

Integrating graphic and alphanumeric information in a GIS application using 19-th century maps from Iasi county

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Abstract: Old maps are graphical condensation forms of a historical, social and cultural reality in a territory. Their integration into a GIS format allows obtaining a huge amount of data. In this paper a map at the scale 1:200.000 from 1897 was interpreted showing the communication path, settlements, administrative boundaries and hydrography in the county of Iassy. By digitizing graphical data and by integrating them topologically, databases were obtained about the geometry (areas, lenght, neighborhoods). The resulting data allow making multiple thematic maps and comparative statistical analyses.

Keywords: thematic maps, topology, queries, digitize

1. Introduction

Graphic and alphanumeric information, existing on old analog maps, constitute an important information package, necessary in analyzing territories developments during historical periods. GIS technology allows the integration of these data on a single platform and a unique projection system.

Following the integration of two maps of the Iasi county - one written in 1897 to 1:200,000 scale, and the second written in 1928 in 1:300,000 scale - were obtained, by comparative analysis on the territory geometry and on alphanumeric data collected from the map and the legend, a series of statistic data and thematic maps. The software platform used was Autodesk MAP 3D 2010, trial version.

2. Working mode

2.1. Analysis of existing information

Iasi county map drawn in 1928, at 1:300,000 scale, was the subject of another work. The digital data of the map were integrated with the data of the map drawn in 1897, in order to make comparative analyzes of the Iasi county developments, between two historical periods.

The common elements represented on the two maps are:

- a. means of communication - roads (national, county, pavements and utilities);
- b. administrative boundaries (county limit, commune limits).

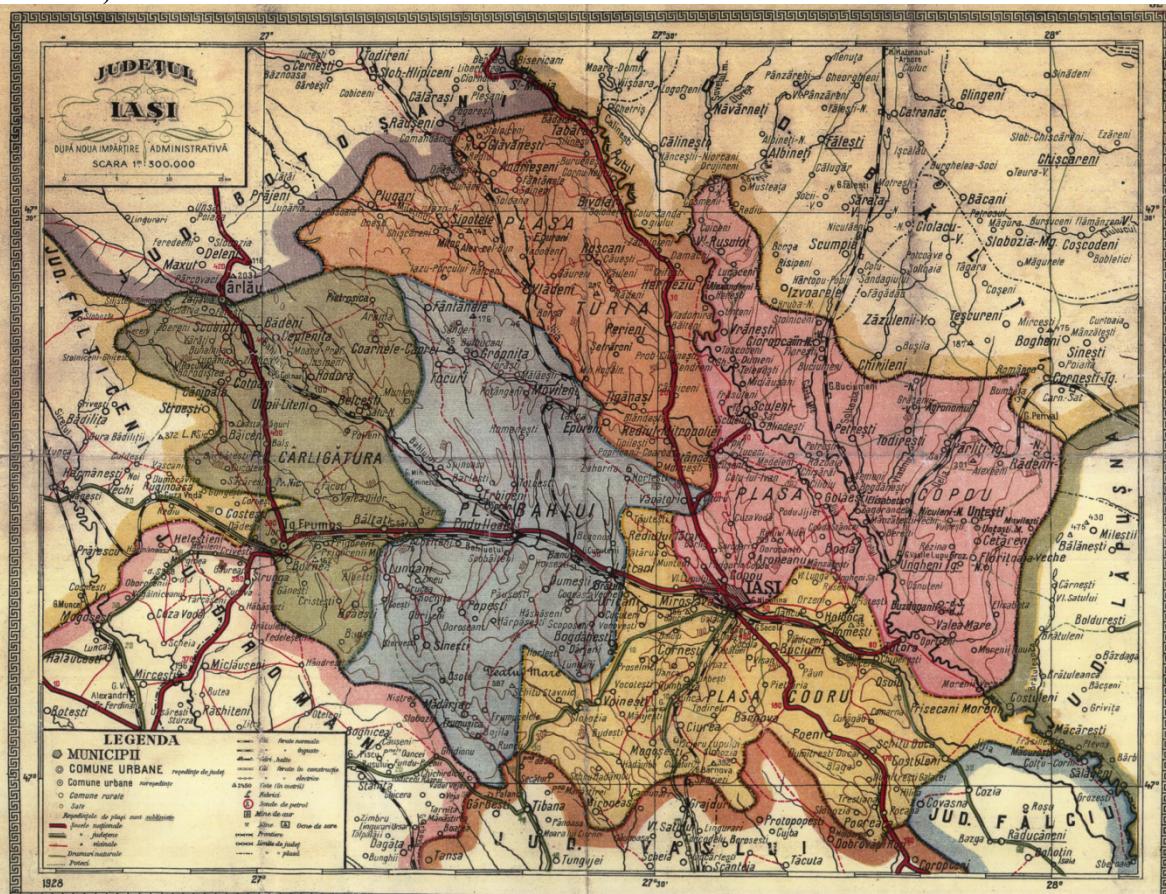
The spatial positioning of the map drawn in 1897 was achieved through georeference, using as common points, the position of six cities represented on both maps. We used this procedure because the map drawn in 1897 does not contain parts that have known geographical coordinates.

Spatial positioning accuracy is quite crude, given the scales of the two maps, but for comparative statistical, administrative and spatial development analysis, this is acceptable.

The two maps integrated into the system are shown in Figure 1.



a)



b)

Fig.2.1. Iasi county map drawn in the years: a) 1897, b) 1923

2.2 Graphic data vectorization

The digitization process was preceded by defining the work layers as of map legend. These layers are:

Table 2.1-Inventory of the thematic layers for the two maps

No.	Layer name 1897	Layer description 1897	Layer name 1928	Layer description 1928
1	Railways	Railways	Railways	Railways
2	National ways	National routes	National routes	National routes
3	County ways	County routes	County routes	County routes
4	Vicinal ways	Vicinal roads	Vicinal roads	Vicinal roads
5	Natural ways	Natural routes	Natural routes	Natural routes
6	Rural communes; hamlets	Rural communes; hamlets	Villages	Villages
7	Urban communes	Urban communes	Rural Communes	Rural Communes
8	Sub-prefecture residence	Sub-prefecture residence	Urban communes non- residence	Urban communes non-residence
9	County limit	Iasi county limit	Urban communes residence	Urban communes residence
10	Raster1	Iasi county map	Level curves	Level curves
11	County limit	Iasi county limit	Water	Water
12	Plase limits	Plase limits (realms)	Raster	Iasi county map 1928
13			pctStereo	Points used for georeference
14			County limit	Iasi county limit
15			Plase limits	Plase limits

Digitization was done in layers in order to edit the graphic information and integrate in the GIS application. The result of the digitization process is shown in Figure 2.2.

2.3. Editing and creating topologies

The editing process is to eliminate all errors occurred during the digitizing and graphic data preparation for topologies implementation. Elimination of errors was achieved automatically by means of specialized functions, for each layer.

The existing organizational form in 1897, in Iasi County, is plasa (realm), five units, each unit having a residence. After errors elimination, each polygon (plasa) was numbered starting with 1. For the map drawn in 1928 the numbering was made from number 6 to 10. Creating topology is required to establish spatial relationships between graphic objects and to obtain statistical information about the geometry of objects. In this respect have been created the following topologies:

- Topo_plase – resulting information about plase surfaces and their perimeters;
- Topo_C.F. – resulting information about railways length;
- Topo_Căi_năționale - resulting information about national roads length;
- Topo_Căi_județene - resulting information about county roads length;
- Topo_Căi_vicinale - resulting information about vicinal roads length;
- Topo_Căi_naturale - resulting information about dirt roads length;

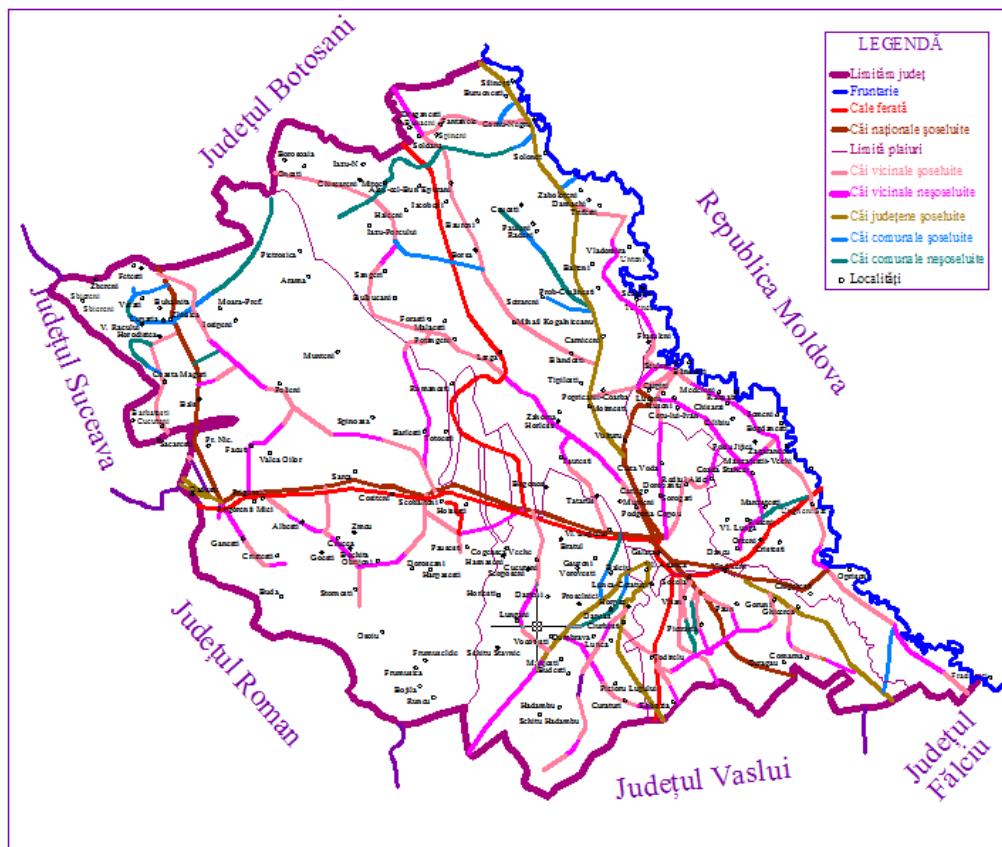


Fig.2.2. Map drawn in 1897 in vector format

2.4. Designing, creating and attaching the Access database for the two maps

After identifying existing alphanumeric information on the two maps, were designed and networking in Access medium, two tables, which were loaded with data via two forms (Fig. 2.3.).

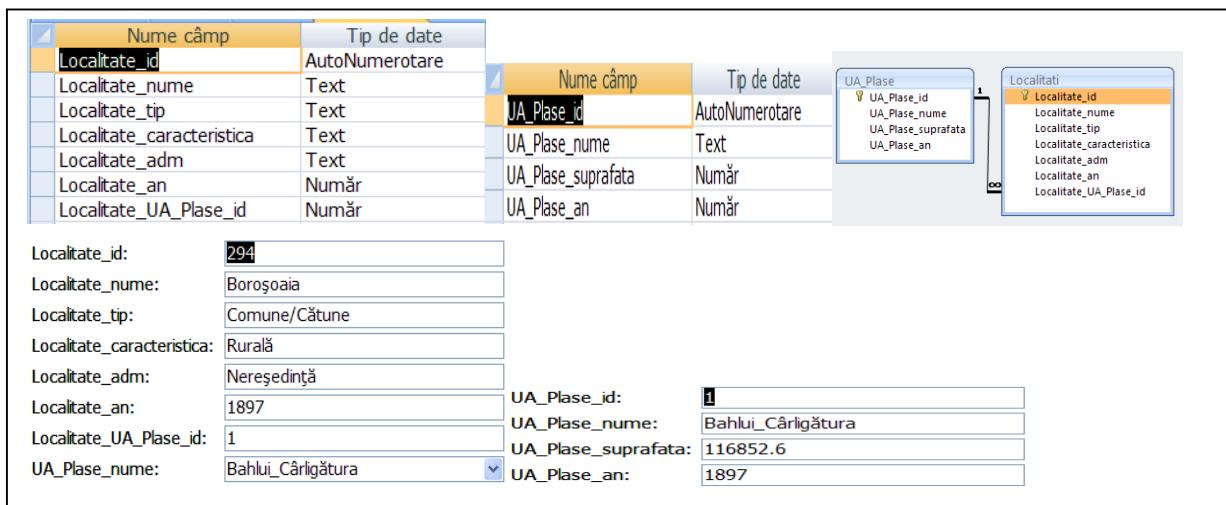


Fig.2.3. Design, networking and forms for the Localities and UA_Plase.

UA_Plase table contains a total of 10 entries and Localities table contains a total of 398 records (fig.2.4), information on the two maps.

The screenshot shows two Microsoft Access tables side-by-side. The left table, 'UA_Plase', has 10 rows and 4 columns: UA_Plase_id, UA_Plase_nume, UA_Plase_suprafata, and UA_Plase_an. The right table, 'Localitate', has 398 rows and 7 columns: Localitate_id, Localitate_tip, Localitate_c, Localitate_adm, Localitate_nume, Localitate_an, and Localitate_UA_Plase_id. Both tables are in grid format with horizontal and vertical lines separating the rows and columns. The Localitate table includes a vertical primary key column on the far left.

UA_Plase_id	UA_Plase_nume	UA_Plase_suprafata	UA_Plase_an
1	Bahlui_Cârligătura	116852.6	1897
2	Turia_Copou	98896.4	1897
3	Stavnic	39379.5	1897
4	Codru	25135.6	1897
5	Braniste	30834.5	1897
6	Cârligătura	62599.6	1928
7	Turia	66576.1	1928
8	Bahlui	82854.7	1928
9	Codru	75191.9	1928
10	Copou	94140.7	1928

Localitate_id	Localitate_tip	Localitate_c	Localitate_adm	Localitate_nume	Localitate_an	Localitate_UA_Plase_id
1	Comună	Urbană	Nereședință	Harlau	1928	6
2	Comună	Rurală	Nereședință	Scobinți	1928	6
3	Comună	Rurală	Nereședință	Bădeni	1928	6
4	Comună	Rurală	Nereședință	Cepenița	1928	6
5	Comună	Rurală	Nereședință	Coarnele-Caprei	1928	6
6	Comună	Rurală	Nereședință	Cârjoaia	1928	6
7	Comună	Rurală	Nereședință	Cotnari	1928	6
8	Comună	Rurală	Nereședință	Hodora	1928	6
9	Comună	Rurală	Nereședință	Ulmii-Liteni	1928	6
10	Comună	Rurală	Nereședință	Belcești	1928	6
11	Comună	Rurală	Nereședință	Băiceni	1928	6
12	Comună	Urbană	Reședință Plasă	Târgu-Frumos	1928	6
13	Comună	Rurală	Nereședință	Băltăței	1928	6
14	Comună	Rurală	Nereședință	Buznea	1928	6
15	Comună	Rurală	Nereședință	Brăiești	1928	6
16	Sat	Rural	Nereședință	Zagavia	1928	6
17	Sat	Rural	Nereședință	Sticlaria	1928	6
18	Sat	Rural	Nereședință	Fetești	1928	6
19	Sat	Rural	Nereședință	Zbereni	1928	6
20	Sat	Rural	Nereședință	Sbiereni	1928	6
21	Sat	Rural	Nereședință	Vârâtăi	1928	6
22	Sat	Rural	Nereședință	Buhalnița	1928	6
23	Sat	Rural	Nereședință	Zlodica	1928	6
24	Sat	Rural	Nereședință	Lupăria	1928	6
25	Sat	Rural	Nereședință	Valea Racului	1928	6
26	Sat	Rural	Nereședință	Horodiștea	1928	6
27	Sat	Rural	Nereședință	Pietroșica	1928	6
28	Sat	Rural	Nereședință	Arama	1928	6
29	Sat	Rural	Nereședință	Moara-Pref.	1928	6
30	Sat	Rural	Nereședință	Iosipeni	1928	6
31	Sat	Rural	Nereședință	Munteni	1928	6
32	Sat	Rural	Nereședință	Coasta Măguri	1928	6
33	Sat	Rural	Nereședință	Balș	1928	6
34	Sat	Rural	Nereședință	Polieni	1928	6
35	Sat	Rural	Nereședință	Bărbătești	1928	6
36	Sat	Rural	Nereședință	Cucuteni	1928	6

Fig. 2.4. Database tables loaded with information from the two maps

All data were related to the text label attached to each plasa and every locality.

2.5. Thematic maps and statistical data

Using Object Data topological information and the created database, resulted, using thematic query procedures, thematic maps and statistical comparison between the two historical moments. Thus were created two thematic maps on administrative units from the two periods together with a comparative table with their surfaces size (Fig. 2.5, Tab. 2.2).

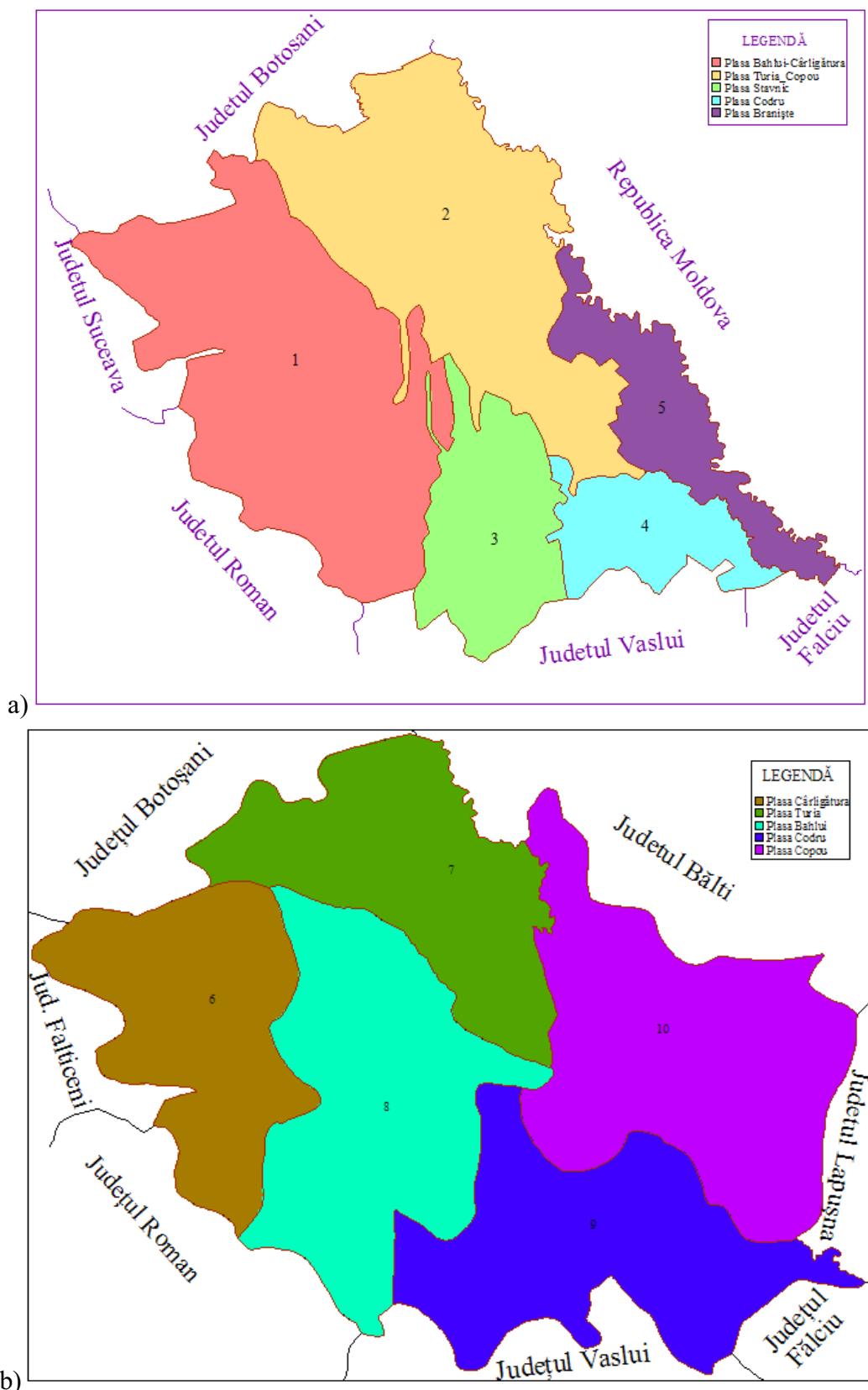


Fig. 2.5. Thematic maps of plase: a 1897, b 1928

Table 2.2 - Polygonal topological information from Iasi county -1897 to 1928

Plasa no.	Plasă name	Surface (ha)	Plasa no.	Plasă name	Surface (ha)
1	Plasa Bahlui-Cârligătura	116852.60	6	Plasa Cârligătura	62599.70
2	Plasa Turia-Copou	98896.40	7	Plasa Turia	66576.10
3	Plasa Stavnic	39379.50	8	Plasa Codru	75171.90
4	Plasa Codru	25135.60	9	Plasa Bahlui	82854.70
5	Plasa Braniște	30834.50	10	Plasa Copou	94140.70
Total		311098.60	Total		381363.10

From the analysis of statistical data, provided by the network topologies for communication paths, resulted statistical data presented in Table 2.3.

Table 2.3 - Topological information network for communication paths of the county Iasi territory -1897 to 1928

1897		1928	
Type of communication path	Length (km)	Type of communication path	Length (km)
Communal paths	128.33	Natural road	262.20
Vicinal paths	522.29	Vicinal road	686.05
County paths	109.95	County road	67.30
National paths	132.58	National road	185.60
Railways	135.16	Railway	227.20

Residences of each administrative subunit are shown in Table 2.4.

Table 2.4 - Polygonal topological information from Iasi county -1897 to 1928

1897		1928	
Plasă name	Residence name	Plasă name	Residence name
Plasa Bahlui-Cârligătura	Urban Com. Târgu Frumos	Plasa Cârligătura	Urban Com. Târgu Frumos
Plasa Turia-Copou	Urban Com. Țigănași	Plasa Turia	Rural Com. Șipotele
Plasa Stavnic	Urban Com. Voinești	Plasa Codru	Rural Com. Podu Iloaiei
Plasa Codru	Urban Com. Bucium	Plasa Bahlui	Rural Com. Bucium
Plasa Braniște	Urban Com. Ungheni	Plasa Copou	Rural Com. Ungheni Târg

Analyzing the administrative map of the 1928 and 1897 resulted data referring to human settlements and their administrative importance (Table 2.5). Map of 1897 because was not an administrative map, has a smaller number of represented localities.

Table 2.5 - Information on existing locations on the map in 1928

1897		1928	
Locality type	No - localities	Locality type	No - localities
Urban Com.	5	Village	214
Rural Com.; village	98	Urban Com.	5
Municipality	1	Rural Com.	73
		Municipality	1

Map of 1897 also contains the positions of rock, sand and ballast quarries.

3. Conclusions

Integration in G.I.S. environment of all cartographic products, made in different historical periods, it has to be a strategy of responsible owners because they are heritage values that must be protected.

Creating a unique database containing information from different historical periods allow analysis of the evolution of land resulting in important statistical data.

4. References

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