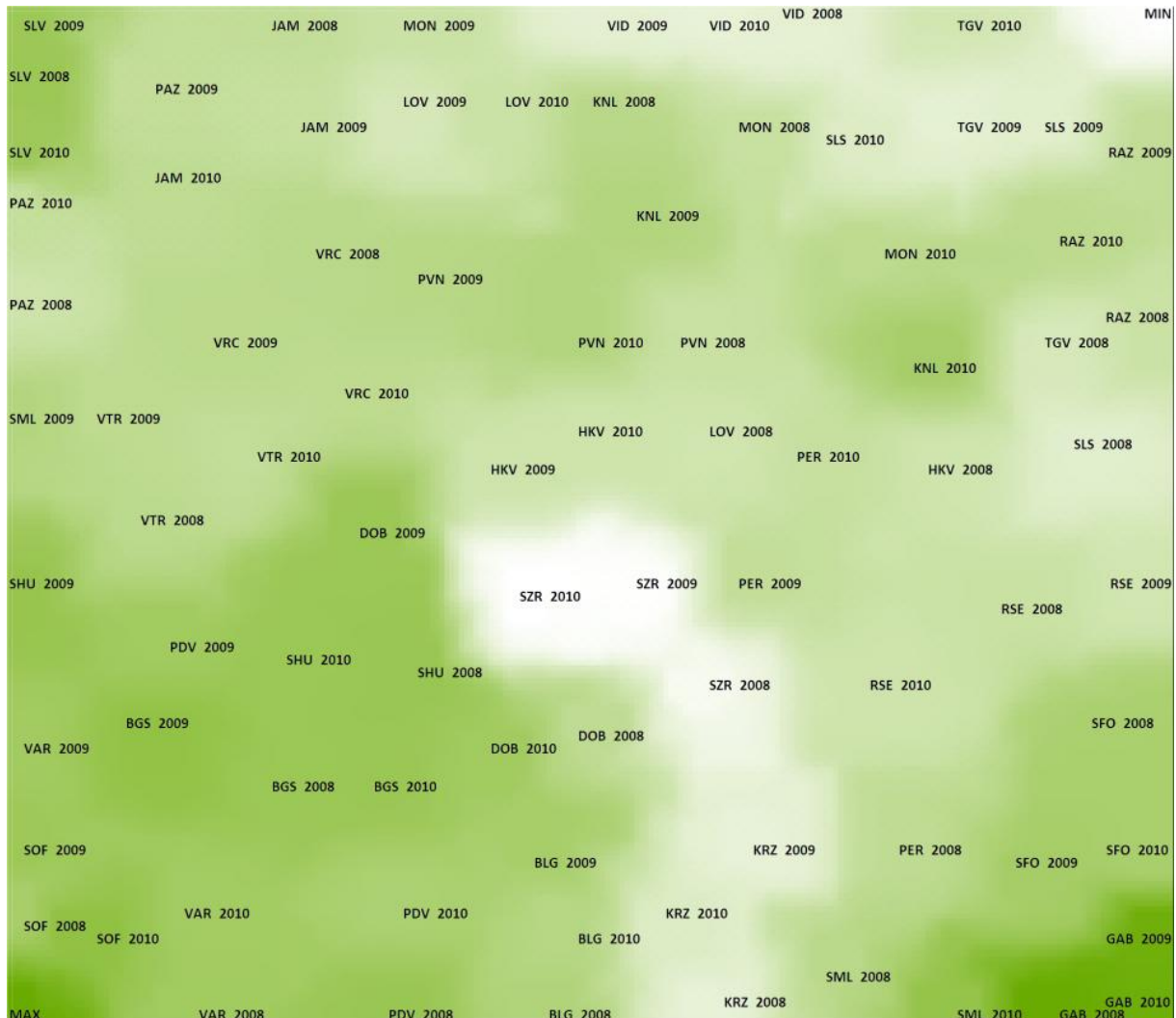
Environment

This map shows the state and development of the environment in the regions during the three-year period.

As can be seen by the low-saturated color on the map, Stara Zagora has the worst state of the environment during the entire period.

Vidin and Silistra have similar, if not as pronounced, environmental trends.

Gabrovo has the best environmental conditions in the country during the entire period, demonstrated by the highly-saturated color on the map.

Sofia (district), Sliven and Smolyan also have relatively good environmental conditions.
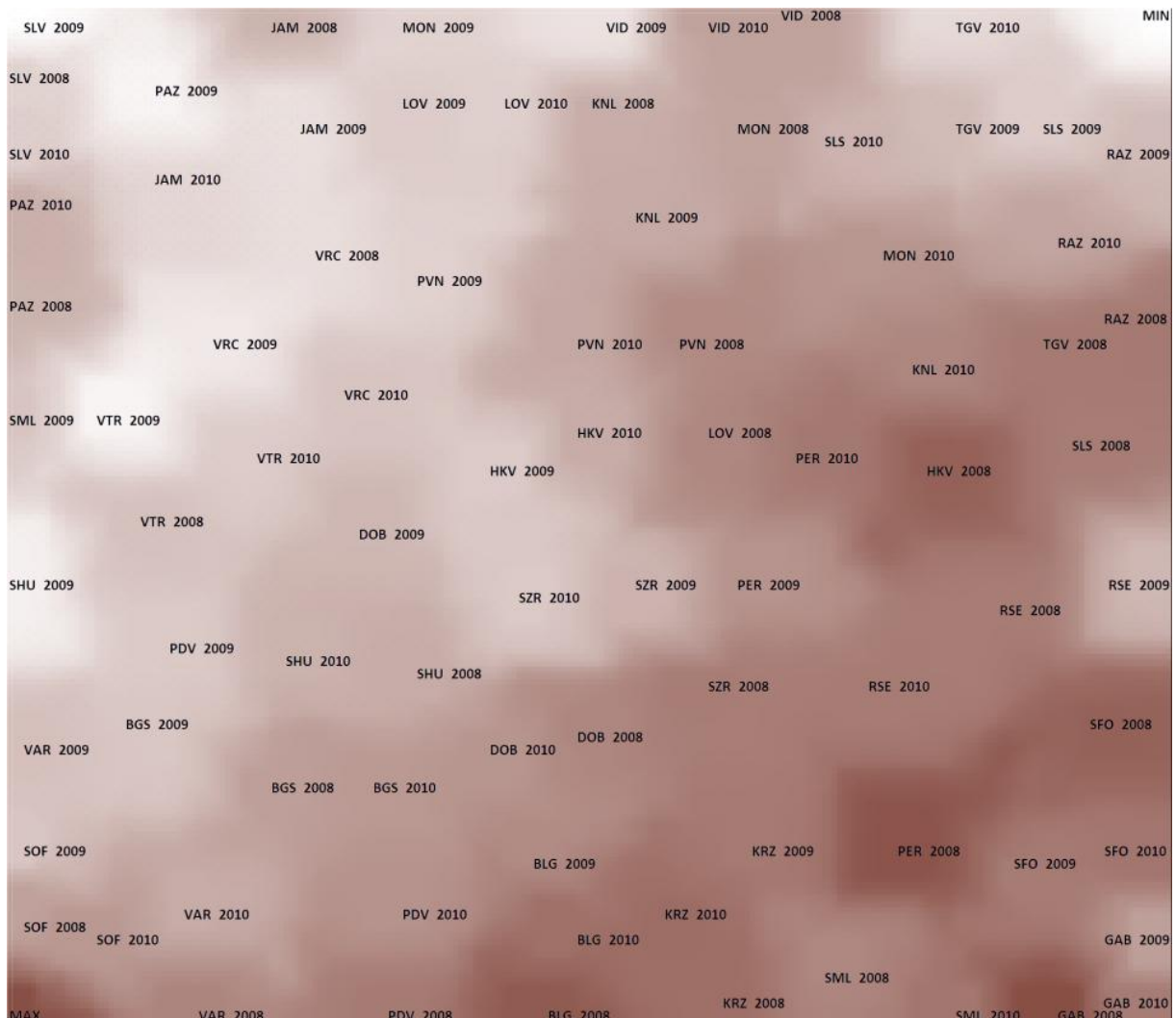
Social Environment

This map shows the state and development of the social environment of the regions during the three-year period.

Unlike the other categories (economy, for instance), the social environment indicators have a more pronounced dynamics. The color saturation on the map shows that in 2008 Haskovo, Pernik and Gabrovo had the best social environment in the country. However, they demonstrate negative development trends, because in the following years their color of the map is less saturated.

In 2010, Kardzhali has the best state of the social environment, even though in this year it does not reach the levels that Haskovo and Pernik had in 2008.

Burgas, Kyustendil and Smolyan show positive trends – the saturation of their zones on the map is increasing during the 2008-2010 period.

Despite the negative trends in 2010, Blagoevgrad has one of the best states of the social environment. This is also true for Kardzhali, which has a slightly positive development trend.