REALIZATION OF INTEGRATED GEOSPATIAL STRUCTURES FOR DATA ANALYSIS IN THE SOCIAL PROTECTION SECTOR OF THE PENSION SYSTEM

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Abstract: Geographic information systems have emerged from the need of people from different functional structures to provide answers to questions arising from daily tasks. A GIS information system provides facilities for meeting workloads in a much shorter time, and the results are much more consistent and reliable. The design of the implementation of a GIS system starts with people and their needs and finishes with computer applications that are used to achieve stated goals, the whole system being designed to fulfill the proposed tasks.
Thus, this paper seeks to carry out a statistical analysis of the Alba County population in the pension system using the facilities offered by the GIS applications. The main function of the identified social indicators is to respond to the requirements of monitoring the situation in the social protection sector, indicators that at national level can be integrated into the National Strategies in various fields.

Keywords: GIS, statistical indicators, spatial distribution, types of pensions

1. Introduction

The defined contribution pension scheme is considered to be very useful in ensuring a fairly decent living for the elderly or those receiving such social contributions. Studies conducted in countries that have implemented this system have shown that in the economies where there is a high rate of unemployment and tax evasion, the capacity of this system to ensure poverty prevention is extremely limited. [1]

Analyzing the social and demographic situation in Romania regarding the public pension system, three factors responsible for the adverse effects on the financial sustainability of the beneficiaries of the pension system were identified [2]
- increasing the life expectancy of the population;
- decrease in birth rates;
- increasing population migration.

The institution responsible for implementing pension policies is represented by the National House of Public Pensions. This is the public institution in Romania which provides pensions and other social security benefits due to persons included in the public pension system and occupational accidents and occupational diseases through the territorial pension houses as well as a series of indemnities with a reparatory character, by special laws. [3]

Given the purpose of this study, it was chosen to use the GIS to provide a statistical analysis of the beneficiaries of the pension system.

Information systems represent a necessity for institutions that are operating with geographic data. Regional development or utilities agencies can use spatial analysis resulting from the implementation of GIS systems for elaboration the development strategies, coordinated resource management, or statistical analysis of different phenomena. [4]

2. Materials and Methods

Information systems for organizing data, information and extracting new knowledge become essential parts of decision-making and development strategy development. In addition to classical data used in computer systems, the trend of recent years has been to complement these data with geospatial ones. These data offer the possibility of geographic location of certain objects on the globe and obtaining information about their shape and size. [5], [6]

GIS is a system that allows the collection, management and analysis of data. Thus, GIS integrates multiple data types, analyzing spatial locations and organizing layers of information in map views, helping users make the most optimal decisions. [7], [8]

Thus, the GIS system is used to create, store, analyze and process information stored in a computerized system, providing utility in various fields of activity: resource management, impact studies, cartography, statistical studies, etc. [9], [10]

Among the advantages of using GIS technology for data analysis within the social protection sector can be listed: [11], [12]

- establishing the link between the regional element and its geographical location;
- viewing data in geographic context;
- creation of spatial data and inclusion of non-spatial information in GIS;
- increasing the detail and visualization of the data;
- building forecasts of a phenomenon in time and space;
- facilitating communication and collaboration between stakeholders;
- geostatistical analysis of information.

Among the disadvantages of using GIS technology can be stated:

- high cost of purchasing GIS products;
- training of specialists in the use of GIS technology;
- lack of technical equipment and qualified staff.

For the chosen case study, it is desirable to develop a GIS prototype to optimize the process of record-keeping for beneficiaries in the public pension system. The main requirements of the GIS application refer to:

- the possibility of inserting data on the main macroeconomic indicators (population, pension beneficiaries, pension categories) for Alba County with the possibility of extending the application across the country;
- storing geospatial information related to Romanian counties;
- visualization of thematic statistical maps;
- generating reports containing statistical and geospatial information needed to make decisions.

In order to realize the application, we took into account the statistical data obtained from the Pensions House of Alba County regarding the number of beneficiaries in the pension system, structured by categories of beneficiaries and the environment of origin (Table 1, Table 2).

Table 1. Pensions House of Alba County - Statistical pensions situation on urban localities

TYPE OF PENSION	Old Age Pension (LV)		Early Retirement Pension (PA)		Partial Early Retirement Pension (PAP)		Invalidity Pension (INV)		Successor Pension (URM)		TOTAL
GENDER	M	F	M	F	M	F	M	F	M	F	
ABRUD	941		186		162		35		9		1333
	478	463	92	94	24	138	16	19	1	8	
AIUD	5197		525		409		151		44		6326
	2226	2971	287	238	35	374	64	87	26	18	
ALBA IULIA	12935		1879		852		525		218		16409
	5116	7819	982	897	106	746	227	298	84	134	
BAIA DE ARIES	736		178		159		31		8		1112
	424	312	77	101	15	144	8	23	2	6	
BLAJ	3843		442		343		226		52		4906
	1590	2253	261	181	36	307	122	104	23	29	
CIMPENI	1271		314		202		57		16		1860
	605	666	187	127	20	182	21	36	7	9	
CUGIR	5624		932		271		235		147		7209
	2156	3468	506	426	46	225	98	137	81	66	
OCNA MURES	2708		301		472		85		25		3591
	1236	1472	182	119	39	433	36	49	16	9	
SEBES	5169		863		351		254		174		6811
	1917	3252	442	421	68	283	108	146	48	126	
TEIUS	1225		159		220		35		12		1651
	574	651	98	61	8	212	17	18	7	5	
ZLATNA	1406		253		382		32		9		2082
	830	576	139	114	15	367	8	24	3	6	
											53290
TOTAL	LV		PA		PAP		INV		URM		
	M	F	M	F	M	F	M	F	M	F	
	41055		6032		3823		1666		714		
	17152	23903	3253	2779	412	3411	725	941	298	416	53290

Table 2. Pensions House of Alba County – Extract of Statistical pensions situation on rural localities

TYPE OF PENSION	Old Age Pension (LV)		Early Retirement Pension (PA)		Partial Early Retirement Pension (PAP)		Invalidity Pension (INV)		Successor Pension (URM)		TYPE OF PENSION
GENDER	M	F	M	F	M	GEND ER	M	F	M	F	
ALBAC	187		95		94		3		1		380
	127	60	64	31	0	94	1	2	1	0	
ALMASU MARE	154		69		120		2		0		345
	111	43	51	18	1	119	2	0	0	0	
ARIESENI	184		42		63		3		0		292
	130	54	30	12	3	60	3	0	0	0	
AVRAM IANCU	191		45		120		0		0		356
	129	62	26	19	5	115	0	0	0	0	
BERGHIN	367		80		64		6		2		519
	163	204	47	33	5	59	6	0	1	1	
BISTRA	558		182		234		17		2		993

TYPE OF PENSION	Old Age Pension (LV)		Early Retirement Pension (PA)		Partial Early Retirement Pension (PAP)		Invalidity Pension (INV)		Successor Pension (URM)		TYPE OF PENSION
GENDER	M	F	M	F	M	GEND ER	M	F	M	F	
	414	144	114	68	9	225	12	5	1	1	
BLANDIANA	160		36		58		3		1		258
	86	74	26	10	0	58	3	0	1	0	
....	....		....		....		....		....		....
	....	....	....	....	....	....	....	....	....	....	
SONA	727		92		112		36		7		974
	323	404	55	37	10	102	24	12	6	1	
SPRING	396		88		92		10		3		589
	158	238	57	31	10	82	5	5	1	2	
STREMT	411		58		119		14		2		604
	231	180	29	29	7	112	8	6	1	1	
SUGAG	358		51		81		7		3		500
	204	154	28	23	1	80	1	6	1	2	
UNIREA	878		103		198		15		1		1195
	439	439	72	31	5	193	8	7	0	1	
VADU MOTILOR	115		32		69		2		0		218
	71	44	20	12	2	67	2	0	0	0	
VALEA LUNGA	444		60		103		8		5		620
	225	219	40	20	3	100	5	3	4	1	
VIDRA	124		53		83		3		1		264
	94	30	35	18	6	77	2	1	1	0	
VINTU DE JOS	717		152		180		24		3		1076
	351	366	85	67	11	169	15	9	2	1	
											34201
TOTAL	LV		PA		PAP		INV		URM		
	M	F	M	F	M	F	M	F	M	F	
	22750		4344		6315		628		164		
	11756	10994	2701	1643	320	5995	398	230	102	62	34201

Creating the GIS application and generating the required statistical situations was done based on the analysis of the categories of beneficiaries and the type of approved pension. The following pension categories are granted in the public pension system:

a) old-age pension;
b) early retirement pension;
c) partial early retirement pension;
d) invalidity pension;
e) successor pension.

3. Results and Discussion

The old-age pension is due to persons who meet, cumulatively at the retirement age, the conditions for the standard retirement age and the minimum contribution period provided by this law.

Following the introduction of data into the GIS application, age-old retirement situations resulted from the following parameters:

- old-age pensions;
- old-age pensions - women;
- old-age pensions - men;
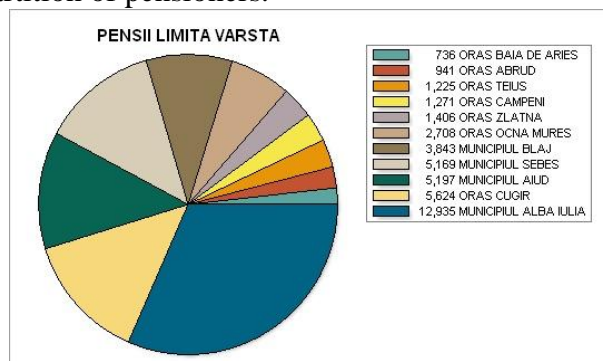- spatial repartition of pensioners.
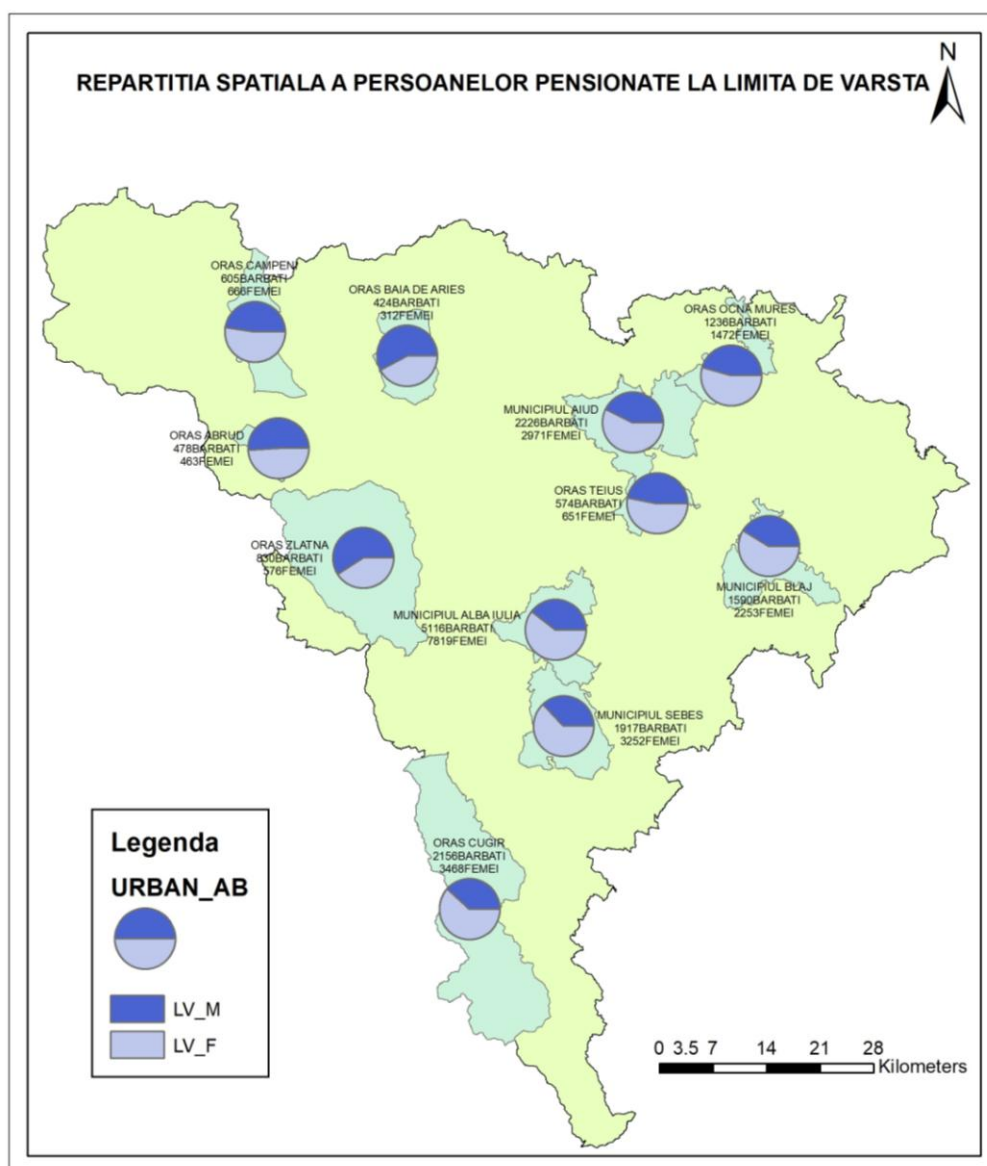

Fig. 1 Old-age Pensions

Fig. 2 Old-age pensions – spatial distribution on urban area

Early retirement pension is due, at most 5 years before reaching the standard retirement age, to persons who have completed a contribution period of at least 8 years longer than the full length of the contribution provided by this law. The statistics on the categories of beneficiaries, by gender, are shown in Figures 3 and 4.
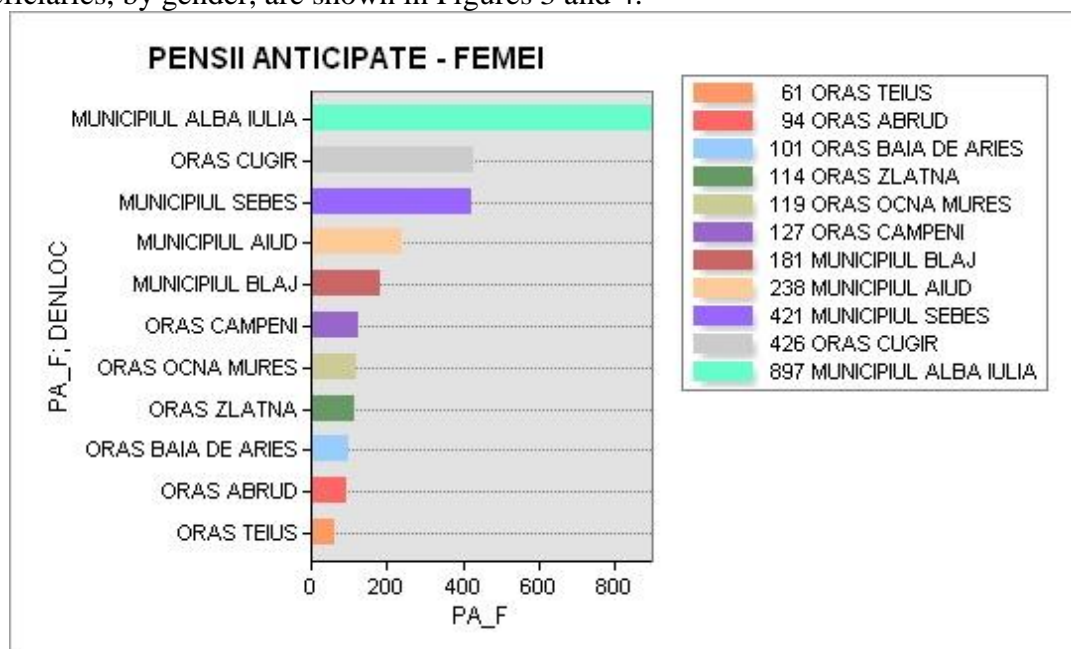
Fig. 3 Beneficiaries of Early Retirement Pension - Women
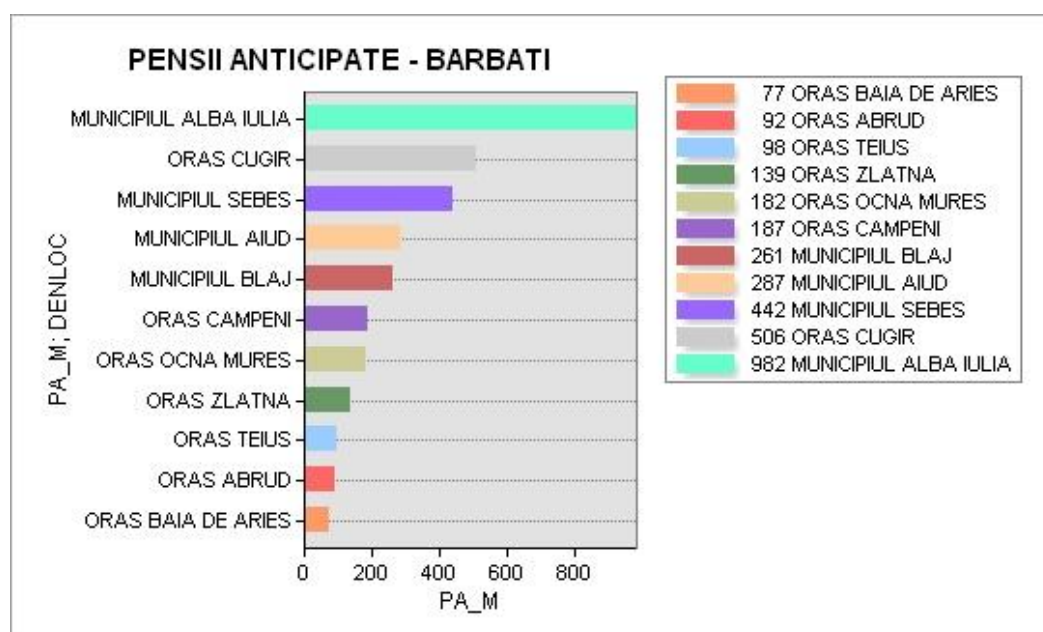
Fig. 4 Beneficiaries of Early Retirement Pension - Men

As regards other types of pensions, the analysis algorithm was followed in the same way, resulting in statistical situations and spatial distributions of pension beneficiaries in the system.
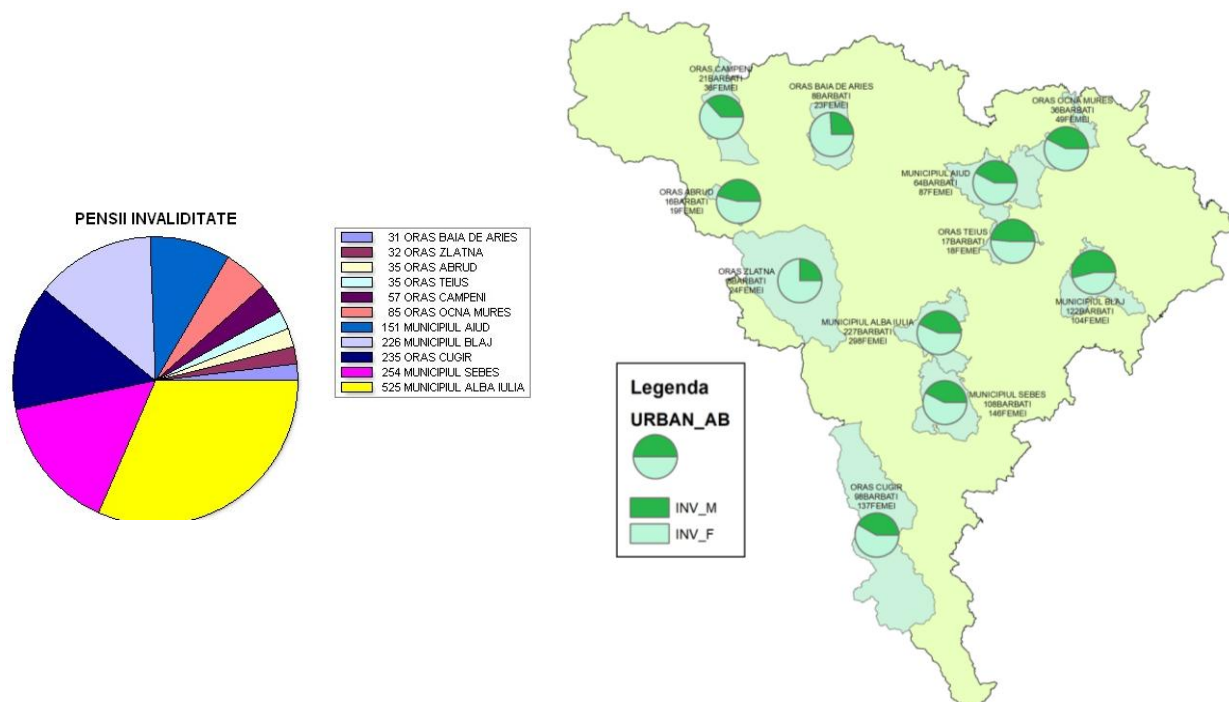
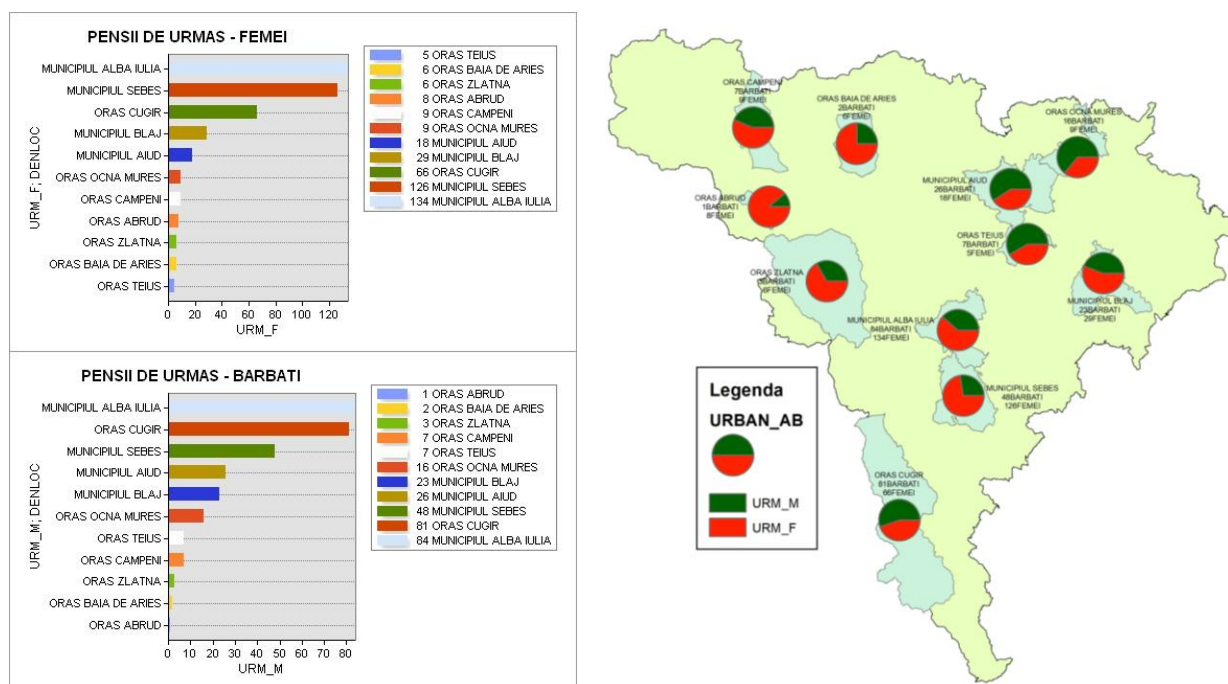Fig. 5 Beneficiaries of Invalidity Pension

Fig. 6 Beneficiaries of Successor Pension

Also, on the basis of available data, a series of statistics on the situation of citizens with pension rights could be developed, including territorial disposition and categories of rights obtained at county level.
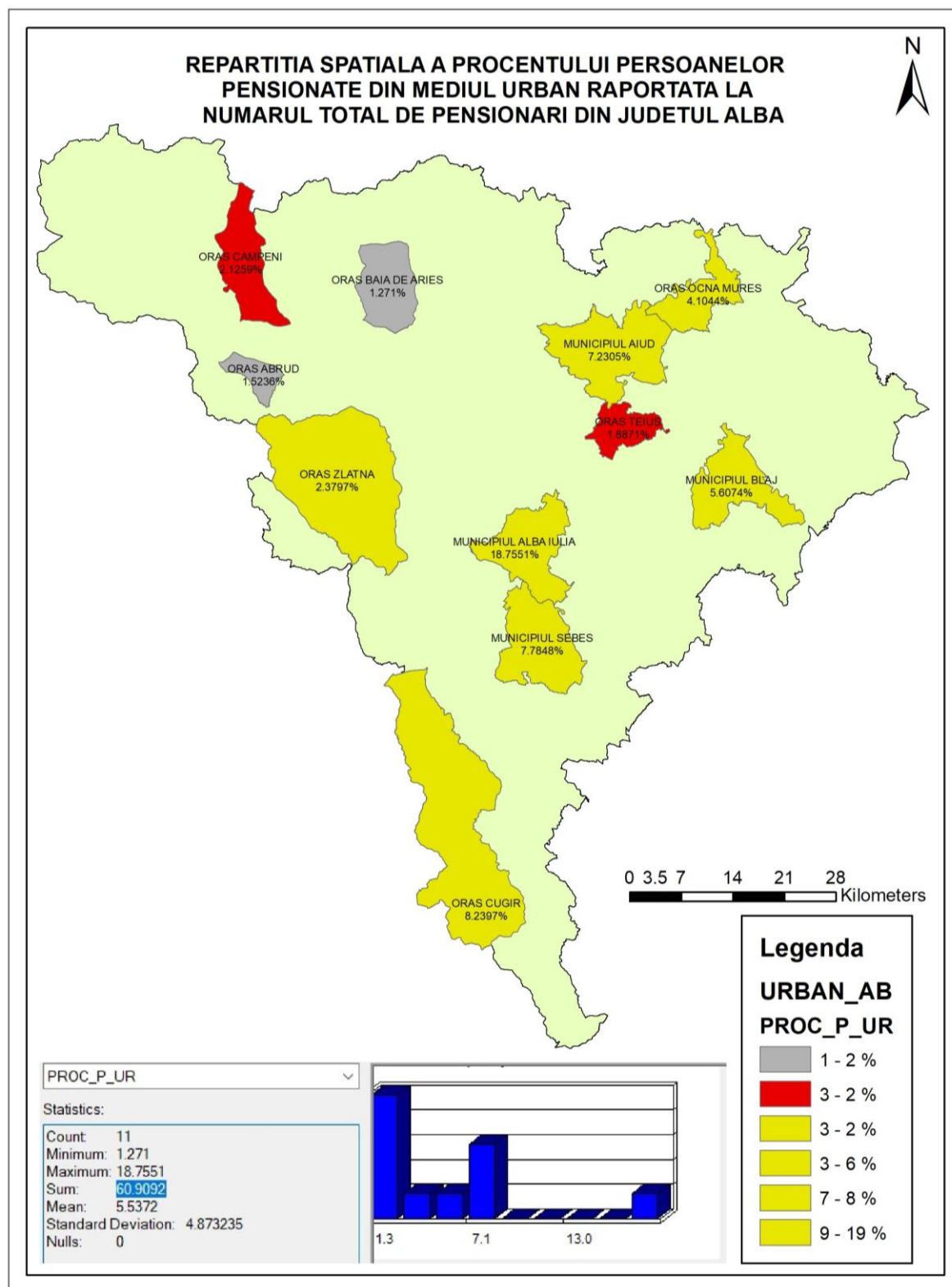
Fig. 7 Spatial percent distribution of pensioners in the urban area

At national level, based on the data obtained, the ratio of the total number of average state social security pension on the employees was 9 to 10, this report showing significant territorial variations depending on the degree of development of each county in part. [13]
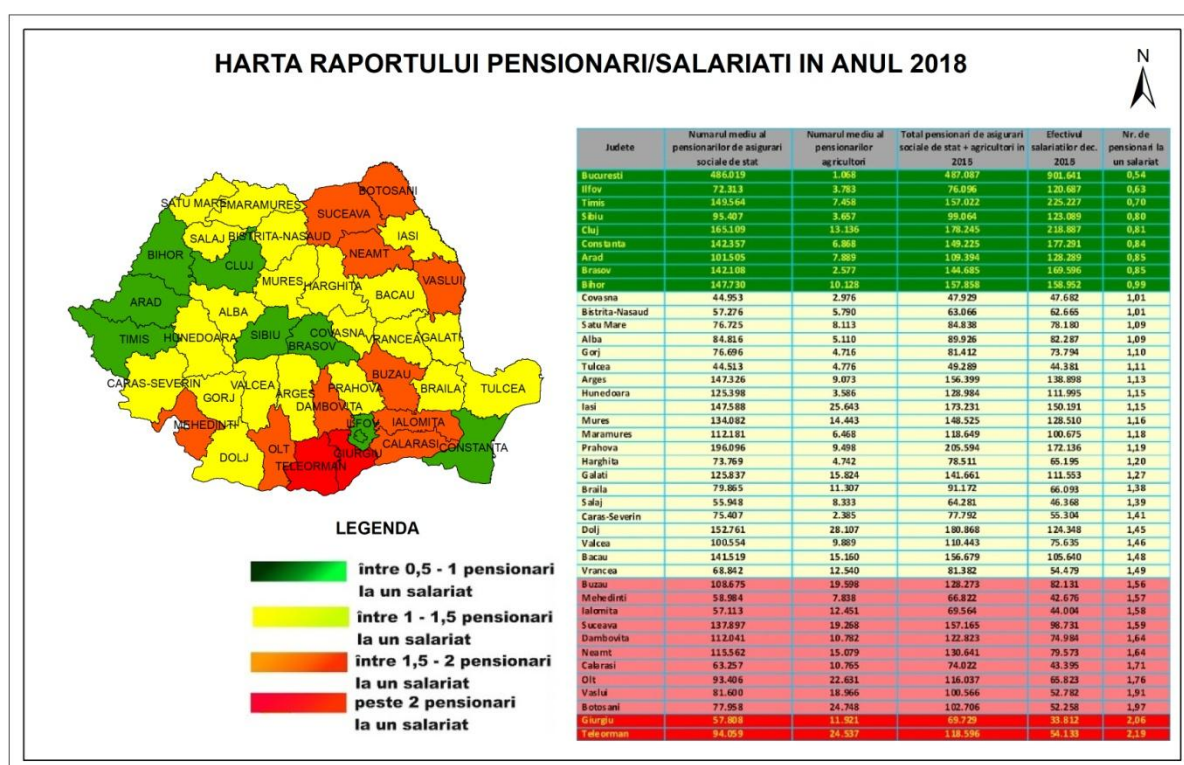
Fig. 8 Map of pensioners / employees ratio in year 2018

4. Conclusions

The set of indicators for the social protection sector for Romania is structured on the objectives of the National Sustainable Development Strategy, which is a solid basis for the regular monitoring of the progress made in achieving the strategic objectives of sustainable development.

The indicators present in the database are aimed at the target objectives and the modalities of action established by the National Strategy for Sustainable Development. These were defined on the basis of the information available within the National Pensions House and the institutions under its subordination or coordination.

The application integrates economic, social and environmental indicators that are useful for the three-dimensional assessment of sustainable development in Romania. At the same time, the application allows the development of these statistics and the updating with other elements necessary for the development of an IT application for data protection related to the social protection sector at national level.

The GIS prototype is a starting point for the development of a complex geographic system capable of spatial analysis with the possibility of viewing thematic maps for all macroeconomic indicators of interest to decision-makers and control bodies.

5. References

1. I.M. Dragotă, E. Miricescu, Sistemul public de pensii din România: între crize şi reforme. Analiza sistemului pensiilor speciale, Economie teoretică şi aplicată, Volumul XVII, No. 9(550), pp. 81-102, 2010;
2. M. Şeitan, M. Arteni, A. Nedu, Evoluţia demografică pe termen lung şi sustenabilitatea sistemului de pensii, Îmbunătăţirea capacităţii instituţionale, de evaluare şi formulare de

politici macroeconomice în domeniul convergenţei economice cu Uniunea Europeană a Comisiei Naţionale de Prognoză, cod SMIS 27153, 2012;

3. *https://www.cnpp.ro/home;*
4. *C.M. Mitran, V. Nicoara, Eficienta utilizarii tehnologiei GIS in elaborarea strategiilor de dezvoltare regionala. Studiu de caz: Regiunea de dezvoltare Centru, Geographia technica, nr . 1 , 2006;*
5. *G.E. Voicu, F. Voicu, Urban Development of the Touristic Area Poarta Raiului Through the Implementation of GIS, 15th International Multidisciplinary Scientific GeoConference SGEM 2015,Conference Proceedings, Book2 Vol. 2, 1183-1190 pp, 2015;*
6. *T. Borşan, GIS - Fundamente teoretice si practice, Seria Didactica, 2013;*
7. *AC Badea, G Badea, Cadastru, bănci de date şi aplicaţii GIS în zone urbane, Editura Conspress, 2014;*
8. *G.E. Voicu, F. Voicu, Evaluation of natural potential and vulnerability of territory to risks. Case study: Sântimbru Commune, Alba County, Pangeea, nr.18, p. 101-112, 2018;*
9. *IS Herban, C Grecea, CC Musat, Using a Geographic Information System (GIS) to Model, Manage and Develop Urban Data of the Timisoara City, Journal of environmental protection and ecology, 13 (3), 1616-1624, 2012;*
10. *G. Badea, A.C. Badea, V. David, Advantages of using IT Solutions in Land Surveying and Cadastral Project Management, 14th SGEM GeoConference on Informatics, Geoinformatics and Remote Sensing, vol 2, p. 27-34, 2014;*
11. *C. Grecea, I. Ienciu, L. Dimen, A.C. Bălă, L. Oprea, Impact of Surveying Engineering on the Environmental Protection Problems, Journal of Environmental Protection and Ecology, 13 (1), 352-360, 2012;*
12. *Herbei, M., GIS si Modelare cartografica, Petrosani, 2015;*
13. *http://www.insse.ro/cms/sites/default/files/com_presa/com_pdf/pensii_tr4r18.pdf.*