GISta Hungarorum – An Integrated and Visualized Municipal Level HGIS Database of the Kingdom of Hungary and Its Successor States (1330–2010)*

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Zarys treści: Projekt GISta Hungarorum (2014–) ma na celu zebranie, zintegrowanie i wizualizację seryjnych źródeł danych dotyczących osadnictwa od XIV do XXI w. na terenie dawnego Królestwa Węgier i Chorwacji (12 500 osad, 300 000 km kw.), częściowo opublikowanych w Internecie przez Archiwum Narodowe Węgier, a częściowo niepublikowanych, w formie bazy danych przestrzennych (http://gistahungarorum.abtk.hu). Ten projekt łączy badania historyczne i nowoczesne planowanie terytorialne dzięki

Abstract: Project GISta Hungarorum (2014–) aims to collect, integrate and visualize settlement level serial data sources from the 14th to the 21st centuries for the former area of the Kingdom of Hungary and Croatia (12,500 settlements, 300,000 sq. km), partly published online by the National Archives of Hungary, partly unpublished, in a form of a geospatial database (http://gistahungarorum.abtk.hu). This umbrella project links historical research and modern territorial planning through its GIS-aided

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wykorzystaniu systemu GIS i oferuje nowe spojrzenie na badanie nierozstrzygniętych kwestii historycznych poprzez setki tematycznych kartogramów i analizę statystyczną 10 milionów rekordów w bazie danych.

Słowa kluczowe: hGIS, humanistyka cyfrowa, precyzyjne bazy danych, analiza statystyczna, geografia historyczna, nierówności regionalne, trendy rozwojowe, historia długiego trwania, Królestwo Węgier

approach and offers new insights into unsettled historical questions through hundreds of thematic cartograms and the statistical analysis of 10 million records.

Keywords: hGIS, digital humanities, fine-scale databases, statistical analysis, historical geography, regional inequalities, development trends, longue durée history, Kingdom of Hungary

Introduction

Over the past few decades, the rise of digital humanities and historical GIS (hGIS) has reshaped how scholars investigate historical processes, especially regarding spatial inequalities, regional development, and long-term socio-economic trends.[1] Parallel to this, several European countries have developed geoportals and integrated historical data infrastructures to enable fine-grained, longitudinal analysis of socio-spatial phenomena.[2] Despite these general advancements, a comprehensive, harmonized platform for analyzing historical data at the settlement or district level over multiple centuries was missing in Hungary, despite promising beginnings in the 1970s and 1980s.[3]

This article introduces and reflects on **GISta Hungarorum**, a large-scale, interdisciplinary project initiated in 2014 that aims to fill this gap by constructing a geoportal[4] integrating settlement-level data from the 14th to the 21st centuries from different serial sources and locations

[1] See France 'reloaded' by Clout, parallel to Braudel's attempt, followed by many others: H.D. Clout, *The Land of France 1815–1914* (London, 1983 [2018]); P.-P. Combes, M. Lafourcade, J-F. Thisse, J-C. Toutain, 'The rise and fall of spatial inequalities in France: A long-run perspective', *Explorations in Economic History*, 48, no. 2 (2011), pp. 243–71; S. Dormard, 'Economic development and regional disparities in France', in: *Employment and Regional Development Policy: Market Efficiency versus Policy Intervention*, eds H. Karl, P. Rollet (Hannover, 2004), pp. 50–67; K. Enflo, A. Missiaia, 'Regional GDP estimates for Sweden, 1571–1850', *Historical Methods*, 51, no. 2 (2018), pp. 115–37; eaed., 'Regional GDP before GDP: A methodological survey of historical regional accounts', in: *Regional Economic Development and History*, eds M. Molema, S.Svensson (Routledge, 2019), pp. 82–97; I. Scargill, 'Regional Inequality in France: Persistence and Change', *Geography*, 76, no. 4 (1991), pp. 343–57; K. Terlouw, 'A general perspective on the regional development of Europe from 1300 to 1850', *Journal of Historical Geography*, 22, no. 2 (1996), pp. 129–46; id., 'Transnational regional development in the Netherlands and Northwest Germany, 1500–2000', *Journal of Historical Geography*, 35, no. 1 (2009), pp. 26–43; D. Tirado-Fabregat, A. Díez-Minguela, J. Martinez-Galarraga, 'Regional inequality and economic development in Spain, 1860–2010', *Journal of Historical Geography*, 54 (2016), pp. 87–98.

[2] In East-Central Europe, see the portal atlasfontium (https://atlasfontium.pl/en/category/atlas-of-sources-and-materials/) of the Tadeusz Manteuffel Institute of History, Polish Academy of Sciences. For research on the history of 19th-century Austria-Hungary, the GASID project at Jagiellonian University (https://gasid.pl/) focuses on Austrian Silesia (1831–1841) and Galicia (1860s). IAPN (Atlas of Independent Poland) traces changes from 1918 in several time horizon using spatial visualization of digitized sources (https://atlas1918.ihpan.edu.pl/). Another example in the West is the Historical Atlas of the Low Countries (1350–1800): https://datasets.iisg.amsterdam/dataset.xhtml?persistentId=hdl:10622/PGFYTM by Rombert Stapel, 'Historical Atlas of the Low Countries. A GIS Dataset of Locality-Level Boundaries (1350–1800)', *Research Data Journal for the Humanities and Social Sciences*, 8, no. 1 (2023), pp. 1–33. Other databases of neighboring countries are less sophisticated or not visualized: for Austria-Hungary, see also: https://www.czoernig.com/ (by Tomáš Cvrček), or https://phaidra.univie.ac.at/ (keyword: Erdélyi) (all accessed: 8 Aug. 2025).

[3] G. Perjés, 'Az 1728. évi adóösszeírás adatainak feldolgozása', *Statisztikai Szemle*, 52, no. 11–12 (1974), pp. 1068–100; G. Perjés, 'Jelentés az 1728. évi összeírás gépi feldolgozásáról', *Agrártörténeti Szemle*, 20, no. 1–2 (1978), pp. 11–80; G. Perjés, 'Bihar megye 1728. évi adóösszeírásának gépi feldolgozása', *A Hajdú-Bihar Megyei Levéltár Évkönyve*, 6 (1979), pp. 33–109; S.M. Eddie, *Ami „köztudott", az igaz is? Bevezetés a kliometrikus történetírás gondolkodásmódjába* (Debrecen, 1996); Gy. Benda, *Statisztikai adatok a magyar mezőgazdaság történetéhez 1767–1867* (Budapest, 1973); L. Katus, 'Economic growth in Hungary during the age of dualism (1867–1913): a quantitative analysis', in: *Social-Economic Researches on the History of East-Central Europe / Sozial-ökonomische Forschungen zur Geschichte von Ost-Mitteleuropa*, ed. E. Pamlényi, Studia Historica 62 (Budapest, 1970), pp. 35–127.

[4] http://gistahungarorum.abtk.hu , www.gistory.hu (accessed: 8 Aug. 2025).

covering the territory of the former Kingdom of Hungary. While the creation of such a platform is itself a significant infrastructural and scholarly achievement, this article is not merely a technical report. Instead, it addresses the following research question: What are the methodological challenges and scholarly potential of building a transhistorical, fine-resolution geodatabase for a multiethnic and politically fragmented historical region like the former Kingdom of Hungary?

In answering this question, the authors explore the project's rationale, design principles, and key implementation issues, including data harmonization, geocoding, and integrating heterogeneous sources. We also assess how the platform can contribute to current historiographical debates – such as those concerning peripheralization, path dependency in present-day Hungary,[5] or reversal of fortune in many regions after the disintegration of the kingdom in 1920.[6] Due to its numerous indicators across multiple time periods and its high resolution, the database may help verify the validity of reconstructed economic indicators such as Gross Domestic Product (GDP)[7] and the Human Development Index (HDI).[8] Authors also investigate how GISta Hungarorum compares with similar initiatives, such as the Atlas Fontium (Poland), GASID (Galicia), the Atlas of Independent Poland (IAPN), and the Historical Atlas of the Low Countries.

The dynamic expansion of spatial datasets and the advancement of informatics (e.g., analytical methods) have significantly broadened the scope for comparative and *longue durée* regional analysis in historical research since the pioneering work of Fernand Braudel. The recent awarding of the Nobel Memorial Prize to Daron Acemoglu underscores both the increasing demand for historically grounded, long-term investigations and the integration of econometric methods into historical inquiry.[9]

In Hungary, the digitization and online accessibility of serial historical sources (e.g., via Adatbázisok Online)[10] have accelerated the construction of historical databases in the 2000s, which had already begun in the 1970s–1980s by Perjés, Benda, Eddie, and Katus, but met failure then, due to the limited capacities and skills in informatics.[11] This development has revitalized several disciplines, including historical statistics, historical sociology, economic history, and historical geography. Relying on methods initially used in regional science, geography, and economics, quantitative historical research in Hungary has entered a new phase of growth, including renewed interest even in rigorously cliometric approaches.

Parallel to the digitization and database building, the widespread adoption of new evaluation methods, like Geographic Information Systems (GIS) in historical studies, has facilitated a shift from vertical (social) analyses to horizontal (regional) frameworks, thereby enhancing historians' ability to engage in interdisciplinary research and to address spatial dimensions of the past more effectively. This is especially

[5] J. Pénzes, G. Demeter, 'Peripheral areas and their distinctive characteristics: The case of Hungary', *Moravian Geographical Reports*, 29, no. 3 (2021), pp. 217–30; R. Győri, G. Mikle, 'A fejlettség területi különbségeinek változása Magyarországon, 1910–2011', *Tér és társadalom*, 31, no. 3 (2017), pp. 144–64.

[6] D. Acemoglu, S. Johnson, J.A. Robinson, 'The colonial origins of comparative development: an empirical investigation', *American Economic Review*, 91, no. 5 (2001), pp. 1369–401; D. Acemoglu, S. Johnson, J.A. Robinson, 'Reversal of fortune: Geography and institutions in the making of the modern world income distribution', *Quarterly Journal of Economics*, 117, no. 4 (2002), 1231–294.

[7] L. Soltow, 'Wealth distribution in Denmark in 1789', *Scandinavian Economic History Review*, 27, no. 2 (1979), pp. 121–38; J. Söderberg, 'A long-term perspective on regional economic development in Sweden, ca. 1550–1914', *Scandinavian Economic History Review*, 32, no. 1 (1984), pp. 1–16; A. Maddison, *The World Economy. A Millennial Perspective* (Paris, 2010).

[8] L. Prados de la Escosura, 'World Human Development: 1870–2007', *Review of Income and Wealth*, 61, no. 2 (2015), pp. 220–27.

[9] Acemoglu et al., 'The colonial origins'; and Acemoglu et al., 'Reversal of fortune'.

[10] https://adatbazisokonline.mnl.gov.hu/.

[11] For references, see fn. 3.

important, as Hungarian geographers, examining mainly contemporary socio-economic processes and patterns of peripheralization, have rarely extended their investigations into the historical past.[12] This limitation has primarily been due to the difficulty of interpreting historical sources in ways compatible with modern geographical concepts such as development, inequality, or peripheralization.[13] Consequently, a disciplinary gap emerged: historians often lacked proficiency in GIS and other digital tools, while geographers found historical sources difficult to adapt to their methodological frameworks.

This 'no man's land' has only recently begun to be addressed through initiatives such as the GISta Hungarorum project(s), which promote interdisciplinary collaboration. Despite achievements in GIS and database development, digital humanities more broadly remain underrepresented in the training of historians in Hungary.[14]

The place of GISta Hungarorum among similar scholarly enterprises

The development of GISta Hungarorum aligns with a broader European trend toward creating fine-scale, spatially anchored historical databases that enable new forms of diachronic and comparative regional analysis. In this context, it is instructive to compare briefly GISta Hungarorum with other significant initiatives mentioned above: the Atlas Fontium (Poland), GASID (Austria-Hungary), and the Historical Atlas of the Low Countries (HALC).

The **Atlas Fontium** project, developed by the Tadeusz Manteuffel Institute of History of the Polish Academy of Sciences, provides a digital atlas of historical sources covering Polish lands and adjacent regions. It primarily focuses on publishing high-resolution, georeferenced scans and metadata of archival documents with spatial attributes, often at the diocese, parish, or town level. While it emphasizes philological and editorial precision, the quantitative and integrative ambitions of GISta Hungarorum – especially the harmonization of tax, demographic, and economic variables across centuries – go further in enabling statistical and spatial analyses.

The **GASID** (Gazetteer of Austria-Hungary: Statistical and Information Database), coordinated by the Jagiellonian University, presents another relevant project to compare with. GASID focuses on the late 19th and early 20th centuries, especially the censuses from 1880 to 1910, and provides structured data for the Habsburg Monarchy's administrative units. While it offers excellent coverage of a single time period, GISta Hungarorum's more extended temporal scope (1330–2010) and its integration of earlier proto-statistical and Ottoman-era sources offer a more *longue durée* perspective. Moreover, GISta includes harmonized spatial IDs for localities (i.e., settlements, the lowest administrative units) across different time periods, which allow passage across old and present political boundaries and time sections.

The **Historical Atlas of the Low Countries** (HALC), developed at the International Institute of Social History, stands out for its rigorous geocoding of locality-level boundaries (1350–1800) and its use of ontologies to structure semantic metadata. HALC has set a methodological benchmark in its handling of historical toponyms and administrative units. GISta Hungarorum is similar in ambition, but it adds an explicit focus on economic

[12] Győri and Mikle, 'A fejlettség területi'.

[13] For examples, see D.F. Good, T. Ma, 'The Economic Growth of Central and Eastern Europe, 1870–1989', *European Review of Economic History*, 3, no. 2 (1999), pp. 103–38; B. Milanovic, 'An estimate of average income and inequality in Byzantium around year 1000', *Review of Income and Wealth*, 52, no. 3 (2006), pp. 449–70; B. Milanovic, P.H. Lindert, J.G. Williamson, 'Pre-Industrial Inequality', *Economic Journal*, 121, no. 551 (2010), pp. 255–72.

[14] A notable exception is Eszterházy Catholic University in Eger, which offers dedicated courses in GIS, data management, and programming as part of its curriculum in historical studies for PhD students.

and social indicators (e.g., GDP proxies, HDI reconstructions, taxation data), and addresses the challenge of integrating radically different source types – including medieval papal tithes, Ottoman tax registers (*defter*s), and modern censuses – into a single analytical framework.

These comparisons show that GISta Hungarorum complements existing projects, but also has unique features: an emphasis on regional inequalities, interdisciplinary usage, and the possibility of longitudinal, grid-based analysis across nearly seven centuries and four timesections. It is similar to the **Internetowy Atlas Polski Niepodległej** (Online Atlas of Independent Poland, IAPN) project, which is a collaborative effort between the Institute of History of the Polish Academy of Sciences and the Faculty of Geodesy and Cartography at the Warsaw University of Technology, concentrating on the interwar period of the Second Polish Republic (1918–1939). Drawing upon archival topographic and thematic maps from the Military Geographical Institute, the *Słownik geograficzny Królestwa Polskiego* (Geographical Dictionary of the Kingdom of Poland), and the 1921 national census, the IAPN reconstructs the settlement network and administrative structures of Poland during this formative era. Compared to IAPN, GISta Hungarorum has a broader temporal and deeper regional scope, but both projects underscore the potential of digital atlases to enhance the understanding of historical geographies within Central and Eastern Europe.[15]

There are several other European efforts.[16] One of the first HGIS experiments was the **GBHGIS** (the Great Britain Historical GIS) or the 'Vision of Britain' (https://www.visionofbritain.org.uk/gbh-db), which is similar to our GISta Hungarorum with a shorter timespan beginning in 1800 and lower resolution (district level) of spatial entities, but it uses extended sources besides statistical censuses.[17] The Low Countries and Germany also have their long-developed own systems. The History Department of the Netherlands Institute for Scientific Information Services (NIWI) in Amsterdam is digitizing all Dutch historical censuses for the period 1795–1971. The former two pioneering projects – Kartofoot and NLKAART – are integrated into the new Historical Geographic Information System for the Netherlands (HGIN) project.[18] Neither these nor the US development[19] go back before 1800, whereas **GISta Hungarorum** starts earlier and, admittedly, targets the integration of the Ottoman and medieval centuries of Hungary, despite having no institutionalized background.

Basic goals of the GISta Hungarorum project(s) (2014–)

The GISta Hungarorum is a series of database-building projects, initially launched in 2014 by the Hungarian Academy of Sciences (HAS) Institute of History,[20] with the support of the National Archives of

[15] IAPN (Atlas of Independent Poland) offers a splendid solution for visualizing digitized original sources and, at the same time, for interpreting extracted data on thematic maps. GISta Hungarorum cannot offer showing the original picture of the serial source.

[16] See selected works at: HGIS: http://www.hgis.org.uk/bibliography.htm (accessed: 8 Aug. 2025); M. Goerke, *Coordinates for Historical Maps* (Göttingen, 1994).

[17] I.N. Gregory, H. Southall, 'Putting the Past in Its Place: the Great Britain Historical GIS', in: *Innovations in GIS 5*, ed. S. Carver (Taylor & Francis, 1998), pp. 210–21; I.N. Gregory, H. Southall, 'Mapping British population history', in *Past Time, Past Place: GIS for History* (Redlands, 2002), pp. 117–30; H. Southall, 'A Vision of Britain through Time: Making sense of 200 years of census reports', *Local Population Studies*, 76 (2006), pp. 76–84.

[18] E. Vanhaute, 'The Quantitative Database of Belgian Municipalities (19th and 20th Centuries): From Diachronic Worksheets to Historical Maps', in: *Halbgraue Reihe Zur Historischen Fachinformatik*, Serie A : Historische Quellenkunde 25, ed. M. Goerke (Göttingen, 1994), pp. 162–75; L. Schreven, O. Boonstra, P. Doorn, 'Towards a historical geographic information system for the Netherlands (HGIN)', *Historical Geography*, 33 (2005), pp. 134–58.

[19] C.A. Fitch, S. Ruggles, 'Building the national historical geographic information system', *Historical Methods*, 36 (2003), pp. 41–51.

[20] Financed by the National Research, Development and Innovation Fund of Hungary K 117 766, led by Gábor Demeter (2014–2017).

Hungary (MNL OL) and scholars from different universities. The goal (output) of the several intertwining projects is to create and visualize a settlement-level (municipal or parish) database that contains all available quantifiable, serial historical data (state censuses, tax conscriptions) ranging from the Middle Ages up to the present. The name is a paraphrase of Gesta Hungarorum – the first Hungarian chronicle – emphasizing the added value of new methods to be implemented in history, such as GIS-supported quantitative research, which is quite rare in the region at this fine-scale and territorial extent of 300,000 sq. km. We consider our attempt both a new framework for the digital publication of sources and, at the same time, a different history of the Kingdom of Hungary – a history of regions, inequalities, and development patterns and trends never done before in such depth. The more than 10 million statistical data collected for 12,500–15,000 settlements over seven centuries, then integrated and harmonized, allow us to check the validity of old statements, investigate unproven *topoi*, and ask new questions.

The basic idea behind the concept was, on the one hand, to make archival sources (already available online but neither organized into databases nor digitized with OCR, only scanned) ready for research and mass evaluation, including bulk download and bulk data processing. Currently, only a single download is possible at in the digital spaces of the National Archives of Hungary, whereas from 2025 on GISta Hungarorum allows bulk data download of processed original serial sources and statistical publications of the Central Statistical Bureau.

The project also has a more pragmatic goal: we intend to join historical data with modern statistical datasets (using LAU-2 codes[21] as IDs), to promote current research on peripheries and peripheralization processes by highlighting the historical roots of phenomena such as path dependency and reversal of fortune.[22] A deeper historical background is often neglected by Hungarian geographers, who usually go back only to 1945 because of the scarcity of serial sources and the interpretational problems they pose. That way, we may emphasize that history can contribute to applied science and can help increase cost efficiency in territorial planning in Hungary.[23] Finally, as written above, we have specific historiographic goals: to show the long-term spatio-temporal variability of phenomena in the region, and to assess and approximate economic output per area or per capita in the long run, using a fine-scale, longue-durée approach. That way, we aimed to expand the time span and resolution, and even the reliability of historical GDP estimations calculated by Maddison and his followers. Substituting GDP with other indicators of economic performance for centuries for which GDP was infeasible[24] would also enable the implementation of new comparative approaches to the history of the Kingdom of Hungary and the Carpathian Basin.

So GISta Hungarorum aimed to enhance public access to data, develop an auxiliary tool for regional politics, and answer historical questions by tracing long-term inequalities and development. After ten years of research on Hungary and cooperation with scholars of numerous disciplines we decided to broaden the territorial scope: beside involving Croatia, with similar datasets and conscription years to Hungary, a collaboration

[21] LAU-2: local administrative units used in EU, below NUTS-level.

[22] D. Acemoglu, J. Robinson, *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (New York, 2012); Acemoglu et al., 'The colonial origins'.

[23] Pénzes, Demeter, 'Peripheral areas'.

[24] For a country-level approach, see Maddison, *The World Economy*; for regional historical GDP reconstructions within a country, see M.-S. Schulze, *Regional Income Dispersion and Market Potential in the Late Nineteenth Century Habsburg Empire*, Working Papers no. 106/07 (London, 2007).

between GIS-experts in Poland (Catholic University of Lublin), the Czech Lands and Austria (University of Wien, Mátyás Erdélyi dealing with Cisleithanian datasets from 1870–1910) is proposed. To establish a joint framework for future cooperation, data from the GISta Hungarorum will be stored as a backup in the repository of the KUL (Catholic University of Lublin), a group led by Bogumił Szady, to support future transnational project plans.

Challenges and solutions: problems of source availability, data harmonization, and integration

One of the key problems is the lack of harmonization between running and old projects. The National Archives of Hungary has been publishing censuses and tax-registers online for a decade, however the Adatbázisok Online[25] is neither available in English language, nor allows bulk data download, nor supports OCR or AI approach in its present status.[26] Very often only a picture of the source is provided as research material for public, but no digital data (see the conscription of 1828). Sometimes the former is missing and only a digital excerpt of the data, though systematically arranged and stored (ORACLE is used for that purpose), is available as 'single data' for the broad public, see for example, the new Collection of Ottoman Registers (Fig. 1).[27] The spatial visualization of data was also rarely implemented, despite the existing, systematically collected, but not harmonized, data on coordinates. There are some smaller projects visualized on the National Archives website,[28] but these rarely cover the whole country or focus mainly on particular topics, and they are not integrated. The aforementioned Ottoman databases, for example, are available in spatially organized form too, in map view,[29] but the platform, using pins, completely differs from the latest developments in this field (Fig. 1). The latest archival project, Square Cadastre, executed by Csaba T. Reisz, include a GIS-aided database of metadata on 19th-century settlement level cadastral mapping (Fig. 5).[30] Other collections of sources available for public, some which are even linked to this latest experiment, like the Hungaricana collections[31] also lack spatial approach. Though, for instance, the collection of postcards at Hungaricana is pinned too, with proper coordinates, their geographic distribution is not visualized on Webmap. An older development integrated into the Hungaricana collections, the *urbarial* conscription of Marie Therese (the 1770s), also provides a map view with pins, beside the original conscription sheets and its digital excepts and even includes the georeferenced version of the first military mapping as background,[32] but it is not integrated to other datasets and geospatial systems (Fig. 4). Finally, the mentioned serial maps of the two military mappings (1780s-1860s) for the Kingdom of Hungary and the cadastral mappings of the 1860s are stored in georeferenced format at Arcanum Mapire (https://maps.arcanum.com/hu/) and the georeferenced sheets cannot be used free of charge.

Nowadays, the joint efforts between our research group and archivists point towards the creation of geospatial auxiliary tools for the National Archives: the datasets provided by the National Archives in online form (either single data or a scanned document) and digitally processed will soon be

[25] Online databases: https://adatbazisokonline.mnl.gov.hu/.

[26] The only experiment of using AI (developed in Valencia) to read serial taxation data was executed on the conscription of 1828; however, its success rate in reading out taxpayers names remained under the success rate of average human performance.

[27] For researchers, upon further request, archivists may provide bulk data in query tables.

[28] https://adatbazisokonline.mnl.gov.hu/gyujtemeny/terkepek.

[29] https://adatbazisokonline.mnl.gov.hu/adatbazis/oszman/terkep.

[30] https://negyzetkataszter.mnl.gov.hu/?language=english.

[31] https://www.hungaricana.hu/hu/.

[32] https://archives.hungaricana.hu/hu/urberi/.

visualized on the webmap-server of the National Archives, which is under construction. This will include municipal-level shapefiles for Croatia and the Kingdom of Hungary (including Transylvania) for 1830, 1884, and 1910. A draft, viewer version of this, with no possibility to create custom queries beyond the built-in ones, and no chance to reset the data intervals and scales, is already available at GISta Hungarorum[33] (Fig. 2).

The GISta Hungarorum webmap-server was created for public use to visualize socio-economic and demographic indicators derived from the processed raw datasets (censuses and conscriptions) on more than 300 settlement-level thematic maps for several time sections (1720, 1780, 1880, 1910, 2010). In addition to viewing thematic maps, the pop-up windows allow researchers to download raw data individually. Bulk data download is available for the raw datasets between 1720 and 1910 at GISta Hungarorum, and also, there is a different site: www.gistory.hu (also in English) for data between 1870 and 1910, including Croatia. This site also contains vectorized GIS base maps (shapefile format) at a 1:400,000 scale, along with datasets. By the end of 2025, we improved the resolution of the settlement-level shapefiles used as the basis for georeferenced visualization to 1:144,000, thanks to the basemaps stored at the National Archives and digitized by our team.[34] This will result in a better fit with OpenStreetMap or georeferenced satellite imagery, improving from 1 km accuracy to 100–200 meters.

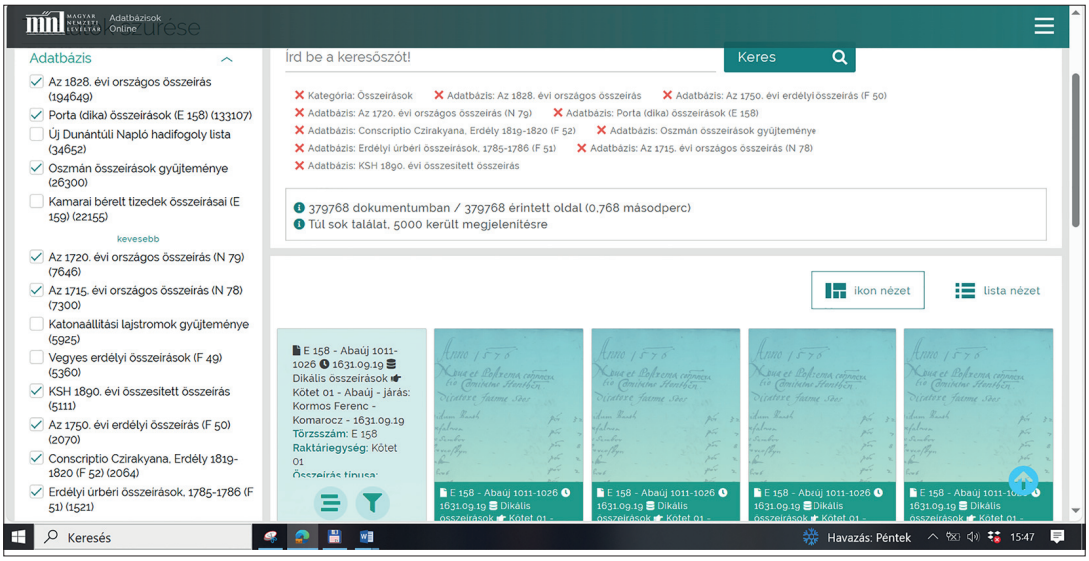
While archivists usually preferred traditional methods, such as pins, for geospatial visualizations, two reasons favor GIS techniques. First, for pins, you need precisely the exact coordinates for a set of data referring to the same locality; otherwise, they will appear as separate points, making data grouping and diachronic investigations problematic. And unlike pins, GIS offers many ways to visualize, sort, and arrange data to highlight phenomena and enhance end users' knowledge. And this is our historians' primary goal, not only data storage in a geospatially organized form preferred by archivists (compare the approaches in Figs 2 and 3 with those in Figs 1 and 4).

GISta Hungarorum, initially a single project (2014–2017), began by processing census data for 12,500 settlements between 1880 and 1910, incorporating *c*. 100 variables. Later scholars (geographers, medievalists, Ottomanists, archeologists, economists, IT-experts) joined, extending the timespan and area covered. The research, after geographers had joined, was extended to 2010, when two methodological problems had to be resolved: first, the harmonization of the data structures of eight countries (the successor states of the Kingdom of Hungary) for the Carpathian Basin, which proved harder than expected. Despite these census data already being digitized and available online, the census structures were quite different, and the administrative levels of data publication were not always the same.

Second, the problem of changing administrative boundaries (which is always a limiting factor on long-term research) had to be handled. Settlement-level IDs had to be harmonized with current LAU-2 codes; the old and current names of settlements had to be identified; and changes in administrative levels had to be accounted for, whereas the modern Romanian datasets were published at *comuna* and *municipiul* levels, not at the settlement (sat) level. The visualization of temporal changes (diachronic investigations) is possible at 5 x 5 and 10 x 10 km scales (*c*. 10,000 and 2,500 grid cells, respectively).

[33] http://gistahungarorum.abtk.hu.

[34] With the cooperation of the National Archives of Hungary. Financed by the National Research, Development and Innovation Fund of Hungary KK 132723, led by Csaba Reisz T. https://negyzetkataszter.mnl.gov.hu/?language=english (accessed: 8 Aug. 2025).



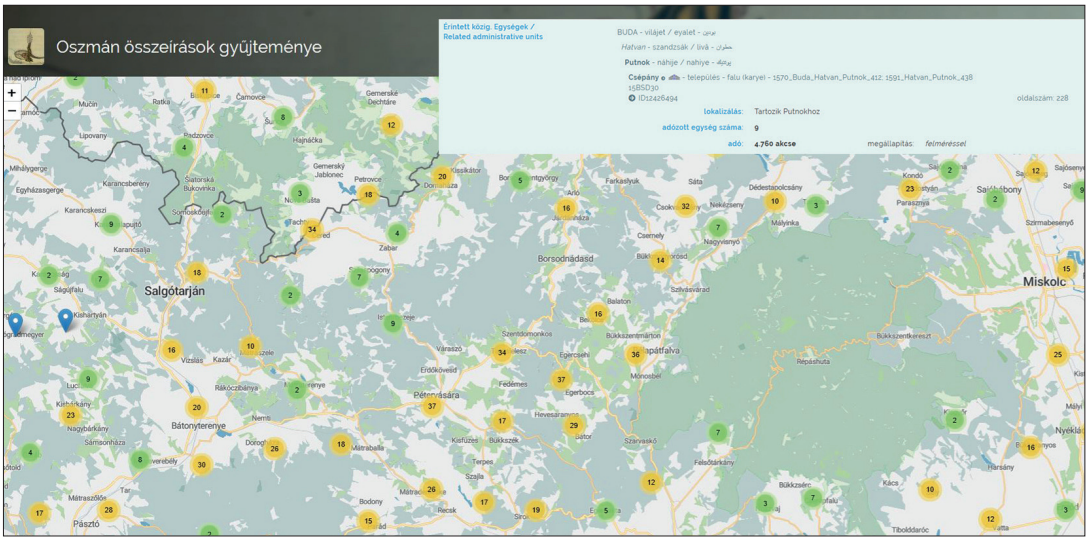


Fig. 1a–b. The online databases of the National Archives of Hungary – Adatbazisok – and the sources processed or under processing (indicated by a tick in the left panel) in the umbrella project GISta Hungarorum from this site: https://adatbazisokonline.mnl.gov.hu/ (accessed: 8 Aug. 2025).[35]

[35] The data of the Ottoman tax-registers are available one by one (no bulk data download) in hierarchical order (type, year, settlement) and in map view too): https://adatbazisokonline.mnl.gov.hu/adatbazis/oszman/terkep; https://adatbazisokonline.mnl.gov.hu/adatbazis/oszman/hierarchia.

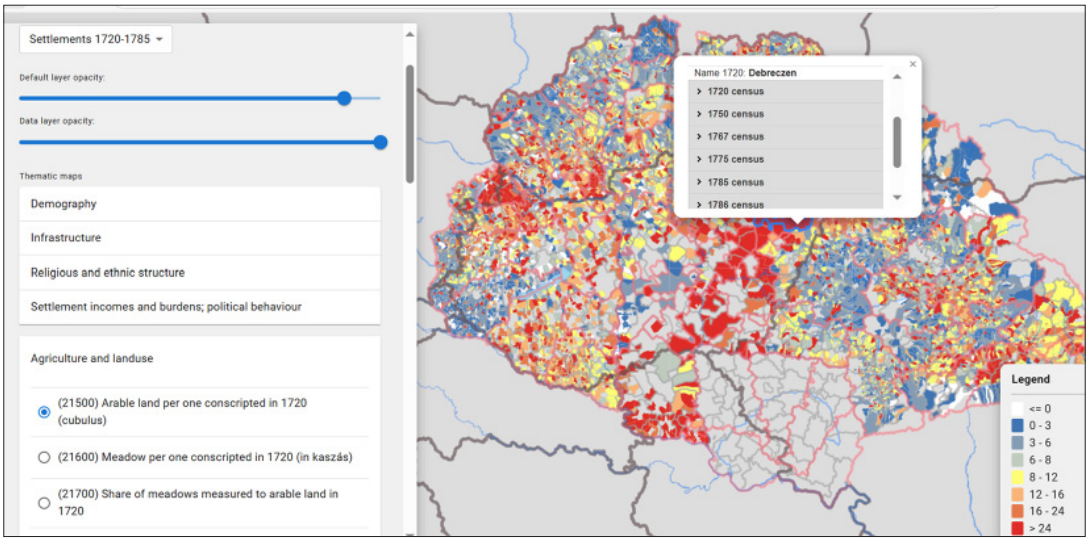


Fig. 2. A thematic map and pop-up window from the GISta Hungarorum webmap containing raw data of the processed conscriptions and censuses from the 18th century (arable land size per one conscripted person, in acres).[36]

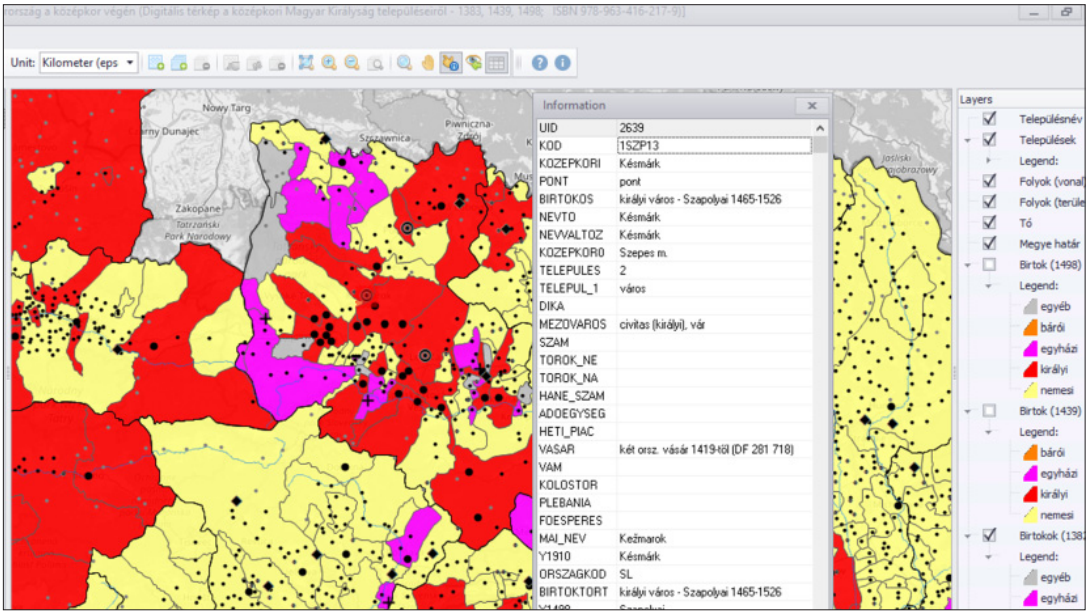


Fig. 3. An antecedent: the first medieval GIS-aided database of Pál Engel (estate types, royal, ecclesiastic, and noble) for three time sections, 1382, 1439, 1498) – containing input data for GISta Hungarorum for time sections in 1330, and 1500 (see Fig. 6).[37]

[36] The server now contains three time sections (18th c., late 19th c., 21st c., and the differences) http://gistahungarorum.abtk.hu (the integration of a new time-horizon for 1828 and extension to Croatia are in progress and will be finished by July 2026) (accessed: 8 Aug. 2025).

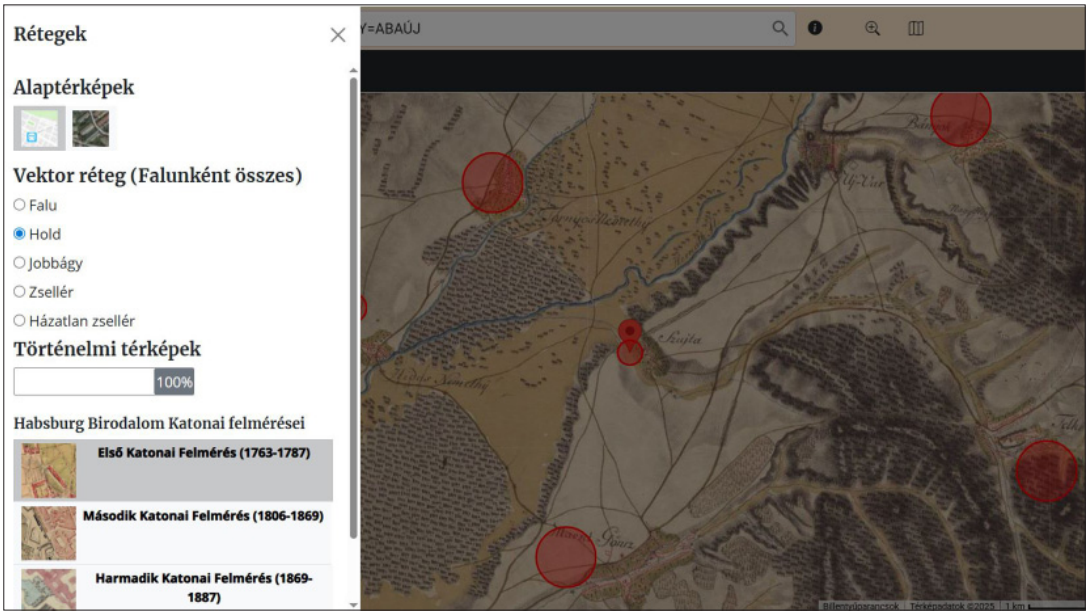


Fig. 4. Another antecedent: the urbarial conscription of tenant peasants by Marie Therese (1767) visualized on a map (https://archives.hungaricana.hu/hu/urberi/) with the georeferenced first military survey in the background and with data tables (land size, tenant peasant numbers) for each settlement.

Further problems occurred when Ottomanists, researchers of the Ottoman era, and medievalists joined. Medievalists use the 4,800 parishes as territorial base units with data for the 1330s,[38] since 67% of the 15,000 settlements had no other attributes beyond their existence and name. Ottomanists, processing up to now 155 tax records from the years 1550–1600, producing a database with over 26,000 entries,[39] work slowly because of the difficulties of reading Ottoman. Both projects already had an existing data structure when they decided to cooperate, and as they used different geocoding (from the first ever GIS project of Medieval Hungary, the so-called Engel-map, Fig. 3),[40] the IDs had to be harmonized to secure trespassing between these time sections and the 18th-century datasets for temporal comparisons.[41]

The present simplified structure of the GISta Hungarorum databases is illustrated in Fig. 6. As can be seen, datasets are bound to shape files (raw maps) through specific IDs at the settlement (or parish level) for each time section, and these IDs correspond to each other (partly by using fixed latitude and longitude values). Shapefiles are in the same projection (Pseudo-Mercator, date: WGS 84) and resolution, thus can be overlain without topological errors. Tables 1, 2, and 3 highlight the internal structure of the databases from time sections down to indicators derived from raw records.

[37] The original application in 2001 was refreshed in 2021 and is available at: https://tti.abtk.hu/adatbazisok-adattarak (accessed: 8 Aug. 2025).

[38] Financed by the National Research, Development and Innovation Fund of Hungary K 145924, led by Beatrix F. Romhányi.

[39] Financed by the National Research, Development and Innovation Fund of Hungary K 108919, K 132475, K, and K 132609 led by Éva Sz. Simon.

[40] Engel 2001. A renewed version is downloadable free of charge, as an application, from https://tti.abtk.hu/adatbazisok-adattarak (accessed: 8 Aug. 2025).

[41] Financed by HAS Lendület "Ten Generations" led by Krisztián Gergely Horváth (2018–2025).

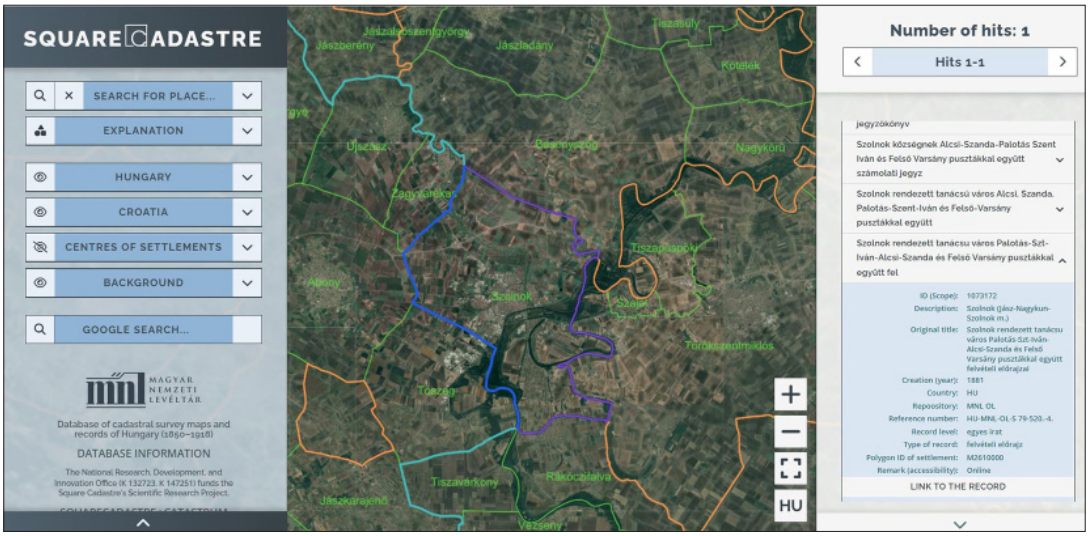


Fig. 5a–b. Square cadastre (Négyzetkataszter) of the National Archives of Hungary, containing data and metadata on cadastral mappings and the location of archival material, with links to Hungaricana that make digital content available in a spatially organized form (below). The shapefile behind, used for data organization, is the same as in GISta Hungarorum (1:144,000), https://negyzetkataszter.mnl.gov.hu/?language=english (Project PI: Csaba T. Reisz) (accessed: 8 Aug. 2025).

While many of the European projects mentioned above work(ed) with continuous time, GISta Hungarorum is based on a series of cross-sections rather than constant time and uses several predefined shapefiles for the centuries, created in ArcGIS and GeoMedia. Continuous time is hard to implement in GIS tools like ArcGIS, but much easier in spatial databases like Oracle or Postgres/PostGIS. One reason the project was carried out using time sections and ArcGIS instead of continuous

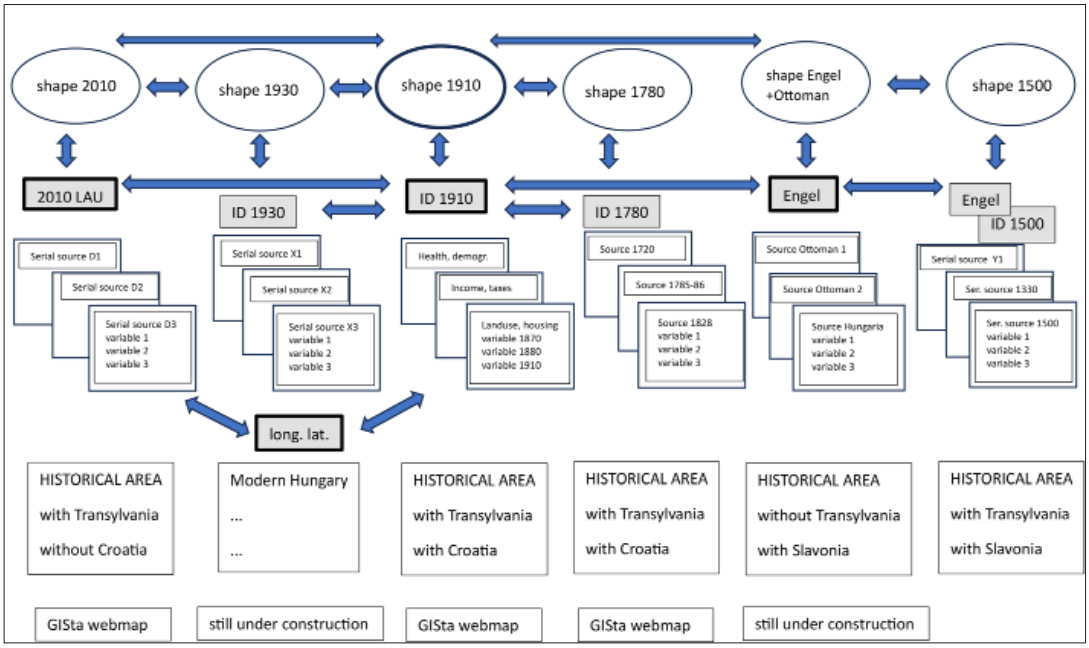


Fig. 6. General scheme of the databases, IDs, and shape files (georeferenced basemaps visualizations) integrated into GISta Hungarorum.

time-sampling is that it integrates existing databases and shapefiles; another is that it aims to provide full territorial coverage for the Kingdom, which requires merging specific dates and sources. For example, for the 1720s, we had to combine data from a relatively short timespan, from 1715 to 1723 (Transylvania). However, to cover the whole country, the project eliminates time differences. The same is true for the Ottoman era: we cannot provide full territorial coverage of the Kingdom of Hungary unless we combine several *defters* from the 1545s to the 1560s.

The interface of GISta Hungarorum, which integrates separate datasets with different backgrounds (from Oracle to Access), was developed by Gergő Gyula (Allum Digital). The statistical data visualized on the webmap-server is stored in PostgreSQL, a large, open-source database management system. For spatial queries, GeoServer was used, which connects to the relevant PostgreSQL tables and acts as an intermediate interface, enabling the transfer of geometric data mapped in the coordinate system. The transferred geometric and mapped data is displayed by Leaflet, a JavaScript library. The system was developed in React, and the controls and panels on the screen are part of the MUI component library available for React.

In general, the main problems encountered during database building and data processing were the following. *Data availability questions:* the Central Statistical Bureau uploaded pictures, and not digitized material. The National Archives of Hungary – Adatbazisok Online – did not allow bulk downloads, thus retyping the data was required, as AI-aided data processing and OCR were unsuccessful. Ottoman conscriptions were carried out in different countries. Transylvania was detached after 1700 and treated separately from the Kingdom of Hungary, which means different census years in the 18th century, different content and structure of the

Table 1. *Time sections processed. Resolution (minimum territorial entity on basemap), basemap type for visualization (polygon for per area investigations; or point in the case of unknown boundaries or location), and estimations on population numbers (for per capita variables) for the different centuries*

Year	Administrative entities used for reconstructions, calculations, and visualizations	Map visualization (shapefile)	Population conscripted (demography)
1330 papal tithe register[42]	parish (+settlement)	point + Voronoi polygon (+ polygons from 1864)	*guesstimation* – 530 persons/priest (except Orthodox and Saxon population) for 14th c.
1495, conscription of war subsidy tax	parish (+settlement)	point + Voronoi polygon (+ polygons from 1864)	*head taxpayers,* 720 persons/priest
1560s Ottoman *defters*	*nahiye* (+settlement) not equal to Christian administrative division	point + polygon (1864)	*males over 13 yrs* + *taxpayers* + rich (*hane* number = tax unit: households over 300 akce income)
1560s Conscriptio portarum / Dicalis conscriptiones	settlement (for Hungarian conscriptions)	point + polygon (1864)	taxpayers and tax units (*porta*)
1720 (1728) Regnicolaris Conscriptio	settlement (+ district + county aggr.)	point + polygon (real administrative area, 1864)	taxpayers
1750	settlement (+ district + county aggr.)	point + polygon (1864)	taxpayers
1785 first census	settlement (+ district + county aggr.) first mappation	point + polygon (1864)	total population
1786 conscription of peasant tax-payers	settlement (+ district + county aggr.)	point + polygon (1864)	taxpayers
1828 conscription of peasant tax-payers	settlement (+ district + county aggr.)	point + polygon (1864)	taxpayers
1870–1910 censuses	settlement (+ district + county aggr.)	point + polygon (1910)	total population
1920–1941 censuses (only for the present-day territory of Hungary)	settlement (+ district + county aggr.)	point + polygon (1930)	total population
1990–2010 censuses	settlement (+ district + county aggr.)	point + polygon (2000)	total population

Table 2. *The territorial coverage of the databases for different periods and the geocoding system that secures trespassing between different time sections*

Year	Hungary	Transylvania	Slavonia	Croatia	ID for georeferencing (IDs from different databases and centuries are linked, allowing the connection of diachronic data)
1330 papal tithe register	DS	DS	DS	-	"Engel's medieval ID" + own ID based on parishes
1495, conscription of subsidy	DS	DS	DS	-	"Engel's medieval ID" + own ID based on parishes
1560s Ottoman *defters*	DS	-	DS	n.a.	"Engel's medieval ID"
1560s Conscriptio portarum / Dicalis conscriptiones	0	-	DS	n.a.	"Engel's medieval ID"
1720 (1728) Regnicolaris Conscriptio	DS	DS	-	-	ID 1780
1750	-	DS	-	-	ID 1780
1785 first census	DS	DS	0	0	ID 1780

[42] L. Fejérpataky, *Rationes collectorum pontificorum in Hungaria. Pápai tizedszedők számadásai*, Monumenta Vaticana Hungariae I/1 (Budapest, 1887), pp. 1281–1375.

Year	Hungary	Transylvania	Slavonia	Croatia	ID for georeferencing (IDs from different databases and centuries are linked, allowing the connection of diachronic data)
1786 conscription of peasant taxpayers	DS	(1750), 0	DS	DS	ID 1780
1828 conscription of peasant taxpayers	DS	0	DS	DS	ID1780
1870–1910 censuses	DS	DS	DS	DS	ID 1910
1920–1941 censuses (only for the present-day territory of Hungary)	DS (post 1920)	0	0	0	ID 1910, ID 1930
1990–2010 censuses	DS	DS	0	0	LAU, GISCO

D = database; S = shapefile; n.a. = not available; – = does not exist; 0 = yet not processed or integrated

Table 3. *Some socio-economic, demographic, and environmental indicators listed (referring to development levels), derived from historical sources in the different periods*

1330	1500	1550-1570s	1720	1780s	1828	1880/1910	2010
• paid tithe (proportional) • number of parishes • tithe/parish • tithe/area • tithe/person (est.) • markets, fairs, tolls • fiscal administration • church hierarchy • place of authentication, categorized • number of mendicant friaries • number of Pauline monasteries • urban privilege received before 1340	• parishes (also as 'civil' administrative units) • legal status, privileges • administrative indicators (central and local administration/place of authentication) • economic indicators (market, toll, mine, etc.) • ecclesiastic indicators (church hierarchy, monasteries, chapels) • cultural and social indicators (literacy, peregrination, school, hospital, artistic production, architecture, etc.)	• *Ottoman defters* • *hane (tax unit)* number • all conscripted • tax paid (landlords' share, proportional tax) • tax/conscripted • *hane*/conscripted • tax/area • Muslim from taxpayers, % • tithe for grains, wine, hay, animals, etc. • *Royal conscriptions* • *porta* number • tax paid • tax/porta • estate size	• *coloni* (tenant peasant) • *inquilini* • arable land • meadow • vineyard • grain output • field system	• soil quality • schoolmaster • priest • ratio of tenant peasants • ratio of the poor living in other's house • area of vineyard per peasant • area of ploughland per tenant • number of days of corvée (*angaria*) per peasant • total sum of state taxes per peasant • ratio of strangers (*extraneus*) • ratio of the absent • number of families per house • family size • closeness the market • ratio of the burghers and staftsmen • value of in-kind services per peasant	• *coloni* (tenant peasant) • *inquilini* • *subinquilini* (landless) • *fratres* • *filii/filiae* • *servi/ancillae* • *opifices* (craftsmen) • *mercatores* (merchants) • households (*domus*) • arable land size/*domus* • meadow • orchard • vineyard • income from vineyard / domus • income from arable land • income from meadow • state tax • draft animals • smaller animals	• altogether 48 original variables are available • average rate of infant mortality in 1901–1910 measured to total death, % • birth rate • death rate • migration rate • tbc death rate, measles, scarlet fever death rate • literacy rate in 1910 • population growth 1900–1910 • deaths seen by doctors • distance from doctor • distance from advocates • religion and ethnicity • dwelling conditions • distance from nearest railway station • non-earners measured to 100 earners • share of industrial earners to all earners in % • etc.	• altogether 12 original variables: • average migration rate in 2001–2011 measured to 1000 prs • average death rate in 2001-2011 measured to 1000 prs • share of population with maximum elementary school measured to the population above 7 yrs, % • share of population with degree measured to total population, % • registered unemployed from all inhabitants in 2010, % • gross income per capita in 2010 calculated in Fts. • Etc.

tax conscriptions, different measurement units, and different locations for unpublished sources.

The amount of missing data was also a problem in creating a coherent database with full territorial coverage. While only one county was missing from the 1785 census, ten counties were missing in the 1786 tax register. Identifying settlement names spanning a long timespan was also a challenge: 700 years had to be covered with Latin, Ottoman, German, Hungarian, Slavic variants, and present names, often without orthography, but with significant ethnic changes reflected in name variants.

Localizing settlements and tracing administrative subdivisions was also problematic, including changing the names of administrative units, altering their territorial extent, and sometimes both. Accurate administrative boundaries are unknown for settlements before the 19th century, which hinders the aggregation of settlement-level data.

Changing measurement units was also considered as a challenge, not only for population (see proxy terms, such as households, *hane, porta, domus*, person, taxpayer, tax unit, family, population, etc.) but for social and economic features, too.

Why is it important to have both point and polygon type vector data for visualization? Besides the goal of illustrating regional differences and their changes over time, polygons were also required for *production/area* calculations; therefore, we had to approximate settlement areas even in periods when no exact settlement boundaries were available. This was done by Voronoi polygons for the 1330–1500s, while for other periods, the polygons representing settlement boundaries (and aggregated to higher administrative levels, like districts and counties) vectorized from the 1:144 000 map of the 1880s (just before the last significant administrative reforms) were modified according to the given settlement list in the 18th century.

Estimating population, even in periods when no population censuses were carried out (see the problem of numerous proxy categories for population before the first real population census of 1785), it was necessary to calculate per capita values for the indicators collected. The approximation of population is definitely needed for production/person calculations or for calculating indicators of inequality (like the Hoover index), if we want to adopt modern approaches to substitute missing GDP, HDI values, etc. Therefore, we used approximations before the first official census in 1785, such as the "conscripted male workforce" (13–65 yrs) in Ottoman *defters*, or used French analogies[43] to calculate how many people were required to sustain a priest in the 1330s.

The problem of visualization, i.e., changing administrative boundaries, in the case of temporal comparisons (diachronic approach), was resolved by gridding (weighted by area, population, etc.), to illustrate differences.[44] Regarding the variables derived from datasets across different time periods to measure one- or multidimensional development and inequalities, Table 3 provides further details.

Finally, in addition to the spatial approach, the database also allows us to conduct non-spatial statistical analyses. We can assess the differences of socio-economic and demographic features using grouping variables as religion, ethnicity, settlement type (legal and size), distance from markets or other infrastructure (rivers, railways, doctors, etc.), social stratification

[43] F. Lot, 'L'état des paroisses et des feux de 1328', *Bibliothèque de l'École des chartes*, 90 (1929), pp. 289–304, calculates approximately 500 people for one parish.

[44] For the optimalization of the grid cells, see P. Netrdová, V. Nosek, P. Hurbánek, 'Using Areal Interpolation to Deal with Differing Regional Structures in International Research', *International Journal of Geo-Information*, 9, no. 2 (2020), pp. 1–14; for testing on Hungarian data, see I. Papp, J. Pénzes, G. Demeter, 'A közlekedési hálózatok és a komplex területi fejlettség időbeli összehasonlító vizsgálatának nehézségei és egy megoldási lehetősége a történelmi Magyarország példáján', *Területi Statisztika*, 61, no. 4 (2021), pp. 445–65.

(based on land size or classified by legal categories), landlords, large estate types, district/county/region and physical geographical features derived from modern SRTM or DEM, considered more or less constant through centuries (slope steepness, slope aspect, relative relief, sunshine, perimeter of the administrative boundary of the settlement measured to administrative area of the settlement, etc.) offering possibilities to investigate the role of these above mentioned features even at settlement level or to compare regions.

Future plans

Up to now, we have data series covering the Kingdom of Hungary for the following time sections: 1330, 1720, 1780, 1880, 1910, 2010. The dataset for 1500 is also under construction. The National Archives of Hungary uploaded scanned sheets of the 1828 conscription for public use and also decided to create a new basemap, in shapefile format, for the 1840s. Therefore, we began processing the socio-economic data derived from online the settlement-level summaries (*Generalia*) of the 1828 conscription, which is considered the last "feudal" conscription.[45] The time-section for the Ottoman 1560s is still under construction; it will be finished by 2028 as part of a different project. The reason for this is that the data for these time sections partly came from Ottoman *defters* (tax registers), besides the Hungarian *dicalis conscriptio* and *conscriptio portarum* tax registers, and we lack human resources to accelerate the process of reading out settlement names written in the Ottoman language. Additionally, we decided to broaden our database and maps territorially too, and began to work on Croatian data available for 1330, 1780s, and 1828,[46] and 1910 under the aegis of a HUNRENtech project,[47] though these are yet not visualized on GISta Hungarorum. By the end of 2026, the 1828 data will be visualized on similar thematic maps to those used for the data from other time sections. Croatian data will be integrated too, for the same time periods, a search engine for settlement name variants will be built in, and the IT expert of the project, Gergő Gyula, will enable the visualization of two phenomena at the same time on one map. Bulk data download is already possible.

Beyond database building, evaluation is also in progress using multivariate statistics to answer questions about inequality,[48] using the Gini-index, the Hoover-index, regression analysis, correlation matrix, PCA, etc. Simple methods, such as grouping variables (e.g., social status, religion) and testing differences with a two-sample t-test, are also possible. The visual evaluation of illustrated patterns is also promising, and the 18th- and 19th-century data has just been published as a digital atlas with 300 settlement-level maps.[49] Classic historical questions can also be addressed, as whether railways contributed to the development of regions or just deepened inequalities, or, from another point of view, was it the developed regions that attracted the railways? To what extent, and when, can we observe differences in the socio-economic and demographic data of nations in Hungary? How did water regulation work influence agrarian output and local demography, etc.? ■

[45] https://adatbazisokonline.mnl.gov.hu/adatbazis/az-1828-evi-orszagos-osszeiras (accessed: 8 Aug. 2025).

[46] J. Buturac, 'Popis župa zagrebačke biskupije 1334 i 1501 godine', *Starine*, 59 (1984), pp. 43–107. For medieval times, see A. Hegedič, K. Čobanović, *Demografska i agrarna statistika Vojvodine 1767–1867* (Novi Sad, 1991); and P. Korunić, *Naselja i stanovništvo Hrvatskih Pokrajina 1828/1830. godine* (Zagreb, 2019). Religious distribution for 1828 will be processed too, apart from the economic data.

[47] G. Demeter, *Atlasz Horvátország történelmének tanulmányozásához 1870–1910 / Atlas for studying the History of Croatia (1870–1910)* (Budapest, 2019).

[48] See the latest volume of *Hungarian Studies Review*, 1 (2025), published in the USA.

[49] *Vidéki társadalom a történeti Magyarországon. Térképgyűjtemény*, A Vidék vonzásában 11, eds Zs. Bottlik, G. Demeter (Budapest, 2025), https://10generacio.hu/hu/eredmenyek/terkepgyujtemeny (accessed: 8 Aug. 2025).

References

Acemoglu D., Johnson S., Robinson J.A., 'Reversal of fortune: Geography and institutions in the making of the modern world income distribution, *Quarterly Journal of Economics*, 117, no. 4 (2002), pp. 1231–294.

Acemoglu D., Johnson S., Robinson J.A., 'The colonial origins of comparative development: an empirical investigation', *American Economic Review*, 91, no. 5 (2001), pp. 1369–1401.

Acemoglu D., Robinson J., *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (New York, 2012).

Benda Gy., *Statisztikai adatok a magyar mezőgazdaság történetéhez 1767–1867*, Számok és Történelem 1 (Budapest, 1973).

Buturac J., 'Popis župa zagrebačke biskupije 1334 i 1501 godine', *Starine*, 59 (1984), pp. 43–107.

Clout H.D., *The Land of France 1815–1914*, Routledge Library Editions: Rural History 3 (London, 1983 [2018]).

Combes P-P., Lafourcade M., Thisse J.-F., Toutain J.-C., 'The rise and fall of spatial inequalities in France: A long-run perspective', *Explorations in Economic History*, 48, no. 2 (2011), pp. 243–71, doi: 10.1016/j.eeh.2010.12.004.

Demeter G., *Atlasz Horvátország történelmének tanulmányozásához 1870–1910 / Atlas for studying the History of Croatia (1870–1910)* (Budapest, 2019), https://www.gistory.hu/g/hu/gistory/gismaps.

Dormard S., 'Economic development and regional disparities in France', in: *Employment and Regional Development Policy: Market Efficiency versus Policy Intervention*, eds K. Helmut, R. Philippe (Hannover, 2004), pp. 50–67.

Eddie S.M., *Ami „köztudott", az igaz is? Bevezetés a kliometrikus történetírás gondolkodásmódjába* (Debrecen, 1996).

Enflo K., Missiaia A., 'Regional GDP before GDP: A methodological survey of historical regional accounts', in: *Regional Economic Development and History*, eds M. Molema, S. Svensson (Routledge, 2019), pp. 82–97.

Enflo K., Missiaia A., 'Regional GDP estimates for Sweden, 1571–1850', *Historical Methods*, 51, no. 2 (2018), pp. 115–37, doi: 10.1080/01615440.2018.1429971.

Engel P., *Magyarország a középkor végén: digitális térkép és adatbázis* (Budapest, 2001).

Fejérpataky L., *Rationes collectorum pontificorum in Hungaria. Pápai tizedszedők számadásai*, Monumenta Vaticana Hungariae I/1 (Budapest, 1887), pp. 1281–375.

Fitch C.A., Ruggles S., 'Building the national historical geographic information system', *Historical Methods*, 36 (2003), pp. 41–51.

Goerke M. ed., *Coordinates for Historical Maps* (Göttingen, 1994).

Good D.F., Ma T., 'The Economic Growth of Central and Eastern Europe, 1870–1989', *European Review of Economic History*, 3, no. 2 (1999), pp. 103–38, doi: 10.1017/S1361491699000076.

Gregory I.N., Southall H., 'Mapping British population history', in: *Past Time, Past Place: GIS for History* (Redlands, 2002), pp. 117–30.

Gregory I.N., Southall H., 'Putting the Past in Its Place: the Great Britain Historical GIS', in: *Innovations in GIS 5*, ed. S. Carver (Taylor & Francis, 1998), pp. 210–21.

Győri R., Mikle Gy., 'A fejlettség területi különbségeinek változása Magyarországon, 1910–2011', *Tér és társadalom*, 31, no. 3 (2017), pp. 144–64, doi: 10.17649/TET.31.3.2866.

Hegediš A., Čobanović K., *Demografska i agrarna statistika Vojvodine 1767–1867* (Novi Sad, 1991).

Katus L., 'Economic growth in Hungary during the age of dualism (1867–1913): a quantitative analysis', in: *Social-Economic Research on the History of East-Central Europe / Sozial-ökonomische Forschungen zur Geschichte von Ost-Mitteleuropa*, ed. E. Pamlényi, Studia Historica 62 (Budapest, 1970), pp. 35–127.

Korunić P., *Naselja i stanovništvo Hrvatskih Pokrajina 1828/1830. godine* (Zagreb, 2019).

Lot F., 'L'état des paroisses et des feux de 1328', *Bibliothèque de l'École des chartes*, 90 (1929), pp. 289–304.

Maddison A., *The World Economy. A Millennial Perspective* (Paris, 2010).

Milanovic B., 'An estimate of average income and inequality in Byzantium around year 1000', *Review of Income and Wealth*, 52, no. 3 (2006), pp. 449–470, doi: 10.1111/j.1475-4991.2006.00198.x.

Milanovic B., Lindert P.H., Williamson J.G., 'Pre-Industrial Inequality', *Economic Journal* 121, no. 551 (2010), pp. 255–72, doi: 10.1111/j.1468-0297.2010.02403.x.

Netrdová P., Nosek V., Hurbánek P., 'Using Areal Interpolation to Deal with Differing Regional Structures in International Research', *International Journal of Geo-Information*, 9, no. 2 (2020), pp. 1–14, doi: 10.3390/ijgi9020126.

Papp I., Pénzes J., Demeter G., 'A közlekedési hálózatok és a komplex területi fejlettség időbeli összehasonlító vizsgálatának nehézségei és egy megoldási lehetősége a történelmi Magyarország példáján', *Területi Statisztika*, 61, no. 4 (2021), pp. 445–65, doi: 10.15196/TS610402.

Pénzes J., Demeter G., 'Peripheral areas and their distinctive characteristics: The case of Hungary', *Moravian Geographical Reports*, 29, no. 3 (2021), pp. 217–30, doi: 10.2478/mgr-2021-0016.

Perjés G., 'Az 1728. évi adóösszeírás adatainak feldolgozása', *Statisztikai Szemle*, 52, no. 11–12 (1974), pp. 1068–100.

Perjés G., 'Bihar megye 1728. évi adóösszeírásának gépi feldolgozása', *A Hajdú-Bihar Megyei Levéltár Évkönyve*, 6 (1979), pp. 33–109.

Perjés G., 'Jelentés az 1728. évi összeírás gépi feldolgozásáról', *Agrártörténeti Szemle*, 20, no. 1–2 (1978), pp. 11–80.

Prados de la Escosura L., 'World Human Development: 1870–2007', *Review of Income and Wealth*, 61, no. 2 (2015), pp. 220–27, doi: 10.1111/roiw.12104.

Scargill I., 'Regional Inequality in France: Persistence and Change', *Geography*, 76, no. 4 (1991), pp. 343–57, doi: 10.1080/20436564.1991.12452341.

Schreven L., Boonstra O., Doorn P., 'Towards a historical geographic information system for the Netherlands (HGIN)', *Historical Geography*, 33 (2005), pp. 134–58.

Schulze M.-S., *Regional Income Dispersion and Market Potential in the Late Nineteenth Century Habsburg Empire*, Working Papers 106/07 (London, 2007), https://eprints.lse.ac.uk/22311/1/WP106schulze.pdf.

Söderberg J., 'A long-term perspective on regional economic development in Sweden, ca. 1550–1914', *Scandinavian Economic History Review*, 32, no. 1 (1984), pp. 1–16, doi: 10.1080/03585522.1984.10408020.

Soltow L., 'Wealth distribution in Denmark in 1789', *Scandinavian Economic History Review*, 27, no. 2 (1979), pp. 121–38, doi: 10.1080/03585522.1979.10415654.

Southall H., 'A Vision of Britain through Time: Making sense of 200 years of census reports', *Local Population Studies*, 76 (2006), pp. 76–84.

Stapel R.J., 'Historical Atlas of the Low Countries. A GIS Dataset of Locality-Level Boundaries (1350–1800)', *Research Data Journal for the Humanities and Social Sciences*, 8, no. 1 (2023), pp. 1–33, doi: 10.1163/24523666-bja10033.

Terlouw K., 'A general perspective on the regional development of Europe from 1300 to 1850', *Journal of Historical Geography*, 22, no. 2 (1996), pp. 129–46, doi: 10.1006/jhge.1996.0009.

Terlouw K., 'Transnational regional development in the Netherlands and Northwest Germany, 1500–2000', *Journal of Historical Geography*, 35, no. 1 (2009), pp. 26–43, doi: 10.1016/j.jhg.2008.03.001.

Tirado-Fabregat D., Díez-Minguela A., Martinez-Galarraga J., 'Regional inequality and economic development in Spain, 1860–2010', *Journal of Historical Geography*, 54 (2016), pp. 87–98, doi: 10.1016/j.jhg.2016.09.005.

Vanhaute E., 'The Quantitative Database of Belgian Municipalities (19th and 20th Centuries): From Diachronic Worksheets to Historical Maps', in: *Halbgraue Reihe Zur Historischen Fachinformatik*, Serie A, Historische Quellenkunde 25, ed. M. Goerke (Göttingen, 1994), pp. 162–75.

Vidéki társadalom a történeti Magyarországon. Térképgyűjtemény (A Vidék vonzásában 11), eds Zs. Bottlik, G. Demeter (Budapest, 2025), https://10generacio.hu/hu/eredmenyek/terkepgyujtemeny.

Internet sites

Adatbazisok Online (MNL OL – National Archives of Hungary): https://adatbazisokonline.mnl.gov.hu/

Arcanum, Mapire: https://maps.arcanum.com/hu/

Atlasfontium, https://atlasfontium.pl/en/category/atlas-of-sources-and-materials/

Collection of Ottoman Registers: https://adatbazisokonline.mnl.gov.hu/adatbazis/oszman/terkep https://adatbazisokonline.mnl.gov.hu/adatbazis/oszman/hierarchia

Engel's medieval map: https://tti.abtk.hu/adatbazisok-adattarak

GASID project at Jagiellonian University: https://gasid.pl/

GISta Hungarorum: http://gistahungarorum.abtk.hu (webmap), www.gistory.hu (raw datasets)

Historical Atlas of the Low Countries (1350–1800): https://datasets.iisg.amsterdam/dataset.xhtml?persistentId=hdl:10622/PGFYTM

Hungaricana collections: https://www.hungaricana.hu/hu/

IAPN (Atlas of Independent Poland): https://atlas1918.ihpan.edu.pl/

Mária Terézia Úrbéri Tabellái: https://archives.hungaricana.hu/hu/urberi/

Ottoman atlas: https://mnl.gov.hu/mnl/ol/terkepek

Square Cadastre (Négyzetkataszter): https://negyzetkataszter.mnl.gov.hu/?language=english

Ten Generations Project: https://10generacio.hu/hu/

The Central European Historical Data Hub, https://www.czoernig.com/

The Vision of Britain (GBHGIS): https://www.visionofbritain.org.uk/gbhdb ■

GISta Hungarorum – zintegrowana i wizualizowana baza danych HGIS na poziomie gminnym dotycząca Królestwa Węgier i państw, które powstały w wyniku jego rozpadu (1330–2010)

Streszczenie

Ideą GISta Hungarorum jest nie tylko stworzenie ujednoliconego, uporządkowanego przestrzennie repozytorium zeskanowanych źródeł archiwalnych, lecz także promowanie badań historyków i geografów, którzy koncentrują się na różnicach regionalnych. Dlatego też nacisk kładziony jest na dane i ich ocenę, a nie na same źródła cyfrowe. GISta Hungarorum przechowuje dane przede wszystkim w formacie cyfrowym i wizualizuje je na około 300 mapach tematycznych, wykorzystując wielokąty o wysokiej rozdzielczości w skali 1:144 000 (z dokładnością do 200 m).

Starsze i niedawno utworzone historyczne bazy danych zintegrowane w ramach GISta Hungarorum obejmują informacje dotyczące podatków seryjnych z XIV w., podatków z XV w., podatków osmańskich (XVI w.), proto-statystyczne rejestry podatkowe z XVIII stulecia oraz historyczne spisy ludności z XIX w. – wszystkie zapisane na poziomie osad. Gromadzenie danych nadal trwa, zwłaszcza w odniesieniu do okresu osmańskiego (zarówno osmańskich *defters*, jak i węgierskich spisów podatkowych); z terytorialnego punktu widzenia są luki dla Transylwanii (1786, 1828) i Chorwacji (1786, 1828). Przetwarzanie danych zostało zakończone dla Królestwa Węgier dla następujących okresów: lata trzydzieste XIV w., XVI w., lata dwudzieste i osiemdziesiąte XVIII w., 1828 r., lata osiemdziesiąte XIX w., druga i czwarta dekada XX w. (te ostatnie tylko dla współczesnych Węgier) oraz druga dekada XXI w. (Basen Karpacki).

Taka baza danych może być wykorzystywana do różnych celów w ramach różnych dyscyplin naukowych. Umożliwia ona badanie statystyczne różnic społeczno-ekonomicznych i demograficznych na poziomie osadnictwa w kilku przedziałach czasowych. Dane można również agregować do wyższych poziomów administracyjnych. W 2025 r. wszystkie instytucje partnerskie otrzymają nowe mapy dla roku 1910, lat osiemdziesiątych XIX w. i końca XVIII w. w skali 1:144 000 (które zastąpią starsze wersje w skali 1:400 000), aby umożliwić porównanie wizualizacji danych. Zbiór danych pozwala na synchroniczną analizę wzorców przestrzennych i porównania diachroniczne. Z bazą danych można połączyć nawet strony Wikipedii (za pomocą geoID).

Baza danych może być rozszerzona na inne kraje i połączona z innymi bazami danych, takimi jak kataster węgierskiego Archiwum Narodowego lub historyczne bazy danych etnograficzno-folklorystyczno-muzyczne HAS itp. Dane można przesyłać na platformy, jak np. Nodegoat, aby zwiększyć możliwości wizualizacji. Zharmonizowane identyfikatory na poziomie osad umożliwiają połączenie danych średniowiecznych z najnowszymi danymi statystycznymi XXI w.; baza danych z powodzeniem integruje dane z różnych instytucji (Centralnego Urzędu Statystycznego i Archiwum Narodowego Węgier). Struktura bazy pozwala na badania obejmujące kilka (nawet niekwantyfikowalnych) zmiennych (wyznanie, pochodzenie etniczne, status prawny osady, odległość od infrastruktury i surowców, cechy geograficzne itp.). Dzięki temu można ponownie przyjrzeć się wybranym problemom badawczym, zarówno już rozstrzygniętym, jak i nadal nierozwiązanym.

Korzyścią dodatkową jest opracowanie lub wdrożenie nowych metod oceny produkcji w stosunku do powierzchni i produkcji na mieszkańca nawet dla średniowiecza i okresu nowożytnego. Procesy peryferyzacji można również obserwować w długim okresie od nowożytności do współczesności jako wsparcie współczesnego planowania terytorialnego. Planowana integracja GISta Hungarorum z podobnymi zbiorami danych z krajów sąsiednich z pewnością przyczyni się do wyjścia z poziomu historii narodowych i utoruje drogę do odtwarzania historii „globalnej" lub „transnarodowej". ■

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