A MODEL OF A SYSTEM OF MONITORING AND ALERT SYSTEM OF THE RISK OF UNEMPLOYMENT – ROMANIAN CASE[1]

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Abstract

Public Employment Services (PES) have to "react efficiently and effectively to unceasingly changing public and political demand" and also to cope successfully to the growing "competitive environment's "demand. (Public Employment Services' Contribution to EU 2020: PES 2020 Strategy Output Paper, 2013). One direction that allow PES to "enhancing labour market transparency and providing evidence to support policy design" is to fully exploit the informational potential provided by the registered unemployment indicator in a systemic way.

In Romania the registered unemployment administrative unit is AJOFM – County Agency for Employment and Training of the Labour Force (CAE) - the PES provider at NUTS 3 level, while the lowest administrative unit is represented by localities at LAU 2 / NUTS 5 level. The ANOFM – The National Employment Agency for Labour Force in short NEA implements the policies and strategies of Labour Ministry in the field of employment and training for the persons seeking a job. The following 4 dimensions of the unemployment risks, expressed through aggregate indices for: the level, seasonality (with 2 aggregate indices), of cohesion tendency and of the density of unemployment served to make a sketch for an **System of Monitoring and Alert system of the Risk of Unemployment.** The Unemployment risk for each county by 10 sub-indices (5 urban and 5 rural) by the 4 dimensions of the unemployment risk at county level is represented in radar graphs. The 10 scores for each county, are compared to scores obtained at national average and with the theoretical thresholds (maximum and minimum of the intermediary categorical scale) and finally all the counties are grouped by 4 cluster types in regard with the unemployment risk: **Alarm, Alert, Balance, Low risk of unemployment and figured in Maps.**

Keywords: unemployment risk, registered unemployment, local level, composite indicators, monitoring and alarm system

JEL classification:

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Introduction

In line with Europe 2020 Strategy [1] there are integrated approaches as it is the post-carbon perspectives well as environmentally, socially and economically sustainable [2]. The response to multiple challenges of climate change, ecosystem degradation, social equity and economic pressures requests a shift in paradigm especially for urban areas.

The interest for tackle unemployment in sustainable way is iterated by European Commission [3] Strengthening the social dimension of European Monetary Union is under competences of the Member States. Following the crises, the unemployment and persistent unemployment is an important part of the human capital underutilisation and also an important cause of labour market unbalances. Using adequate instruments and tools is possible better policy coordination, effective monitoring, and better **understanding of social developments** and finally diminish the risks "unemployment, poverty and wider social consequences." [3] Unemployment (internal imbalance indicator) next is included next to other fourteen indicators in the Macroeconomic Imbalances Procedure (MIP) scoreboard part of the The Alert Mechanism Report (AMR). [4]

McVicar [5] concludes that there is "evidence is growing that job search monitoring and benefit sanctions for infractions reduce the duration of unemployment and increase the rate of job entry". Following the crises in many OECD countries "job search monitoring and benefit sanctions are likely to remain important policy tools". Robalino and Weber [6] considers that "biometric identification can facilitate the monitoring of conditionality's related to participation in job-search and training activities" in the case of designing and implementing unemployment benefit systems in middle and low income countries.

Public Employment Services (PES) have to "react efficiently and effectively to unceasingly changing public and political demand" and also to cope successfully to the growing "competitive environment's "demand. [7].

PES are the principal labour market institutions with the objective to accelerate the labour market integration of jobseekers contributing to successful labour market transitions. This process is realised through specialised services and measures (active and passive). The changing labour market realities, more and more visible after the crises, requests the PES capacities adapting. [8]

In 2014, Romania is positioned in the IInd quadrant by the type of use of PES in job search and share of unemployed jobseekers. This Quadrant includes the countries with "Low use of PES and High Unemployed" close to Spain and Italy. [7] Even is a EU country Romania is an emergent economy[9], in development, fact that indicates the underestimation of unemployment especially in rural areas, the registration rates are very low [10]. Jobseekers in Romania exceeds the national registered unemployed persons by law (law 76/2002) (including also the inactive and employed), but ignoring the international mobility and migration for work of the Romanian citizens.

In 2016 Romania's among the priorities challenge are the "key development disparities are between urban and rural areas" coupled with "delays in adopting a general and transparent human resources management approach" [11] Strengthen the National Employment Agency's services to employers and jobseekers and improve access to integrated public services and "offering personalised services to jobseekers and employers"[12] represents a key challenge for Romania. [11] One direction that allow PES to "enhancing labour market transparency and providing evidence to support policy design" is to fully exploit the exquisite informational potential provided by the registered unemployment indicator in a systemic way. The main contribution of this article is to make a sketch for a System of Monitoring and Alert System of the Risk of Unemployment (SMASRU) that allow **to exploit simultaneously the national, regional and local profile of unemployment in both spatial and temporal analysis**. Even if the registered unemployment is a partial measure for labour market attachment, the detailed characteristics of this indicator provided by National Institute of Statistics offers the conditions to push its boundaries.

In Romania the registered unemployment administrative unit is ***CAE*** - the PES at NUTS 3 level, while the lowest administrative unit is represented by localities at LAU 2 level equivalent to NUTS 5 level. Some recent research results proved that the spatial variation of registered unemployment is more heterogonous at NUTS 5 level than at NUTS 3 level. The

Law 76/2002 is profiling the labour market policies and especially active measures in a homogenous perspective addressing the "normal spatial" profile of registered unemployment, regardless the spatial variation (managed at national level by ANOFM – the PES at NUTS 0 level). On this background our research question is focused identification of on better "unusual" profile of registered unemployed persons comparing to the "normal profile".

The following 5 dimensions of the unemployment risks, expressed through aggregate indices for: the LAU 2 average level by county, seasonality (with 2 aggregate indices: (1) month average variation, (2) monthly amplitude), of cohesion tendency and of the density of unemployment served to make a sketch for an System of Monitoring and Alert system of the Risk of Unemployment. Using [13] the indices for the unemployment risk is the result of the following steps applied by area of residence (both in rural and urban area): multivariate analysis, normalizing through applying an Quartile "Categorical scale", aggregation of the sub-indices and finally cluster analysis by each of 4 dimension by the cumulative criteria's: average level of unemployment at LAU2 level, the variation of unemployment average at LAU2 versus national average at LAU2 level, cumulative effects on short (1 year span) and medium term (3 years span), indices calculated in both annual and monthly variation. Among the results of this System is possible to represent by radar graphs the Unemployment risk for each county by 10 sub-indices (5 urban and 5 rural) by the 4 dimensions of the unemployment risk at county level, iterated above. The 10 scores for each county, are compared to scores obtained at national average and with the theoretical thresholds (maximum and minimum of the intermediary categorical scale) and finally all the counties are grouped by 4 cluster types in regard with the unemployment risk: Alarm, Alert, Balance, Low risk of unemployment and figured in Maps

Methodology and Data

The space and time is more and more represented in maps, as a synthetic and dynamic tool to better monitor the unemployment. USA is providing a large spectrum of dynamic maps for monitoring: unemployment rate annual and also monthly changes by county and state, since 2007 [15] and also in [15], [16]. Cournoyer presents since 2010 the U.S. Metros / Mapping persistent unemployment with predictions for 2018 [17]

Alberti [18] analysis data from Current Population Survey of the Census Bureau (used by the Bureau of Labor Statistics) from 2006 to the present in monthly frequency, on four dimensions: race or ethnicity, gender, age, and educational attainment. This interactive tool allow to monitor also the seasonal variation, current month and moving average of that month and the preceding 11 months.

Gløersen et. al. [19] integrates in analysis the density dimensions in view to differentiate the core to periphery.

Kouba et.al. [20] Calculates for eight regions in four countries: Austria, the Czech Republic, Hungary and Slovakia, a space with high level of heterogeneity: the Potential percentage of unemployed reduction if the unemployed in selected occupations were perfectly mobile across the studied area and the Mismatch index.

In view to avoid unemployment insurance fraud while the person is employed, Fuller et.al [21] concludes that "the optimal policy monitors the unemployed at fixed intervals. …Unemployment benefits are relatively flat between verifications but decrease sharply after a verification."

In line with Moretti [22] Crowley et.al [23] suggested that "geographic disparities in youth unemployment levels are truly to be addressed" for youth, as one precondition of the success of their employment.

Romania is ranking 90's place from 181 countries (Index Mundi) in the "Unemployment, total (% of total labour force) (national estimate)". [24] Evidence map: The impact of monitoring and sanctioning on unemployment exit and job-finding rates" points that Romania is an efficiency driven economy while the developed countries are driven by innovation – driven economy [25] addressed by Card et.al. [26] Clipa & Pohoață & Clipa presented in 2012 the new economic geography and regional policy in Romania [27]. Mocanu-Perdichi made in 2009 a sustainable development index for Romania at county and regional level [28].

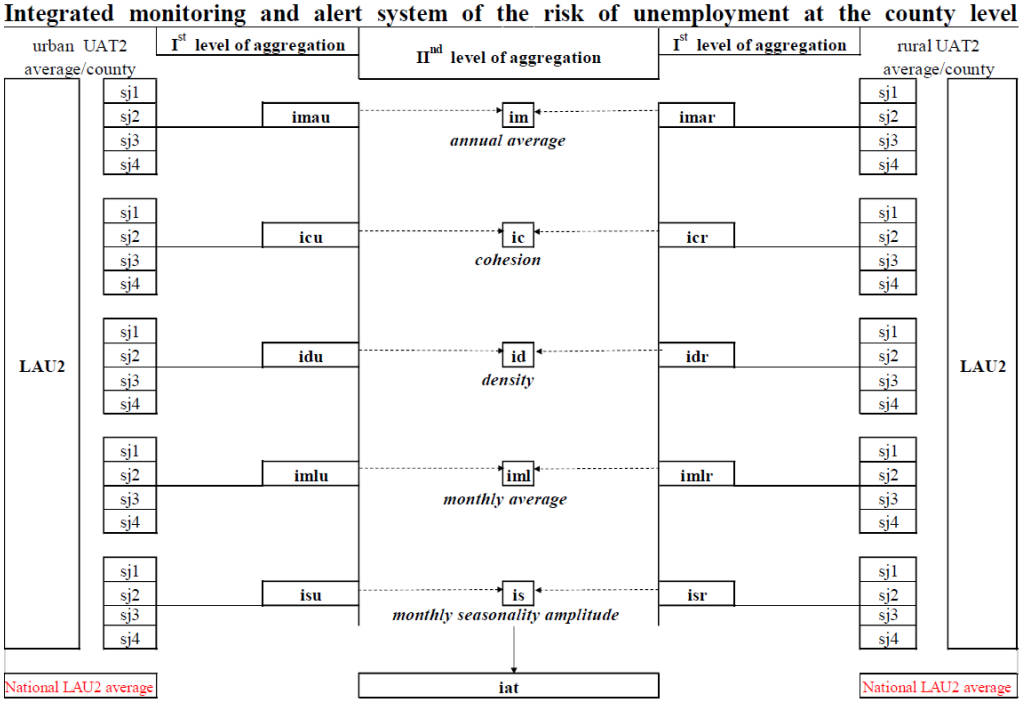
The number of administrative unemployed persons is one of the best labour market data accessible at the moment in both spatial and temporal profile. This approach was experimented by author's team (Lincaru, Ciuca, Pirciog, Atanasiu, Chiriac and Drăgoiu) in a large spectrum of papers. [29], [30], [31], [32], [33], [34]

In this (2016) autumn the Development Ministry MDRAP launched the Territorial Observatory – an Informational Integrated System to Support the Public Policies for Territorial Development, [35] which provides over than 100 indicators [36] from different domains (territory, dwelling, economy, demography, planning) at NUTS5 /LAU 2 level. The registered unemployment is presented in a dynamic map for the unemployment rate (with interactive options: select top 10%, bottom 10%, average, etc.).

Our model is presented in Figure 1.

Figure 1

Integrated monitoring and alert system of the risk of unemployment at the county level



Unemployment risk assessment / county

iat =

4	3	2	1
Alarm	**Warning**	**Echilibru**	**Low risk of unemployment**

Source: realised by authors

Lattice data

- $q \in 1 \div 3189$ *number of LAU2 or NUTS5 level*
- **J** $\in 1 \div 42$ *number of counties NUTS3 level*
- q_j *number of LAU2 in a county j*
- qu_j *number of urban LAU2 units in a county j*
- qr_j *number of rural LAU2 units in a county j*
- **qu** *number of urban LAU2 units at national level*
- **qr** *number of urban LAU2 units at national level*

u urban residence areas (314 LAU2) by SIRUTA
r rural residence areas (2867 LAU2) by SIRUTA, missings 8 LAU2

t reference year,

t-1 lag with short term perspective

t-3 lag with medium term perspective

$m \in 1 \div 12$, *the index of the month in a year*

N number of registered unemployed persons in the month m of the year t in the q UAT2 from the j county

i indices following the Quartile normalisation method

ma annual average

ml month average

A_{kj} area of LAU2 from the k units in a j county [km2]

Administrative and geographical data – area data it is also the statistical unit LAU2 /NUTS 5 level (and not the persons or households), following Anselin [37]. Location variables LAU2

local administrative units counting 3190 units, with polygons provided by ESRI in 2014 using SIRUTA from INS, with the role of statistical units. For each polygon it is calculated its area.

a. Area data are provided by Romania ESRI shape polygons that reflects territorial description of LAU2 are regulated according Law 351/6th July 2001 regarding the National Territory Arrangement Plan - spatially geocoded using the polygons areas for LAU2 described by ESRI Romania using Arc GIS Software. The territorial administrative units LAU2 level are represented in SIRUTA code by Municipality, County residence, Town and Commune and are equivalent with NUTS5 level. Based on the development status was coded rural areas the communes and all other categories as urban areas (with status detained in the reference year 2013).

b. attribute data: Socio-economic indicators (Romania, provided by INS) as attribute information for each LAU2 the statistic unit by cluster type: Registered unemployed persons at the end of the month in 2010-2013 at LAU2 level, SOM101E INS TEMPO, counting 4 years*12months * 3190 LAU2 units;

Variable number of unemployed registered at the local level LAU2 (Figure 1) is differentiated by urban and rural counties by the following dimensions:

- Dimension 1: **Unemployment annual average dimension;**
- Dimension 2: **Cohesion annual tendency dimension;**
- Dimension 3: **Unemployment the annual density tendency estimation unemployment at LAU2 level by county (unemployed persons/km2**);
- Dimension 4: **Seasonality (1) tendency estimation based on each month average variation unemployment at LAU2** level by county (unemployed persons/month/LAU2) and then annual average;
- Dimension 5: **Seasonality (2) tendency estimation based on monthly amplitude (Maximum- Minimum) of unemployment at LAU2 level by county** (unemployed persons/month/LAU2);

These five dimensions noted as $D_{v,}$ v=1 to 5, are calculated for 4 years 2010:2013 as follows:

Dimension 1: Unemployment annual average dimension.

Calculated by residence area (urban and rural)

Calculated by residence area (urban and rural)

the annual average of urban unemployment at LAU2 level by county (average):

$$N_{j_{u_t}} = \sum_{q=1}^{qu_j} \frac{\sum_{m=1}^{12} N_{qu_{t_m}}}{12qu_j} \quad (1)$$

the annual average of rural unemployment at LAU2 level by county (average):

$$N_{j_{r_t}} = \sum_{q=1}^{qr_j} \frac{\sum_{m=1}^{12} N_{qr_{t_m}}}{12qr_j} \quad (2)$$

National annual average of unemployment at LAU 2 level

$$N_{u_t} = \sum_{q=1}^{qu} \frac{\sum_{m=1}^{12} N_{qu_{t_m}}}{12 * qu} \quad (3)$$

Dimension 2: Cohesion annual tendency dimension

$$Max(N_{ju_t}) = \max_{i=1,\ qu_j} \frac{\sum_{m=1}^{12} N_{i_{tm}}}{12}$$

$$Min(N_{ju_t}) = \min_{i=1,\ kj} \frac{\sum_{m=1}^{12} N_{i_{tm}}}{12}$$

the urban Cohesion tendency estimation

$$\text{Ncu\_sj1} = \boldsymbol{Max}(N_{ju_t}) - \boldsymbol{Min}(N_{ju_t}) \quad (4)$$

$$Max(N_{jr_t}) = \max_{i=1,\ qr_j} \frac{\sum_{m=1}^{12} N_{i_{tm}}}{12}$$

$$Min(N_{jr_t}) = \min_{i=1,\ kj} \frac{\sum_{m=1}^{12} N_{i_{tm}}}{12}$$

the rural Cohesion tendency estimation

$$\text{Ncr\_sj1} = \boldsymbol{Max}(N_{jr_t}) - \boldsymbol{Min}(N_{jr_t}) \quad (5)$$

Dimension 3: Unemployment the annual density tendency estimation unemployment at LAU2 level by county (unemployed persons/km2),

$$\boldsymbol{Ndu_{ju_t}} = \sum_{q=1}^{qu_j} \frac{\sum_{m=1}^{12} \frac{N_{qu_{tm}}}{A_{qu_j}}}{12qu_j} \quad (6)$$

$$\boldsymbol{Ndr_{jr_t}} = \sum_{q=1}^{qr_j} \frac{\sum_{m=1}^{12} \frac{N_{qr_{tm}}}{A_{qr_j}}}{12qr_j} \quad (7)$$

Dimension 4: Seasonality (1) tendency estimation based on each month average variation unemployment at LAU2 level by county (unemployed persons/month/LAU2),

In this case there are 2 sub aggregation level reflecting t*he unemployment LAU2 average at county level – spatial heterogeneity by month, finally aggregated by year.*

$$\boldsymbol{Nmlu_{u_{tm}}} = \sum_{q=1}^{qu} \frac{N_{qu_{tm}}}{qu} \qquad \text{For each month } m \in [ian: december] \quad (8)$$

$$\boldsymbol{Nmlr_{r_{tm}}} = \sum_{q=1}^{qr} \frac{N_{qr_{tm}}}{qr} \quad (9)$$

At each county there are calculated the unemployment means at county level for each month following the steps:

Subprocedure

a. *Calculating (12 times each * 5 dimensions=60 indicators)*

$$Ndu\_sj1_m\ ,\ Ndu\_sj2_m, Ndu\_sj3_m, Ndu\_sj4_m$$

$$Ndr\_sj1_m,\ Ndr\_sj2_m\ ,\ Ndr\_sj3_m\ ,\ Ndr\_sj4_m$$

b. *Normalising in quartile* $\in\{1, 2, 3, 4\}$*, where 1 is for low variation , ...4 is for high variation;*

c. $$\text{imlu\_sjw} = \left[\frac{\sum_{m=ian}^{December} [\![Ndu\_sjw]\!]\_m}{12}\right]_{Normalised}$$

d. Sezonality - Aggregate index for the change in average monthly urban unemployment at UAT2 level

$$\textbf{imlu = imlu\_sj1+ imlu\_sj2+ imlu\_sj3+ imlu\_sj4} \quad (10)$$

Obs – the same steps for Seasonality (1) tendency estimation based on each month average variation rural unemployment at LAU2 level by county (unemployed persons/month/LAU2)

Dimension 5: Seasonality (2) tendency estimation based on monthly amplitude of unemployment at LAU2 level by county (unemployed persons/month/LAU2)

Seasonality (2) tendency estimation based on monthly amplitude of urban unemployment at LAU2 level by county (unemployed persons/month/LAU2)

$$\left.\begin{aligned} Max(N_{j_{u_{tm}}}) &= \max_{j}\left[\max_{t,\,m=1\div12} N_{qu_{j_{tm}}}\right] \\ Min(N_{j_{u_t}}) &= \min_{j}\left[\min_{t,\,m=1\div12} N_{kj}\right] \end{aligned}\right\} \quad \text{Nsu} = \boldsymbol{Max}(N_{j_{u_{tm}}}) - \boldsymbol{Min}(N_{j_{u_{tm}}}) \tag{11}$$

Seasonality (2) tendency estimation based on monthly amplitude of rural unemployment at LAU2 level by county (unemployed persons/month/LAU2)

$$\left.\begin{aligned} Max(N_{j_{r_{tm}}}) &= \max_{j}\left[\max_{t,\,m=1\div12} N_{qr_{j_{tm}}}\right] \\ Min(N_{j_{r_t}}) &= \min_{j}\left[\min_{t,\,m=1\div12} N_{kj}\right] \end{aligned}\right\} \quad \text{Nsr} = \boldsymbol{Max}(N_{j_{r_{tm}}}) - \boldsymbol{Min}(N_{j_{r_{tm}}}) \tag{12}$$

For each Dv is calculated at the **county** level for each s_{jw} (w=1 to 4)

sj1:

Dv_sj1 **Mean Dvj (/ 12 months)** (13)

Short term inertia

sj2: Dv_sj2 **Short term ST** (14)

$$ST\_Dv_{j_r} = Dv_{j_{r_t}} - Dv_{j_{r_{t-1}}}$$

Medium term inertia

sj3: Dv_sj3 **Medium Term MT** (15)

$$MTDv_{j_r} = Dv_{j_{r_t}} - Dv_{j_{r_{t-3}}}$$

Spatial heterogeneity

sj4: Dv_sj4 **Distance from national mean DM** (16)

$$DMDv_{j_r} = Dv_{j_{r_t}} - Dv_{r_t}$$

Normalisation Max Min (OECD, 2008) (17)

$$\max_{j=1,\ 42}\left(\text{Dv\_s}_{jw}\right) - \min_{j=1,\ 42}\left(\text{Dv\_s}_{jw}\right) \Rightarrow$$

$$\text{Quartile} \Rightarrow \begin{cases} 1\ if\ \text{Dv\_s}_{jw} \in Q1\ [0;25\%) \\ 2\ if\ \text{Dv\_s}_{jw} \in Q2\ [25;50\%) \\ 3\ if\ \text{Dv\_s}_{jw} \in Q3\ [50;75\%) \\ 4\ if\ \text{Dv\_s}_{jw} \in Q14\ [75;100\%] \end{cases}$$

iat= im+ic+id+iml+is (18)
im =imau+imar (19)
imau = imau_sj1+ imau_sj2+ imau_sj3+ imau_sj4 (20)
imar = imar_sj1+ imar_sj2+ imar_sj3+ imar_sj4 (21)
ic =icu+icr (22)
icu = icu_sj1+ icu_sj2+ icu_sj3+ icu_sj4 (23)
icr = icr_sj1+ icr_sj2+ icr_sj3+ icr_sj4 (24)
id =idu+idr (25)
idu = idu_sj1+ idu_sj2+ idu_sj3+ idu_sj4 (26)
idr = idr_sj1+ idr_sj2+ idr_sj3+ idr_sj4 (27)
iml =imlu+imlr (28)
imlu = imlu_sj1+ imlu_sj2+ imlu_sj3+ imlu_sj4 (29)
imlr = imlr_sj1+ imlr_sj2+ imlr_sj3+ imlr_sj4 (30)
is =isu+isr (31)
isu = isu_sj1+ isu_sj2+ isu_sj3+ isu_sj4 (32)
isr = isr_sj1+ isr_sj2+ isr_sj3+ isr_sj4 (33)

where, 1 = below the national average, 2 = close to the national average, 3 = level of attention, 4 level alarm

Composite indicator for the **annual average unemployment** at LAU2 level by county (average):

- *im – national*
- *imau – urban*
- *imar – rural*

Sub-composite indicator for **urban** unemployment at LAU2 level by county
1 = low number of unemployed persons/ small changes ....4 = high number of unemployed persons / varies widely

- *imar_sj1 - annual average variation*
- *imar_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *imar_sj3imau_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *imar_sj4 - distance of county average compared to national average of LAU2- danger indicator*

Sub-composite indicator for **rural** unemployment at LAU2 level by county

- *imar_sj1 - annual average variation*
- *imar_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *imar_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *imar_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Composite indicator for the **cohesion tendency estimation** of unemployment at LAU2 level by county (Max-Min, average)

- *ic – national*
- *icu – urban*
- *icr – rural*

Sub-composite indicator for the **cohesion** tendency estimation of **urban** unemployment at LAU2 level by county
1 = low number of unemployed persons/ small changes ....4 = high number of unemployed persons / varies widely

- *icu_sj1 - annual average variation*
- *icu_sj 2icu_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *icu_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*

- *icu_sj4 - distance of county average compared to national average at LAU2 level - danger indicator*

Sub-composite indicator for the **cohesion** tendency estimation of **rural** unemployment at LAU2 level by county

- *icr_sj1 - annual average variation*
- *icr_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *icr_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *icr_sj4 - distance of county average compared to national average at LAU2 level - danger indicator*

Composite indicator for the **density tendency estimation** of unemployment at LAU2 level by county (unemployed persons/km2)

- *idu - national*
- *idu - urban*
- *idr - rural*

Sub-composite indicator for the **density** tendency estimation of **urban** unemployment at LAU2 level by county

(1 = low number of unemployed persons/km2/ small changes....4 = high number of unemployed persons/km2, / varies widely)

- *idu_sj1 - annual average variation*
- *idu_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *idu_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *idu_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Sub-composite indicator for the **density** tendency estimation of **rural** unemployment at LAU2 level by county

- *idr_sj1 - idr_sj1 – annual average variation*
- *idr_sj2- change on short term in 2013 compared to 2012, 1 year spin*
- *idr_sj3– change on medium term in 2013 compared to 2010, 3 years spin*
- *idr_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Composite indicator for the **Seasonality (1) tendency estimation based on each month average variation** of unemployment at LAU2 level by county (unemployed persons/month/LAU2)

- *iml - national*
- *imlu - urban*
- *imlu - rural*

Sub-composite indicator for the **Seasonality (1)** tendency estimation based on **each month average variation** of **urban** unemployment at LAU2 level by county

1 = low number of unemployed persons/ small changes ....4 = high number of unemployed persons / varies widely

- *imlu_sj1 - annual average variation*
- *imlu_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *imlu_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *imlu_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Sub-composite indicator for the **Seasonality (1)** tendency estimation based on **each month average variation** of **rural** unemployment at LAU2 level by county

- *imlr_sj1 - annual average variation*
- *imlr_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *imlr_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *imlr_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Composite indicator for the **Seasonality (2) tendency estimation based on monthly amplitude** variation of unemployment at LAU2 level by county (unemployed persons/month/LAU2)

- is - national
- isu - urban
- isr - rural

Sub-composite indicator for the Seasonality (2) tendency estimation based **on monthly amplitude of urban** unemployment at LAU2 level by county

1 = low number of unemployed persons/ small changes ....4 = high number of unemployed persons / varies widely

- *isu_sj1 - annual average variation*
- *isu_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *isu_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *isu_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

Sub-composite indicator for the Seasonality (2) tendency estimation based **on monthly amplitude of rural** unemployment at LAU2 level by county

- *isr_sj1 annual average variation*
- *isr_sj2 - change on short term in 2013 compared to 2012, 1 year spin*
- *isr_sj3 - change on medium term in 2013 compared to 2010, 3 years spin*
- *isr_sj4 - distance of county average compared to national average at LAU2 level- danger indicator*

The normalised values of indices and sub indices are represented in Arc Gis Desktop – Arc View 9.3. as choropleth maps by the 4 categories determined.

Results

The result of this activity is a sketch for a fully use the informational potential of registered unemployment indicators, already available spatial vectorised, comparing LAU2 average both in time and space. The spatial units corresponds with administrative units, each level of analysis corresponding with a policy level of action, institutional attributes, measures and action packages and intervention / monitoring mechanism. The results provide an image of registered heterogeneity in space and time, looking at the average, density, amplitude of unemployment at LAU2 level by month, year, county, national, etc. The results could be gathered by the following typologies that allow differentiation / resemblance counties in comparable terms (Figure 1) by several criteria:

- Changes in chronological annual and monthly (seasonal) short and medium term unemployment levels; this criterion is relevant for sizing NEA and especially the CAE capacity to provide customized solutions for customers of PES services.

- Change in spatial heterogeneity of unemployment: its size of intra-county amplitude and density variation provide a profile for the cohesion tendency monitoring at the county level. These information is useful regarding the PES's measures designing and sizing of resources

in order to increase access to work. These issues presents also the potential to improve the economic performance of the demand. Unemployment available in a rich information format and with a very good frequency and therefor e could work as the mirror for economic activity, could be used as a proxy indicator for employment (considering as 0 in information, employment as 1);

- The agglomeration / concentration of unemployment is looked in short-term coupled with medium term. This criterion provides additional information on the depth, severity and magnitude of unemployment in some areas, is working as monitoring instrument for analysis disadvantaged areas, areas regulated by the Government Decision 24/1998 and implemented by Regional Development Ministry MDRAP;

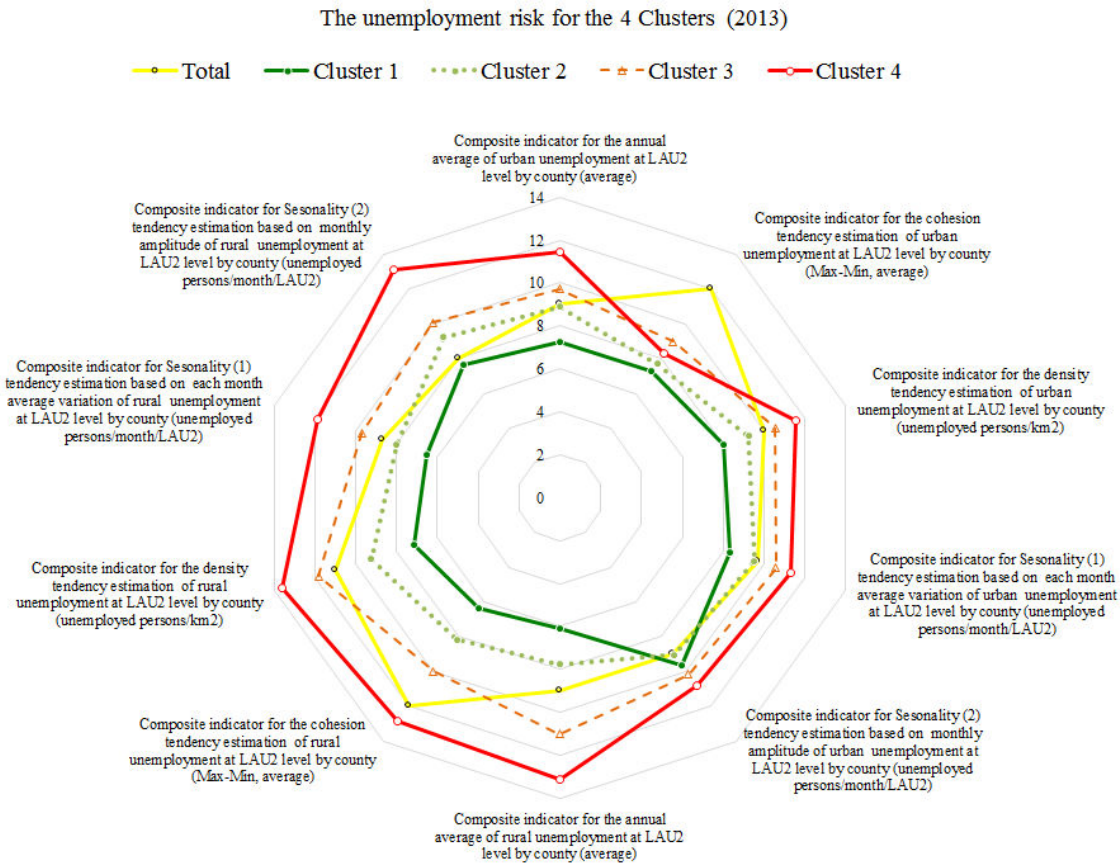
- This dashboard offer an input to better design the inter-county mobility of labour force at this stage on national area but this limit could be easily passed through if the model is applied in trans-frontier neighbouring LAU2 units abroad.

The main objective of this system is to support management at county unemployment (CAE structures) and nationally (NAE) in a coordinated macro, mezzo and micro integrated manner. This system (completed) can serve as a management tool with minimal additions could increase the transparency of PES services for all its beneficiaries. The model when is validated could be transformed in an algorithm with output in a dynamic map application, easily accessible for interested stakeholders.

The proposed system integrates the before mentioned four dimensions of risk of unemployment, each detailed at the county level by 5 sub-indices calculated for 2013, using data back in 2010. The level, seasonality (two aggregate indices), the trend of cohesion and density of unemployment. The method used was that normalization, aggregation, finally clustering and map representation.

For the 5 dimensions correspond to each dimension 4 sub indices (average, short term, medium term and distance to national mean) calculated by residence area (urban and rural). The Level I of aggregation characterize urban unemployment by the five sub indices (imau, icu, idu, imlu, isu) and the rural unemployment by the five sub-indices (imar, icr, idr, imlr, isr). Level II of aggregation sum up all five sub-indices at urban and rural areas at national level (im, ic, id, iml, is). Unemployment aggregate risk assessment / county is summarized with comparable values at national level by a total aggregate index (iat) as a result of aggregation Level II.

Figure 2



(Average scores / cluster type)

Cluster of unemployment risk type	cod	*Imau*	*icu*	*idu*	*imlu*	*isu*	*Imar*	*icr*	*idr*	*imlr*	*isr*	Iat
Alarm	Cluster 4	11	8	12	11	11	13	13	14	12	13	**4**
Warning	Cluster 3	10	9	11	11	10	11	10	12	10	10	**3**
Equilibrium	Cluster 2	9	8	9	10	9	8	8	9	8	9	**2**
Low risk of unemployment	Cluster 1	7	7	8	8	10	6	6	7	6	8	**1**

Score minim - 4/ dimension
Score maxim – 16/ dimension

Note: distortion between the 4 clusters and risk profile registered for the national level is induced by very high population of Bucharest (not included and corresponding administrative subdivisions sectors of the capital).

Scores at the county level are distributed quantile and indexes are assigned values from 1 to 4 according to the risk of unemployment (Table 1, Figure 2), from the maximum risk to minimal risk, as follows:

Cluster 4 - Unemployment Cluster **Alarm** type – label the counties with high scores 4. The main feature of these counties is the cumulative achievement of all the risks of unemployment except for the change in the aggregate index trend cohesion at urban UAT2. This last dimension is questionable, requesting more attention.

Cluster 3 - Unemployment Cluster **Alert** type – labels the counties that achieve scores that are assigned values about big scores - 3. The main feature of these counties is the realization of lower values than those in cluster 4 but higher than those of cluster 2, except for the change in the aggregate index trend cohesion at urban UAT2 where indicated a higher risk than counties in cluster 4. The mark of this cluster is higher relative score of density comparing to all other sub indicators.

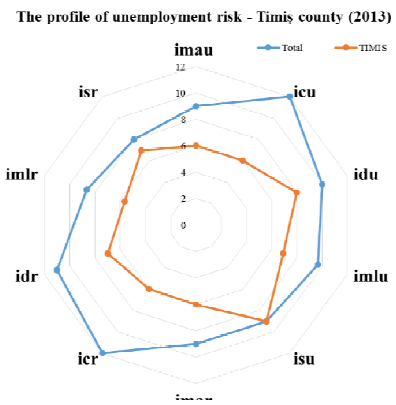
Cluster 2 - Unemployment Cluster **Balance** type - labels for counties that achieve scores that are assigned values about low scores - 2. The main feature of these counties is the realization of lower values than those in Cluster 3 but higher than those in cluster 1, except for aggregate risk index expressed by the aggregate index for Seasonality (2) tendency estimation based on monthly amplitude of urban unemployment at LAU2 level by county (unemployed persons/month/LAU2) is lower than the 1 cluster's index value.

Cluster 1 - Unemployment **Cluster Low risk** type - labels the for counties associates who are assigned with very low scores - 1. The main feature of these counties is the cumulative achievement of low values for all risk of unemployment size, except for aggregate risk index expressed by Seasonality (2) tendency estimation based on monthly amplitude of urban unemployment at LAU2 level by county (unemployed persons/month/LAU2) is having higher values than the values achieved in cluster 2.

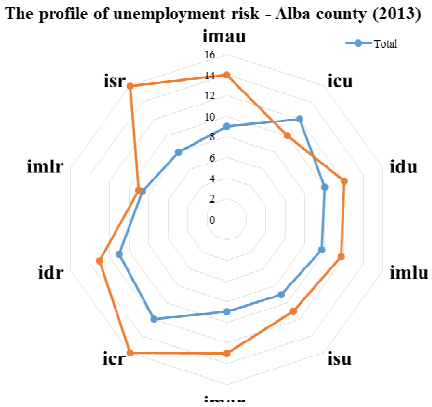
Integrated monitoring and alert system of the risk of unemployment at the county level (for all 42 counties) presents an dashboard the following selected elements:

a. **Summary scores aggregated** levels by counties (Figure 3) and their **hierarchy** (Figure 4): Hierarchy by aggregate unemployment risk reflects the Counties profile by the 5 dimensions of the risk of unemployment at the county level: average, cohesion, density, seasonality (seasonality by monthly average and seasonality by monthly amplitude) based on the unemployment variation at LAU2 level with base 2013 by area of residence (urban and rural).

Figure 3 The worst and best counties in terms of unemployment risk in 2013



Best performance



Worst performance

b. Composite indicator for unemployment risk at LAU2:

- Map 1. Composite indicator for urban unemployment risk at LAU2 level by county, 2013- [Iau]
- Map 2. Composite indicator for rural unemployment risk at LAU2 level by county, 2013- [Iar]

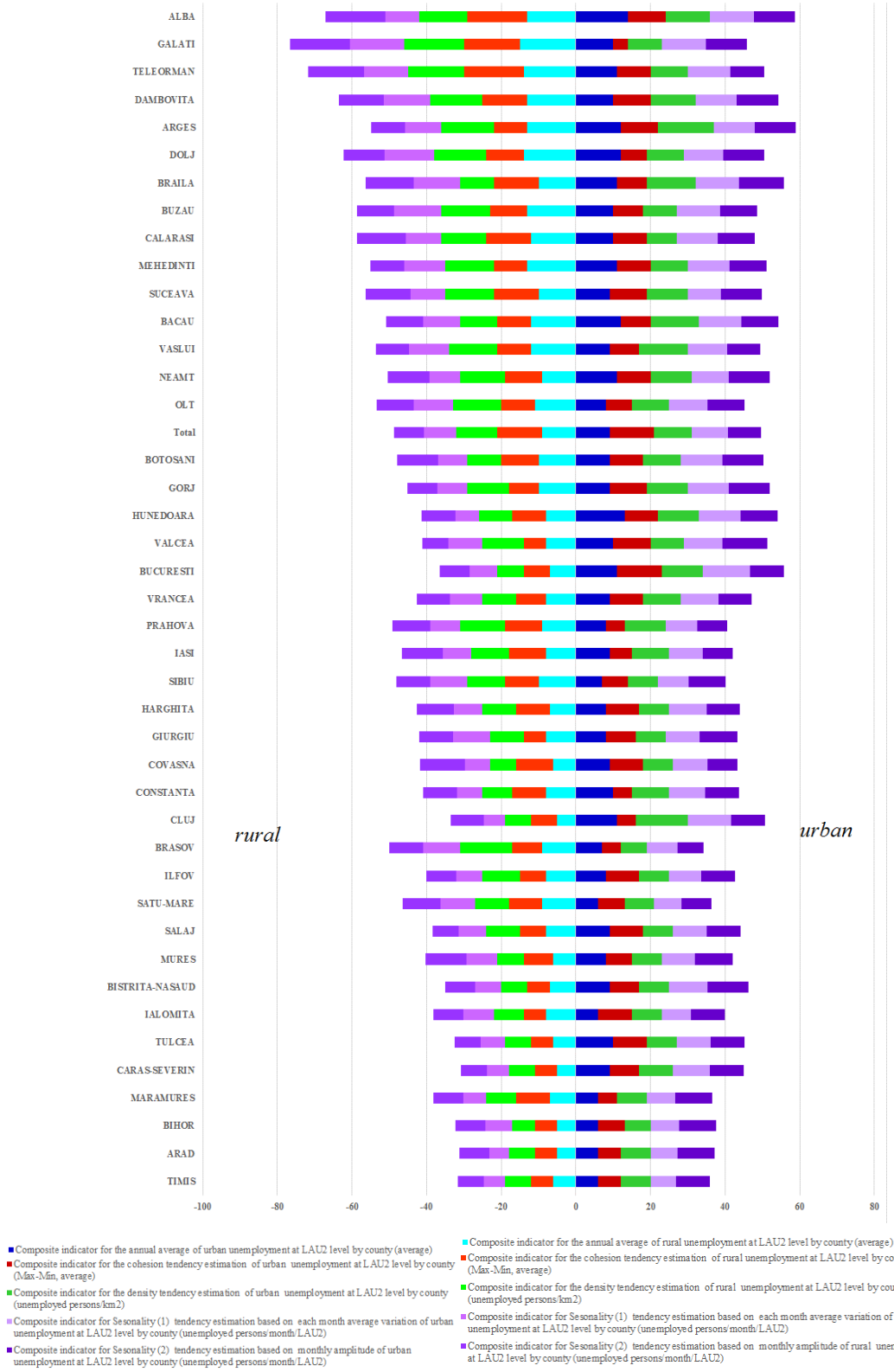
c. Summary of subindex corresponding risk of unemployment at counties level dimensions 2013:

c1. Annual **average** of unemployment at LAU2 level:

- Map 3. Composite indicator for the annual average of urban unemployment at LAU2 level by county (average) 2013 - [imau]
- Map 4. Composite indicator for the annual average of rural unemployment at LAU2 level by county (average) 2013- [imar];

Figure 4 Counties profile by the 5 dimensions of the risk of unemployment at the county level: average, cohesion, density, seasonality (seasonality by monthly average and seasonality by monthly amplitude) based on the unemployment variation at LAU2 level with base 2013 by area of residence (urban and rural)

- Hierarchy by aggregate unemployment risk -



c2. **Cohesion** tendency estimation of unemployment:

- Map 5. Composite indicator for the cohesion tendency estimation of urban unemployment at LAU2 level by county (Max-Min, average) 2013- [icu];
- Map 6. Composite indicator for the cohesion tendency estimation of rural unemployment at LAU2 level by county (Max-Min, average) 2013- [icr];

c3. **Density** tendency estimation of unemployment at LAU2 level:

- Map 7. Composite indicator for the density tendency estimation of urban unemployment at LAU2 level by county (unemployed persons/km2) 2013- [idu];
- Map 8. Composite indicator for the density tendency estimation of rural unemployment at LAU2 level by county (unemployed persons/km2) 2013- [idr];

c4. Seasonality (1) tendency estimation based on each **month average variation** of unemployment at LAU2 level:

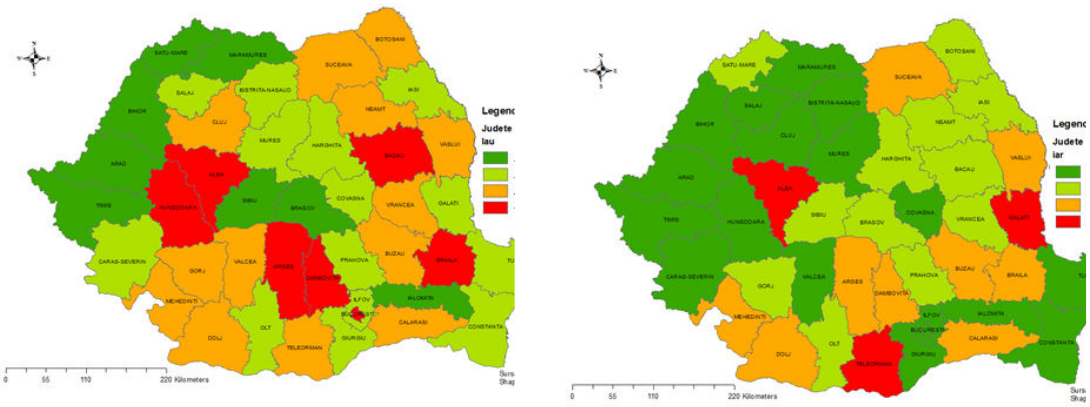
- Map 9. Composite indicator for Seasonality (1) tendency estimation based on each month average variation of urban unemployment at LAU2 level by county, 2013 (unemployed persons/month/LAU2) - [imlu];
- Map 10. Composite indicator for Seasonality (1) tendency estimation based on each month average variation of rural unemployment at LAU2 level by county, 2013 (unemployed persons/month/LAU2) - [imlr];

c5. Seasonality (2) tendency estimation based on monthly **amplitude** of unemployment at LAU2:

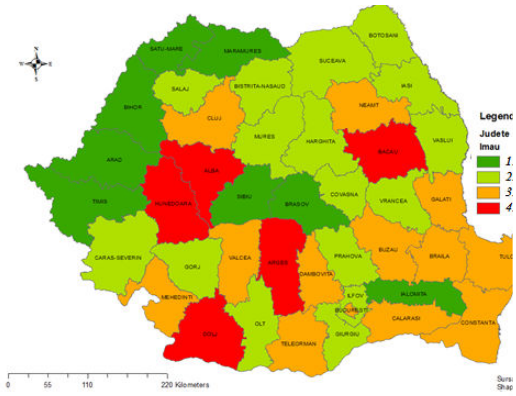
- Map 11. Composite indicator for Seasonality (2) tendency estimation based on monthly amplitude of urban unemployment at LAU2 level by county 2013 (unemployed persons/month/LAU2) - [isu];
- Map 12. Composite indicator for Seasonality (2) tendency estimation based on monthly amplitude of rural unemployment at LAU2 level by county 2013 (unemployed persons/month/LAU2) - [isr];

Figure 5 Choropleth maps of the counties profile by the 5 dimensions of the risk of unemployment at the county level: average, cohesion, density, seasonality (seasonality by monthly average and seasonality by monthly amplitude), in 2013

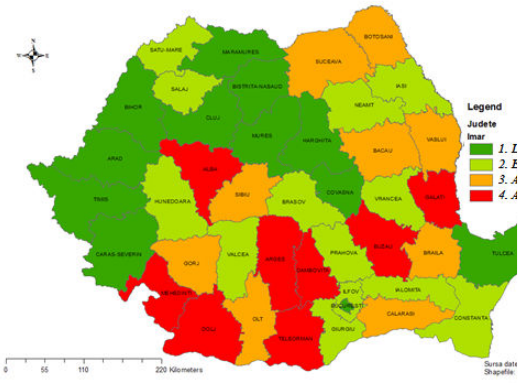
Map 1: [Iau] **Map 2: [Iar]**



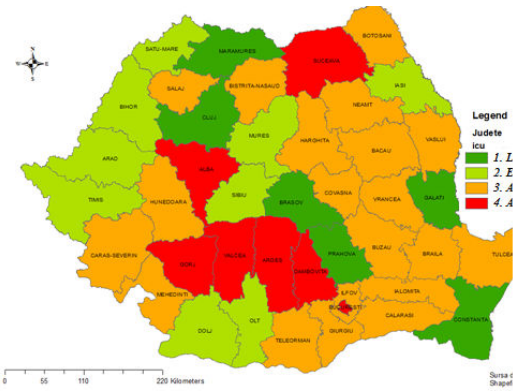
Map 3: [imau]



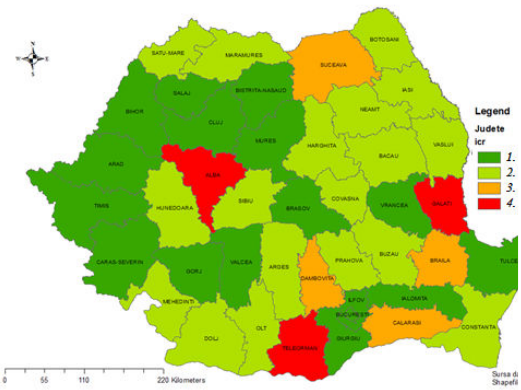
Map 4: [imar]



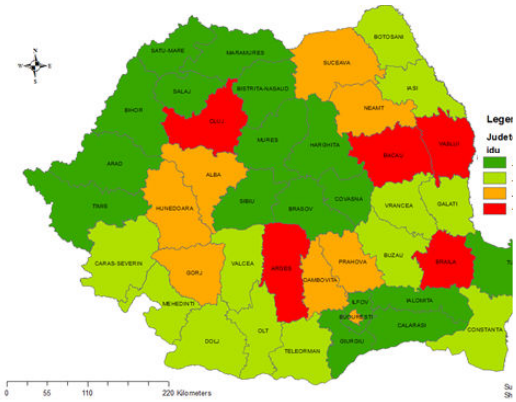
Map 5: [icu]



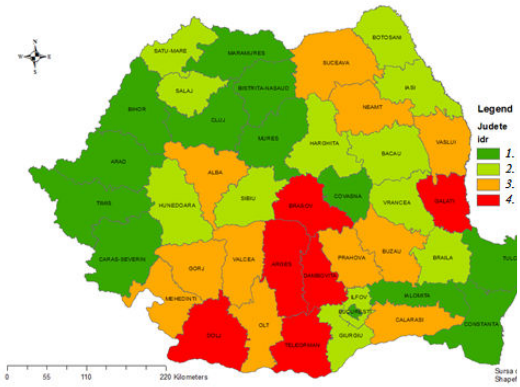
Map 6: [icr]



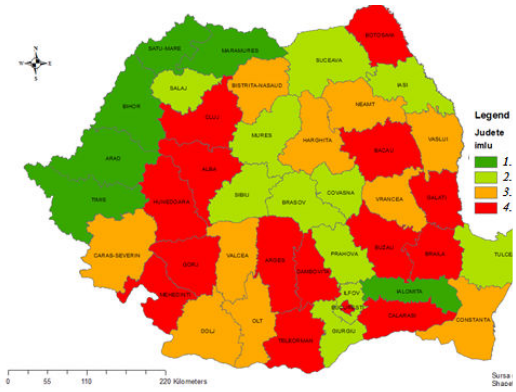
Map 7: [idu]



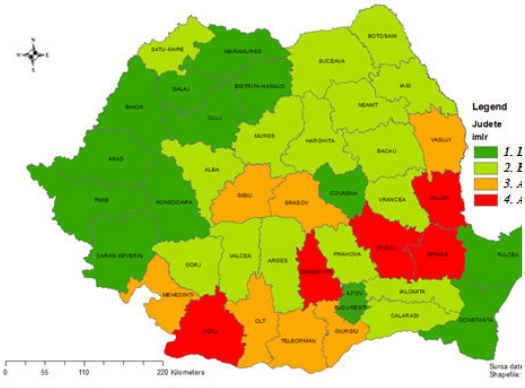
Map 8: [idr]



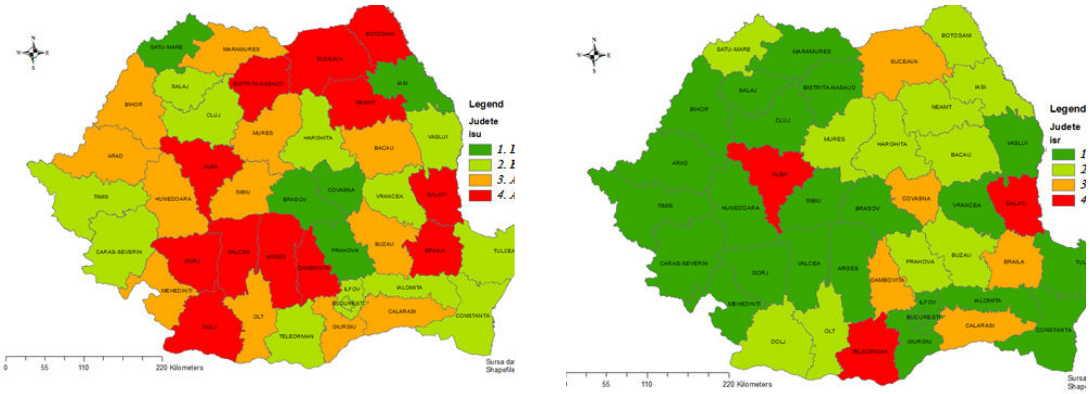
Map 9: [imlu]



Map 10: [imlr]



Map 11: [isu] **Map 12: [isr]**



Source: maps realised by authors in Arc GIs Desktop, counties boundaries from ESRI RO, using own calculation with unemployment data from TEMPO INS

Discussions

Among the effects of information economy already visible is represented by the labour market big data (inclusive public data) available and accessible for all. In regard to labour market management NEA has the main role as a data and user at central, mezzo and local level. These challenge are assumed by NEA through NEA's 2014-2020 in the "Upgrading and improving public employment services" it's IInd Objective.[38] Our paper offer support to create tools to realise the Specific Objectives " "II.1 Developing and adapting information system to support the work of the NEA" and "Specific Objective II.3 creating a system of labour market analysis" [38]

The dashboard sketch intend to present the variation in the number of registered unemployed at the LAU 2 level both in time and space. This management tool make a complex evaluation in a differentiated and comparable manner the registered unemployment at LAU level providing 4 facilities:

1. Unemployment risk evaluation uses 4 labels: Alarm, Alert, Balance, Low risk of unemployment and figured in Maps;
2. The counties hierarchy by risk of unemployment criterion evaluated multidimensional;
3. Grouping counties with similar characteristics;
4. Complex counties characterization by radar graphs (in report to its cluster and national characteristics);

This synthesis allows us to provide useful outputs in managing unemployment, as follows:

- Sizing more accurate budgets for NEA accordingly to the rural /urban main profile of the counties;
- More adequate diagnosis unemployment levels at county level by identifying processes of accumulation, agglomerations and persistent unemployment in some locations. These conditions are prerequisite for designing specialized packages of measures and services better tailored for the PES clients, some of them innovative or in addition to the current applied;
- More efficient allocation of resources – e.g. in case of seasonality, anticipation and human resource in excess need for short period of time - civil servants involved in the implementation of programmed actions could be organised in more flexible manner;
- Anticipating Changes in registered unemployment in a fully compatible form with the NEA Informational System and its national network;
- Increasing the efficiency and efficacy of PES activity towards: increasing the registration rates in both urban and rural area, increasing its capacity to accelerate the integration of jobseekers on the labour market and finally increasing the use of PES and decreasing the Unemployment,

The new opportunities provided by [35] allows the dynamic instruments like maps / mobile applications etc. to increase the labour market transparency at all levels, following the current functional models [15], [16], [17]

Conclusions / Final remarks

In an increasing dynamic global environment the technological solutions provides new challenges and opportunities. Gathering the existing information regarding the registered unemployment is possible to provide a better answer using an improved profile with a relative small added supplementary effort. Unemployment enriched profile is represented by the maps resulted our model's executing. This model emphasise and amplify counties spatio-temporal profile by the 5 dimensions of the risk of unemployment at the county level: average, cohesion, density, seasonality (seasonality by monthly average and seasonality by monthly amplitude) based on the unemployment variation at LAU2 level with base 2013 by area of residence (urban and rural).

In European landscape Romania presents in 2015 a totally different structure of the share of population in total population: Cities 32.3%, Towns and suburbs 23.6% and rural areas 44.1% compared to EU28: Cities 41.6%, Towns and suburbs 30.7% and rural areas 27.7%. [39] Romania is an emergent economy, an upper middle income country - in development, with only 54% urban population from total population in 2014, decreasing with -0,1pp since 1990 [39] – presenting almost flat tendency of urbanisation, process dissimilar to high income countries. The high income countries presents accelerate processes of urbanisation from 74% in 1990 to 81% 2014 [40] Urban / rural dichotomy reflects the major divide for Romania – but there is still room to further discuss the periurban areas.

LAU2 level base of aggregation put in light the high heterogeneities in NUTS 3 counties areas! Here in Romania but also in EU 28 - OECD alerts about the poverty in urban areas requests a magnifier tool to better understand these phenomena's.

Spatial perspective offers the informational tools to shape a precise profile, multidimensional integrated as a base to smart development not only to urban areas but also to rural areas if designing adequate solutions.

Main limit of this model is given by the fact the Bucharest, the biggest city in Romania (also the capital of Romania) – is a LAU2 – introduce distortions, therefore requests a special study case.

Automatization through an algorithm and building dynamic maps could improve this model development if is desirable. Monitor maps for unemployment represents useful tools already implemented in some countries as well as in Romania. The Territorial Observatory presents a big data exploitation in dynamic maps by indicator type, intermediary steps towards more advanced tools promotion.

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