ENSURING THE MAINTENANCE OF THE AUTOMATED INFORMATIONAL SYSTEM"STATE ANIMAL REGISTER" IN THE REPUBLIC OF MOLDOVA

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Abstract. The goal of this work is to analyze and reflect the importance of developing the Integrated Agricultural Register for the Republic (IAR) of Moldova, which is based on the implementation of the process of Electronic Transformation of Government through the e-Agriculture principle, storage and maintenance of information systems in the agro-industrial sector, management and processing of required data from existing electronic registers in order to streamline the development and implementation of development policies in agriculture. The Animal Identification and Traceability System (AITS), later referred to as the State Animal Register (SAR), is only a component part of the IAR and has as its primary objective the food security and consumer assurance with products of animal origin. AITS is one of the basic subsystems as an integral part of the traceability process of animal products. The SAR Automated Informational System is a set of elements and procedures that allow the identification and registration of animals and holdings, ensuring compliance of the traceability principle. All animals belonging to the bovines, sheep, goats, swine, horses, donkeys and descendant species obtained by crossing them, all holdings in which these animals are kept or handled, either farm, sheepfold, fair, slaughterhouse, will be identified. [1]

1. Introduction

In the last decades, the majority of governmental organizations in the whole world started the organization and management of the geospatial information withing the so-called National Spatial Data Infrastructure. The purpose of them is to reduce the effort duplication of institutions or agencies in the process of gathering and producing of geospatial data, to improve the geospatial data quality and significantly reduce the costs of obtaining them, as well as to create a network of valid spatial data resources that will serve as an important support in decision making. In this regard, the Government of the Republic of Moldova approves the decision for the approval of the regulation regarding the sharing norms of the geospatial datasets and of the related services between public entities and third parties.[1]

The agricultural sector of the Republic of Moldova is going through a period of transformation from the registers on paper to the registers in electronic format. The Integrated Agricultural Register implies the creation of several information systems and their integration on a single platform. These systems aim to collect data from the territory, through the territorial registrars, located in each district, for the administration and management of the agro-industrial complex. One of these systems is the Automated Information System „State Register of Animals" (AIS „SRA") where, daily, farms and animals such as bovine, sheep, goat, pig, horse, donkey and descendants obtained by cross breeding are registered. [2]

Geographic Informational System (GIS) is used to create, store, analyze and process spatially distributed information through a computerized process. GIS technology can be used in various scientific fields, such as: resource management, environmental impact issues, cartography, etc. [5-8]

2. Purpose

The main purpose of this paper is the study and analysis of the methodology of data framing in AIS SRA,

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as attributes, with GIS as the current cartographic basis int he Geospatial Data Infrastructure, which is of major importance in ensuring and developing the branches of the national economy of the Republic of Moldova. The process is part of the regulation on the establishment and management of spatial data through the national spatial data infrastructure geoportal, a web portal that represents a key element within the National Space Data Infrastructure, ensuring the practical and organized access to the spatial data of several public authorities, provides information about this data, ensures the possibility of searching, viewing and downloading spatial data from different sources.

3. Methodology

Specific to a GIS is the way of organizing the managed information. There are two types of information: one graphic that indicates the spatial distribution of the studied elements and the other as a database to store the attributes associated with these elements. [3-4]

As a vector graphic information, which is a method of representing images using simple geometric figures, the county administrative boundaries throughout the country are used in districts. As a database type information, the attributes generated from the AIS SRA are stored, cush as the number of animals by species – number of animals and all events with these animals respectively – number of events from all districts of the Republic of Moldova. The data used in this paper represents the situation in the State Register of Animals from the year 2018. The number of animals events are the results of queries on the Oracle BI platform for the period 01.01.2018 – 31.12.2018. [2-5]

Table 1. Animal events, 2018.

Event name	Number of events
Primary animal registration	658423
Export	22371
Import	24638
Disappearance	206983
The death of the animal	40819
Loss and recovery of earache	757
Finding the animal	1232
Traditional animal sacrifice	590338
Record of departure	704161
Check in arrival	626068
Registration at the transit point	239
Grand Total	**2876029**

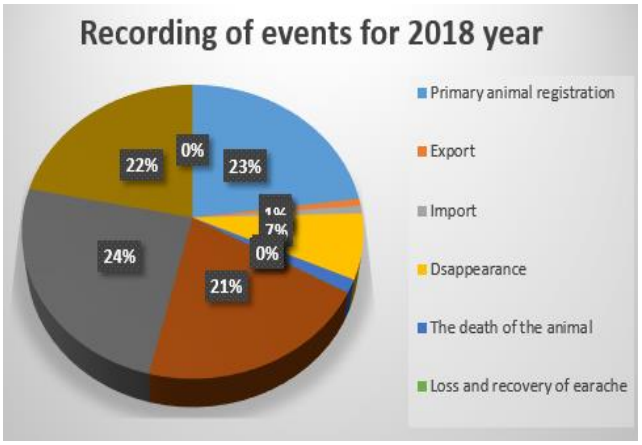

Fig. 1. Events graph, 2018.

Due to the information associated with the graph, the Geographic Information Systems benefit from all the query opportunities offered by the database systems and in addition can easily provide analyzes oriented to certain geographical areas. [2]

Quantum GIS is one the Open Source / Free programs – initially a map viewer. QGIS is developing very energetically, becoming one of the most important GIS software currently used in this study. It has a nice and easy to use graphical interface. [2-4]

QGIS is the program used to create digital maps, reflecting the up to date status of animals on the territory of the Republic of Moldova. By combining the graphic data with the text characteristics of each district, the maps representing the species and the number of existing animals, as well as the map with the total number of animals in each district of the country, are obtained. These maps are designed so that they are visible and easily read by those interested due to gradual colors obtained on the number of animals. [3,10]

If the notion of System represents a set of interconnected elements that work together in order to achieve a certain objective, then the combination between GIS and AIS SRA is a map specific to the agricultural field, which is very useful and necessary to the interested ones. The integration of the graphic database with the attribute database, within some systems, forms a single entity called the digital map, which is a collection of graphic symbols, to which a collection of features (attributes) is attached for each object represented on the map.

Table 2. Number of animals, December 2018.

ID	District	Bovines	Swine	Sheep	Goats	Horses	Donkey	Total by district
1	Anenii Noi	7 072	102 866	5 522	8 290	303	2	124 055
2	Basarabeasca	1 160	2 244	28 303	4 726	296	64	36 793
3	Briceni	6 938	4 261	10 072	1 518	1 035	7	23 831
4	Bălți	1 161	1 909	2 845	1 475	118	1	7 509
5	Cahul	5 299	16 045	65 168	15 192	1 548	484	103 736
6	Cantemir	6 046	14 785	51 941	7 332	1 846	425	82 375
7	Ceadîr-Lunga	3 758	4 592	37 450	16 492	435	85	62 812
8	Chișinău	1 637	1 472	3 262	3 215	265	7	9 858
9	Cimișlia	3 009	3 084	26 740	3 255	701	48	36 837
10	Comrat	4 128	7 393	40 516	7 015	443	563	60 058
11	Criuleni	2 670	46 121	2 221	1 678	85	0	52 775
12	Călărași	5 231	6 888	9 304	5 629	2 697	7	29 756
13	Căușeni	10 908	8 961	26 897	11 404	380	6	58 556
14	Dondușeni	8 122	3 771	3 991	2 977	883	3	19 747
15	Drochia	14 587	5 534	11 080	6 403	1 167	10	38 781
16	Dubăsari	1 508	3 404	1 179	1 526	192	0	7 809
17	Edineț	12 931	5 687	13 646	7 479	1 028	6	40 777
18	Florești	12 676	19 921	11 789	6 327	1 590	6	52 309
19	Fălești	14 488	12 411	30 060	6 982	1 989	13	65 943
20	Glodeni	10 667	10 234	22 470	9 530	1 674	2	54 577
21	Grigoriopol	0	570	203	0	0	0	773
22	Hîncești	14 259	21 050	52 495	14 025	2 444	1	104 274
23	Ialoveni	6 007	8 429	11 035	3 650	597	5	29 723
24	Leova	2 764	2 174	19 214	2 469	698	8	27 327
25	Nisporeni	3 285	27 891	16 181	6 582	1 779	0	55 718
26	Ocnița	3 841	2 164	3 194	1 038	486	1	10 724
27	Orhei	6 710	13 101	10 447	8 087	1 787	7	40 139
28	Rezina	3 178	14 882	2 620	4 633	1 007	0	26 320
29	Rîbnița	1 654	0	0	0	0	0	1 654
30	Rișcani	9 591	7 310	9 335	4 612	1 122	0	31 970
31	Soroca	12 513	8 163	8 314	5 499	1 109	1	35 599
32	Strășeni	3 541	8 330	3 171	3 338	1 004	2	19 386
33	Singerei	11 593	8 291	28 427	7 461	1 123	0	56 895
34	Taraclia	1 979	2 693	40 447	15 211	649	279	61 258
35	Telenești	5 597	9 488	29 761	5 430	1 949	0	52 225
36	Ungheni	14 498	19 808	26 677	5 644	3 165	3	69 795
37	Vulcănești	1 143	6 636	24 801	2 794	96	59	35 529
38	Șoldănești	4 291	12 988	6 629	3 581	1 188	0	28 677
39	Ștefan Vodă	6 083	4 368	8 259	5 723	368	8	24 809
373	Moldova Total	246 523	459 919	705 666	228 222	39 246	2 114	1 681 690

4. Results

According to this principle, seven digital maps were created where the geographical data were used, which represents the coordinates of the spatial points that make up 39 polygons (the administrative boundary of the district) and the non-spatial attributes measured at certain time points in text format – numbers extracted from the database AIS SRA database, representing the number of animals (see columns in table 2) or events with these animals (see table 1).

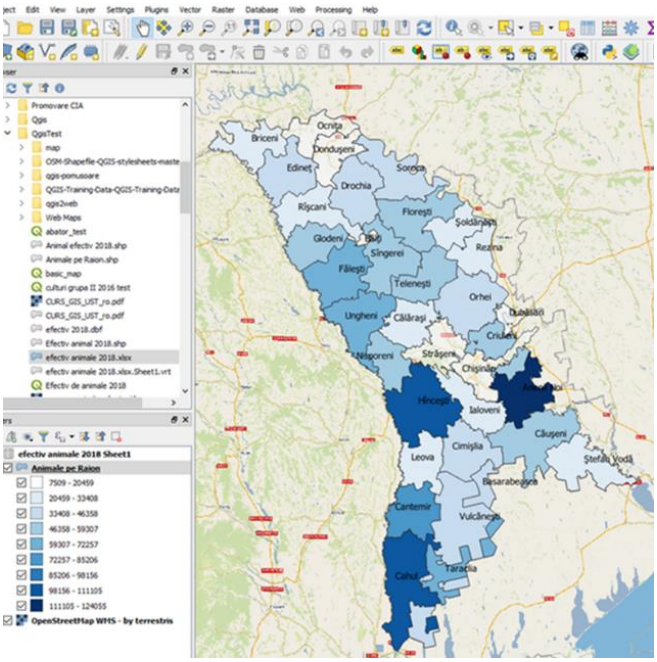

Fig. 2. Distribution of total number of animals.

The map represents the total number of animals registered at the end of 2018 year (see table 2 last column) an is displayed in a special area of the QGIS program window. The map depends on the vector in its plan, enlarged or reduced. The image of the map and the legend are dependend on each other. [3-4, 9-10]

Other maps are obtained from the number of events with these animals, which can be generated from the AIS SRA database from any period of time. Thus, we have below the map which represents the event of primary registration of animals from all districts of the country, according to the attached table (see table 1, first line and Fig.1).

Table 3. . The primary registration of animals event distribution, 2018.

ID	District	Number of animals
1	Anenii Noi	116146.00
2	Basarabeasca	3114.00
3	Briceni	2903.00
4	Bălți	2313.00
5	Cahul	37141.00
6	Cantemir	8224.00
7	Ceadîr-Lunga	13782.00
8	Chișinău	2527.00
9	Cimișlia	3673.00
10	Comrat	14789.00
11	Criuleni	84978.00

12	Călăraşi	11414.00
13	Căuşeni	13897.00
14	Donduşeni	4122.00
15	Drochia	11829.00
16	Dubăsari	1324.00
17	Edineţ	4943.00
18	Floreşti	78195.00
19	Făleşti	10878.00
20	Glodeni	8253.00
21	Grigoriopol	773.00
22	Hînceşti	30379.00
23	Ialoveni	2982.00
24	Leova	4782.00
25	Nisporeni	36617.00
26	Ocniţa	2950.00
27	Orhei	13557.00
28	Rezina	45053.00
29	Rîbniţa	1698.00
30	Rîşcani	7122.00
31	Soroca	13151.00
32	Străşeni	4849.00
33	Sîngerei	8385.00
34	Taraclia	5565.00
35	Teleneşti	7639.00
36	Ungheni	19211.00
37	Vulcăneşti	9306.00
38	Şoldăneşti	4732.00
39	Ştefan Vodă	5227.00
	Total general	**658423.00**

At the base of these maps is uploaded the free OpenStreetMap geographical dataset.

The maps representing each animal species are also created, the data being generated from the AIS SRA where they are updated daily (see table 2 column 3 and 4).

According to the same procedure, another 4 maps are created representing the distribution of each species of animals at national level: goats, sheep, horses and donkeys, mentioned in table 2, columns 5, 6, 7 and 8.

The alert department of the AIS SRA automatically positions the alert registered in the system by the veterinarians in the territory after the outbreak detection and confirmation. With a single click on the alert marked on the map we see the details of the respective alert: the location, the type of infection, the type of animal, the outbreak radius, the holding, the type of hilding and the name of the owner. The alert remains registered in the system, only changing its active or inactive status. [3-6

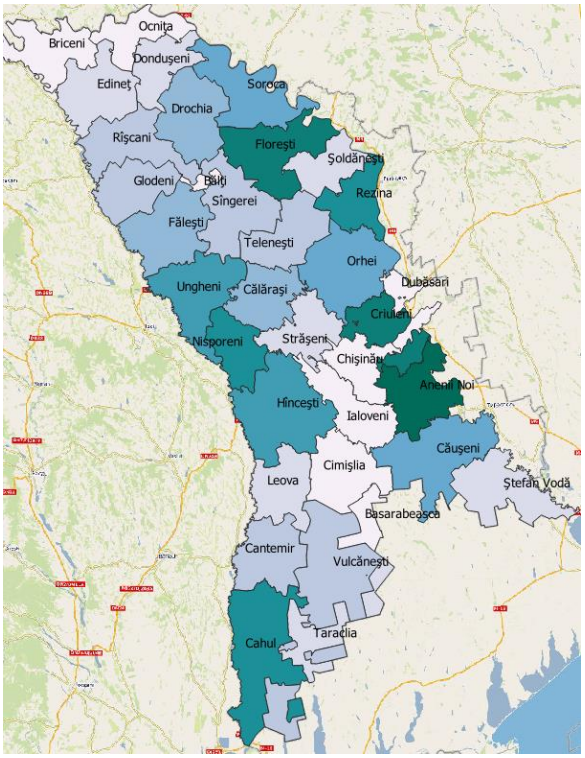

Fig.3. The primary registration of animals event distribution, 2018. [9-10]

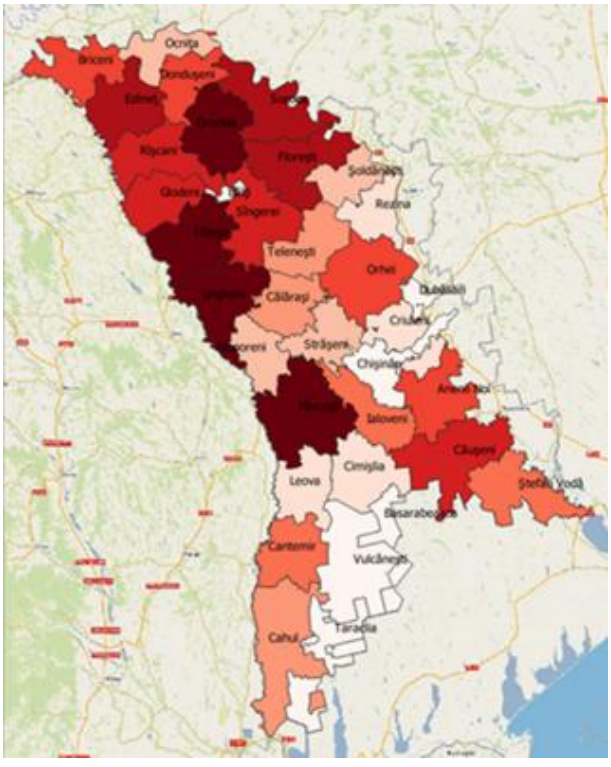

Fig. 4. Distribution of: cattle. [9-10]

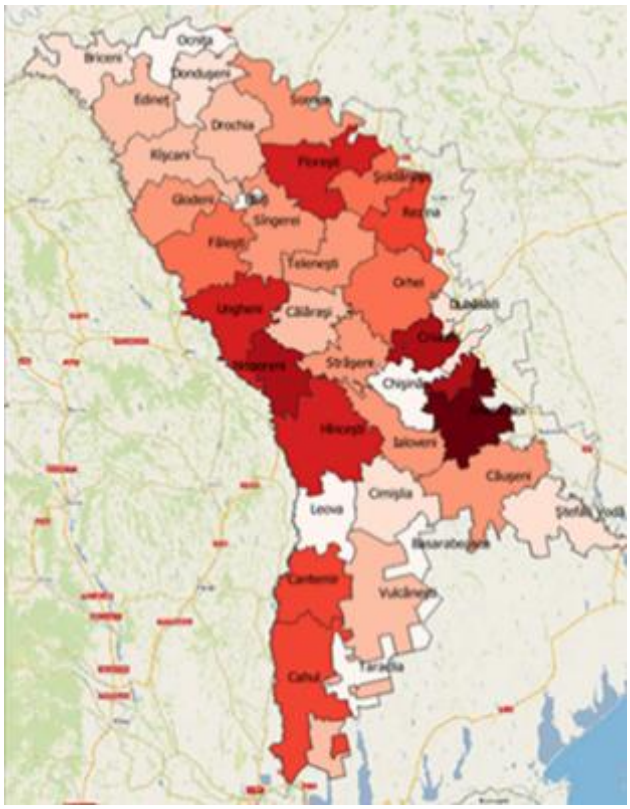

Fig. 5. Distribution of swine.[9-10]

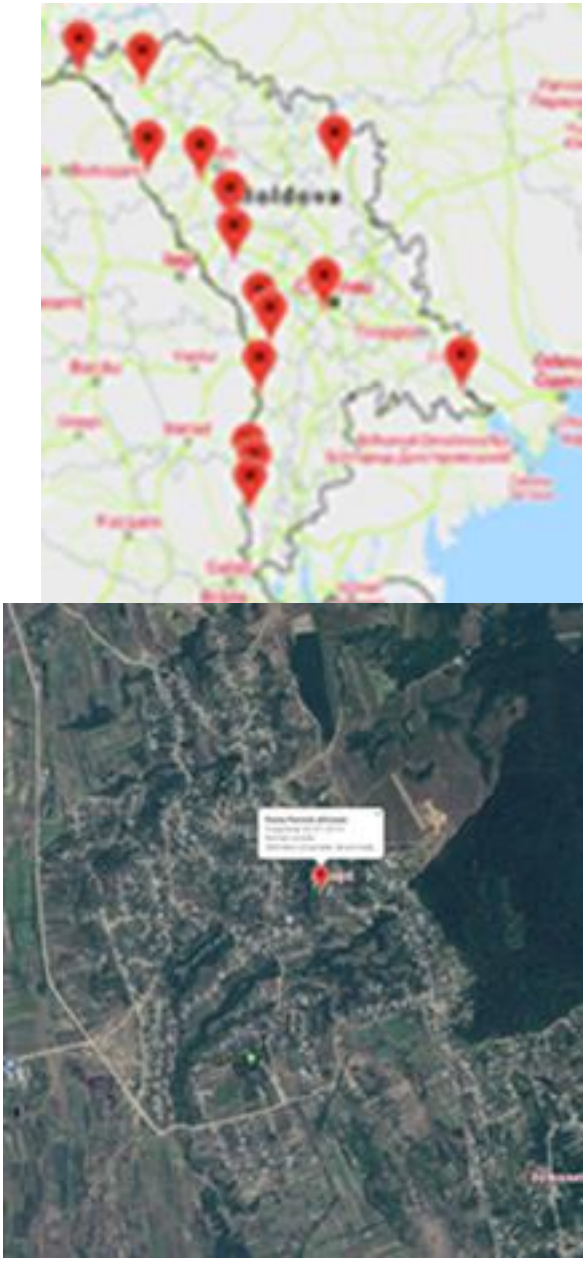

Fig. 6. Alert management. [9-10]

5. Conclusions

The creation of the thematic maps reflecting the data registered in the AIS SRA aims not only at the citizens' access to information (transparency), but also their integration in the National Infrastructure of Spatial Data, which ensures the interoperability of the spatial data between the public entities, both at the national and international level by harmonizing the data according to ISO/TC211 standard.[9-10]

Digital maps in the field of agriculture are created for viewing, processing and analyzing information regarding the respective field. The data is text type. [3]

After scanning, a map becomes a spatial database on a 1:1 scale. The spatial information contained can be transformed using the functions of a GIS, functions that allow printing or plotting at any scale and in any projection. [10]

If necessary, maps can also be created for each event (see table 1). Spatial data can be easily supplemented with maps for viewing farms and slaughterhouses as well as their number, type and geoposition. [2]

Descriptive data (attributes) that characterize spatial data are recorded in a relational database. With the help of a Database Management System, they can be optimally controlled, organized and manipulated. These are edited repeatedly, at certain time intervals, including data that characterize not only the year preceding the editing, but also data from previous years. The agricultural domain requires updates of the frequent digital maps (monthly, or even weekly). [3-4]

Thematic maps of the agricultural field from the point of view of destination are informative maps. A national Spatial Data Infrastructure can be regarded as both virtual network created to allow the development and sharing of geographic digital information and resources at national level. [3-4]

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