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CREATING A DIGITAL ATLAS FOR HERITAGE CITIES AND TOWNS ALONG THE DANUBE

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Abstract

The traditional meaning of an atlas has changed recently, with the prompt rise of digitalisation. This process has also opened new perspectives to collect and present atlas data; the interconnection of the huge quantities of the different data sets, including the new types of data and introducing atlases with new topics as an innovation. The essential meaning of an atlas has been, however, preserved even in its digitalised version – to present spatially related phenomena and items thorough their mapping.

The aim of this paper is to discuss about the structure of a digital urban atlas on the example of the creation a new one – the digital atlas of heritage cities and towns along the Danube, one of the main deliverables of DANUrB+ INTERREG Project. This atlas, planned in both hardcopy and digital versions, is still in progress; hence, the main contribution of the paper is to show the expected structure of the digital DANUrB+ Atlas by comparing the project inputs with several already existing digital urban atlases as role-models.

Keywords: atlas, digitalisation, cultural heritage, Danube, small cities and towns

INTRODUCTION

The ‘sense’ of an atlas has changed recently, with the rise of digitalisation process. Traditionally speaking, an atlas is an analogue/hardcopy publication based on the collection of maps, whereas these maps are usually the maps of the Earth and its regions [9]. However, the digitalisation process has transformed this publication genre in multiple ways [4]. First, the digitalisation has opened completely new perspectives to collect and present atlas data, with the new, ‘non-linear’ interconnection of different data, including maps and the other, supportive material, such as tables, graphs, diagrams, photos, etc. Then, this advantage has enabled to compile and interlink the huge quantities of the different data sets – the cartographic process of big data in its essence [6]. Similarly, the use of software, such as CAD, GIS or specialised illustration software, has become a standard in the present-day map production, which further

propels the digitalisation of atlases. In line with this, a new, digital atlas has been suitable to accept the presentation of the data that did not fit within the scope of an 'old', hardcopy atlas.

Nevertheless, the basic meaning of an atlas as a map collection has been preserved [9]. The point is that the digitalisation has enabled to digitally design, collect and present the different types of maps [7], which was impossible in hardcopy atlases. Therefore, new, thematically oriented atlases have arisen as an innovation last years. One of the already established types of digital atlases is an urban atlas or the atlas of cities/towns [3]. The presentation of urban content within an atlas is not new, but it was usually a side-content to the core content of geographical regions. Then, urban atlases existed before the digitalisation revolution, too; for example, "Urban Atlas: 20 American Cities" was published more than 50 years ago [5]. However, they were rare due to their different scales and formats then 'classic' geographical atlases. The rise of digitalisation has simply enabled the presentation of urbanism-related issues in a digital adjusted atlas, such as urban morphology, the historic development of cities, zoning, urban planning, important landmarks within urban zones, etc.

The development of digital urban atlases is still in progress; currently, there are no many of them. Hence, the creation of the structure of a new urban digital atlas has been a task for university partners from DANUrB+ Project (2020-2022), within INTERREG EU Danube Programme. One of the first focal points of this task is to geographically, spatially and temporarily adjust the current experience in the existing urban digital atlases to the focus of the DANUrB+ project on (1) small and medium Danubian cities and towns, (2) the retrospective of their urban genesis, (3) urban morphology and (4) urban cultural heritage as (5) the prospective generators of their urban regeneration and revitalisation. In this consideration, the central issue is to link urban space with cultural heritage located within its limits. It is important to underline that the importance of urban heritage and the understating of the genesis of urban space has been in focus of general science recently. "During the last decades, representations of medieval and early modern urban space have witnessed an increasing popularity as objects of study" [8, p. 9]. Nevertheless, the creation of an urban atlas on the interconnection between urban heritage mapping and the development prospects of the existing cities and towns is still without many 'straight' role-models.

The aim of this paper is to present the dichotomy between traditional and new elements in creating a digital atlas on the example of the atlas of heritage cities and towns along the Danube in DANUrB+ Project. This atlas, planned in both hardcopy and digital versions, is still in preparations, so the main contribution of the paper is to show the process and expected structure of the digital version of DANUrB+ Atlas. The ultimate purpose of this paper is to open discussion between the experts in urban planning and design and the experts in heritage

studies, seeing the link between these two fields as a critical element for the development of this innovative form of a digital atlas.

This paper is formed as a scientific review. The first part is the review of existing digital urban atlases and similar map collections as role-models for the new DANUrB+ atlas of heritage cities and towns along the Danube. The second part is the interconnection of the acquired data from the review of the atlases and the fundamentals of the project. The final outcome is the proposed structure of this new digital urban atlas, presented as the algorithm of the atlas content. The discussion of this structure makes the concluding section of the paper.

METHOD

This paper is formed as a scientific review. The first part is the review of existing digital urban atlases and similar map collections as role-models for the new DANUrB+ atlas of heritage cities and towns along the Danube. The second part is the interconnection of the acquired data from the review of the atlases and the fundamentals of the project. The final outcome is the proposed structure of this new digital urban atlas, presented as the algorithm of the atlas content. The discussion of this structure makes the concluding section of the paper.

PROJECT INPUTS FOR A NEW DIGITAL ATLAS

The full title of the mentioned DANUrB+ project is “DANube Urban Brand + Building Regional and Local Resilience through the Valorisation of Danube’s Cultural Heritage”. This project builds on the success o the first project with a similar title – “DANUrB – a Regional Network Building through Tourism and Education to Strengthen the “Danube” Cultural Identity and Solidarity” (2017-2019). Both projects have been conducted through the EU INTERREG Danube Transnational Programme, within the programme priority “Environment and Culture Responsible Danube Region”. In the first project, associated partners were mainly the towns and small cities with fortresses along the Danube as the main heritage assets (Fig. 1).

Fig.1. *Fortress towns and cities were the main associated partners in the DANUrB project; Left: Esztergom, Hungary; Right: Golubac, Serbia (Author: B. Antonić, 2017)*

As it was highlighted, the digital atlas for heritage cities and towns along the Danube is one of the main deliverables of the new, DANUrB+ Project. However, this is a comprehensive project, which should accomplish many other deliverables and outcomes. Thus, the atlas cannot be seen as an independent project contribution, but as the part of the much bigger corpus of regional knowledge, identity awareness, database, and collective experience through partnership. In light with this main stance, several inputs from four horizontal thematic flows of the project are critical for the atlas creation (INTERREG DTP, 2020):

[1] SHRINKING CITIES AS A CHALLENGE – to opt for the towns and cities that are facing the overall shrinkage. Many towns and cities are shrinking along the river, in contrast to major cities (>100,000 inhabitants) with an international and interregional importance. This situation is generally applicable for the whole Eastern Europe [10]. Moreover, this means that role-model digital atlases had to present that data for, inter alia, small cities and towns;

[2] INTERREGIONAL NETWORK AS A POSSIBILITY – this is an answer on the realised problem that the Danube crosses mostly peripheral and border regions in its flow. Adding the influence of territorial peripherality on urban shrinkage [1], the atlas had to systematise and interconnect the different types of datasets (demographic, economic, social, urban-morphological, visual, urban networks, etc.). This is also an important element to determine role-model digital atlases;

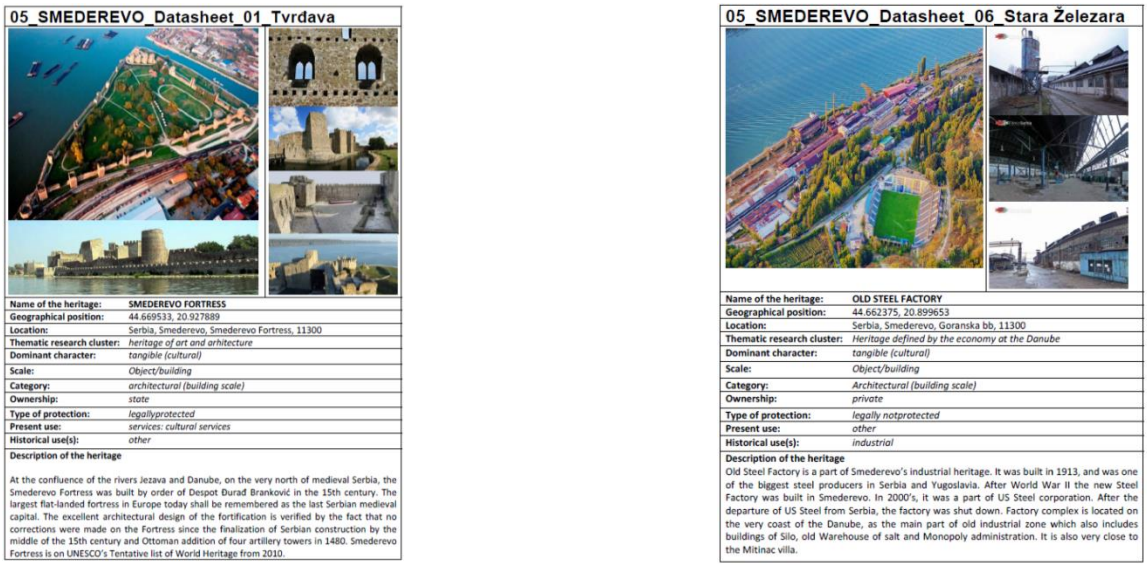
[3] HERITAGE AS A TOOL – to understand on how to use the cultural heritage of focus cities and towns in resilient manner. Their heritage is often abundant simply because the low interest for these peripheral and shrinking cities and towns has left many local heritage sites well-preserved. These sites are usually architectural or ambient assembles. In the first project, they were collected through datasheets in the first DANUrB (Fig. 2). Hence, the role-model atlases had to contain this level of data presentation.

[4] LOCALS AND THEIR COOPERATION AS A DEVELOPMENT ASSET – To collect the examples of local good practice of heritage presentation and management, stakeholders, strategies, regulations, plans, and funding sources, as a sort of grassroots for the further cooperation in the Danube Region. For the role-model atlases, it should be interpreted as a necessity to include the showcases that present their content in their best way.

These four inputs are basic criteria to select and examine the digital urban atlases and similar e-databases that are already on internet.

The work on the content and structure of analogue/hardcopy atlas has already started in the first project period, in the second half of 2020. The preliminary structure of this version of

the atlas has been recently settled on three major sections, plus introductory section about link between the project and the atlas and the scope of the atlas:



05_SMEDEREVO_Datasheet_01_Tvrdava

Name of the heritage:	SMEDEREVO FORTRESS
Geographical position:	44.669533, 20.927889
Location:	Serbia, Smederevo, Smederevo Fortress, 11300
Thematic research cluster:	*heritage of art and arhitecture*
Dominant character:	*tangible (cultural)*
Scale:	*Object/building*
Category:	*architectural (building scale)*
Ownership:	*state*
Type of protection:	*legallyprotected*
Present use:	*services: cultural services*
Historical use(s):	*other*

Description of the heritage

At the confluence of the rivers Jezava and Danube, on the very north of medieval Serbia, the Smederevo Fortress was built by order of Despot Đurad Branković in the 15th century. The largest flat-landed fortress in Europe today shall be remembered as the last Serbian medieval capital. The excellent architectural design of the fortification is verified by the fact that no corrections were made on the Fortress since the finalization of Serbian construction by the middle of the 15th century and Ottoman addition of four artillery towers in 1480. Smederevo Fortress is on UNESCO's Tentative list of World Heritage from 2010.

05_SMEDEREVO_Datasheet_06_Stara Železara

Name of the heritage:	OLD STEEL FACTORY
Geographical position:	44.662375, 20.899653
Location:	Serbia, Smederevo, Goranska bb, 11300
Thematic research cluster:	*Heritage defined by the economy at the Danube*
Dominant character:	*tangible (cultural)*
Scale:	*Object/building*
Category:	*Architectural (building scale)*
Ownership:	*private*
Type of protection:	*legally notprotected*
Present use:	*other*
Historical use(s):	*industrial*

Description of the heritage

Old Steel Factory is a part of Smederevo's industrial heritage. It was built in 1913, and was one of the biggest steel producers in Serbia and Yugoslavia. After World War II the new Steel Factory was built in Smederevo. In 2000's, it was a part of US Steel corporation. After the departure of US Steel from Serbia, the factory was shut down. Factory complex is located on the very coast of the Danube, as the main part of old industrial zone which also includes buildings of Silo, old Warehouse of salt and Monopoly administration. It is also very close to the Mitinac villa.

Fig.2. *Two examples of DANUrB heritage datasheets from the City of Smederevo; Left: Smederevo Fortress as a national heritage of an exceptional importance; Right; Old steelworks as an industrial heritage (Authors: team of the University of Belgrade, 2018)*

[1] LOCALS AND THEIR COOPERATION AS A DEVELOPMENT ASSET – To collect the examples of local good practice of heritage presentation and management, stakeholders, strategies, regulations, plans, and funding sources, as a sort of grassroots for the further cooperation in the Danube Region. For the role-model atlases, it should be interpreted as a necessity to include the showcases that present their content in their best way.

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[2] LEARNING FROM THE PAST – EMBRACING HERITAGE / the specificities of urban genesis due to early capitalism and industrialisation and, then, socialist system in the Danube Region, as well as the heritage as its legacy (industrial heritage, socialist modernist and functionalist heritage, etc.);

[3] POTENTIALS AND CHALLENGES OF THE PRESENT / the issue of post-socialist transition in the Danube cities and towns and its influence on the current urban transformations, where the combination of the data of socio-economic shift is to be connected to spatial reflections in urban space and heritage management. The special attention is to be given to shrinking cities along the Danube;

[4] VISIONS FOR TOMORROW / to determine the best practice examples from the Danube Region as grassroots to develop a broader strategy for the revitalisation of Danubian cities, especially by using local heritage as an advantage.

The content of the digital version of the atlas should be similar, but the structure of this atlas should be adjusted to the potentials of the digitalisation.

FINDING ROLE-MODELS: URBANISM-CUSTOMISED ATLASES IN DIGITAL FORMAT

Four digital web databases with the adequate content related to cities and towns are found. Three of them are named as an *atlas*; however, the last one is not.

"URBAN ATLAS" is the short name of the section of Copernicus Land Monitoring Service. This service is a joint initiative of the European Commission Directorate-General for Regional and Urban Policy and the Directorate-General for Enterprise and Industry. As it is said in its main presentation, "Copernicus is a European programme for monitoring the Earth, in which data is collected by Earth observation satellites and combined with observation data from sensor networks on the earth's surface" (Copernicus, n.d.). This means that this web service, aside of urban issues, presents maps about land use, land cover characteristics, vegetation, water systems and earth surface energy issues.

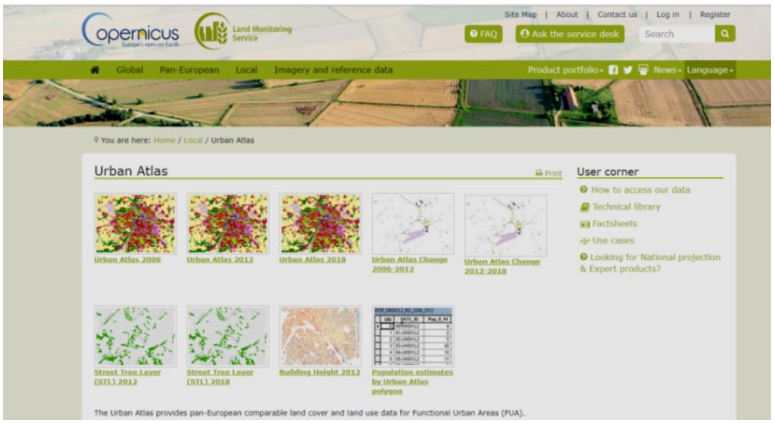

Fig.3. *The main page of the Urban Atlas with the presented main datasets (Source: https://land.copernicus.eu/local/urban-atlas).*

The section of the Urban Atlas mainly covers the data of urban land use, obtained by satellite observations, such as the total land use of a certain urban area, street tree layer, building heights, and population estimates by land use polygons (Fig. 3). The mentioned data is available just for 800 major cities and its surroundings – functional urban areas [2]. Furthermore, it seems that datasets are rather separated by topics; there is no connection to directly move from one topic to another one or to combine topics. Similarly, examples in the form of small urban areas of architectural complexes, adequate for the mapping heritage sites, do not exit. At the end, some datasets of this atlas, such as the changes of land use, have a proactive role and can be utilised as the best practice.

The next atlas is the "ATLAS OF URBAN EXPANSION". This is the project of the Lincoln Institute of Land Policy, with the support of UN-Habitat and New York University. The atlas is focused on larger cities (>100,000 inhabitants).

This digital atlas is similarly based on the maps produced from satellite images, including the data relating to spatial changes in cities around the world (LILP, n.d.). Therefore, the land use in urban areas is its focal point, which consequently predefines the array of available data. Then, it threats urban areas as a whole, without the special concern of some micro-urban zones or architecture-level elements. Despite this limits, it possesses a future-oriented section, related to the future urban expansion in the mean of land use (Fig. 4).

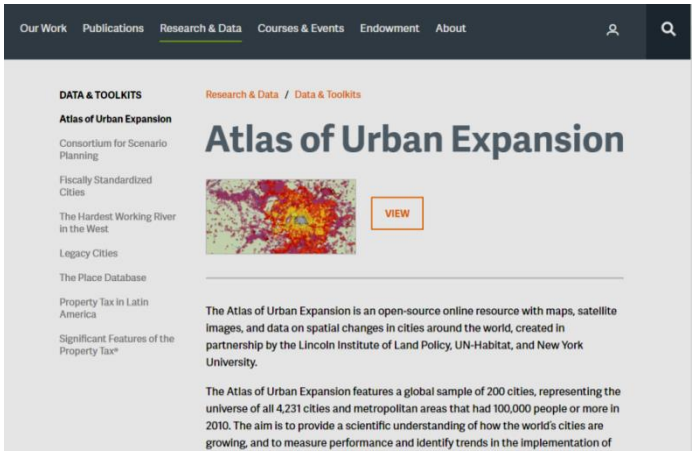

Fig.4. *The main page of the Atlas of Urban Expansion (Source: https://www.lincolninst.edu/research-data/data/atlas-urban-expansion).*

The third atlas is the "ENVIRONMENTAL HEALTH ATLAS" which is developed by Dutch government bodies for the space of the Netherlands. It generally presents information about the living environment to citizens as clearly as possible [15]. As it is stated at the website,

the focus of the atlas is environmental themes, such as climate, air, noise, health or nature. Nevertheless, it goes beyond these limits, including the other themes: soil, construction, heritage, night-time illumination, spatial areas, water, safety, and leisure (Fig. 5).

All the mentioned sections of the atlas are organised as sections with detailed maps. The content of these maps can overlap, which is an advantage. However, the main issue is that map content is not fully digitalised. For example, "Heritage" Section contains four thematic maps: (1) national monuments, (2) urban and village conservation areas, (3) world heritage sites and (4) the map of the indicative sites of archaeological value. Items on these maps are not interactive or geo-tagged; they are simple objects on these maps differentiated by side-legend and if someone wants to find more information, for instance, about some monument or protected urban zone clicking on its object, nothing happens (Fig. 6).

Fig.5. *The map content of Environmental Health Atlas of the Netherlands (Source: https://www.atlasleefomgeving.nl/en/explore).*

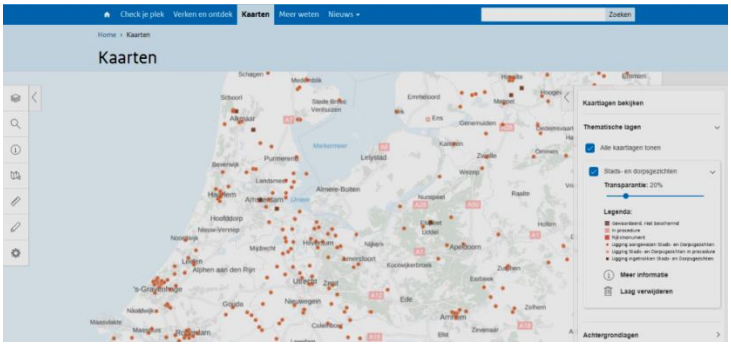

Fig.6. *Environmental Health Atlas – the map of urban and village conservation areas. Objects (dots) on the map are not interactive (Source: https://www.atlasleefomgeving.nl).*

The last presented example is not named as an *atlas*. This is "CITY POPULATION" digital database. Apart of this; it is also a private-led project, developed by Thomas Brinkhoff. Following the name of the digital database, it is obvious that it refers to the maps of population data. Concretely, the mapped and "tabulated population figures are mostly based on census results and on official estimates" [11]. From its home page, this database presents the different means to present content: maps, lists, short data remarks, pies, tables, graphs, diagrams (Fig. 7).

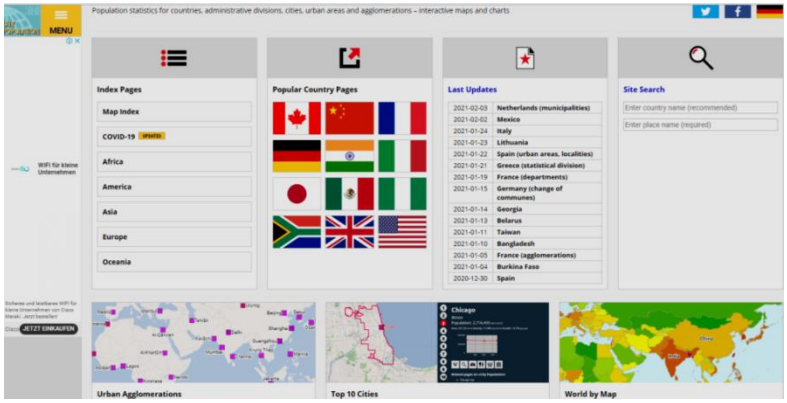

Fig.7. *The home page of the City Population digital database, which clearly presents different means to present content (Source: https://www.citypopulation.de/).*

The previous information means that the data relating to heritage is not included in the database content. However, it is more important to demonstrate how the content functions, because it allows the different scales and spatial levels, which ultimately can be adapted for the presentation of heritage sites of different scale (macro-urban, micro-urban or architectural). Each presented object (city) is interactive, i.e. geo-tagged; a click on it opens brief info about the tagged object on chosen demographic topic, while the side-list of the right moves to present the broader information about this city, including external links, such as the city pages on Wikipedia, Booking, etc. (Fig. 8).

Using the previously acquired inputs as criteria, the comparative analysis of the presented digital urban atlases can be scrutinized in the following table 1.

***Fig.8**. The interactivity of the City Population database on the example of the map of Bulgarian major cities, where the combination of mapping, listing and brief info about the geo-tagged object (Botevgrad) is given (Source: https://www.citypopulation.de/).*

***Table 1.** The comparative analysis of the presented digital urban atlases relating to the acquired criteria (Author: B. Antonić)*

CRITERION / ATLAS	C1: Small cities & towns	C2: Different datasets	C3: Heritage -level objects	C4: Showcases	C5: Interactive elements
1. Urban atlas	No.	No	No	Yes	No
2. Atlas of urban expansion	No	No	No	No	No
3. Environmental health atlas	Yes	Yes	No	No	No
4. City population	Yes	Yes/No	Yes	Yes/No	Yes

INSTEAD OF CONCLUSION – FURTHER DIRECTIONS FOR THE ATLAS CREATION

The first impression after the previous analysis is that digital atlases with urbanism-related content are still rare. However, it is even more evident from this analysis that almost all these atlases are, actually, 'partially digitalised'; even though individual maps are digitalised, objects on maps are rarely interconnected and geo-tagged. Moreover, two of presented atlases are solely oriented to big cities, which data is usually more available and exploited through web in general.

To conclude, the last 'atlas' – "City Population" Web Database – is the only one which has the elements required by settled criteria. In line with this conclusion, the structure of this digital source is used as the primary role-model for the preliminary algorithm of the structure of the DANUrB+ digital atlas (Fig. 9). This preliminary structure of the atlas follows the already adopted three-section division for the hardcopy atlas, but it also respects the different type of data relating to their presentation, which causes three other sections/functionalities: demographic, economic and spatial/morphological ones. This organisation enables a better interrelation (tagging) between maps, datasheets of heritage and other project elements, list of cities and towns, urban-morphological schemes, etc.

The preliminary structure of the atlas is just the first step to compile and create DANUrB+ digital atlas. It is expected that it will be further customised after two future steps; (1) after the data will be completely collected and organised, with the overview on all databases and (2) after the pilot web pages will be created, to understand how geo-tagging and interconnection work on the pilot.

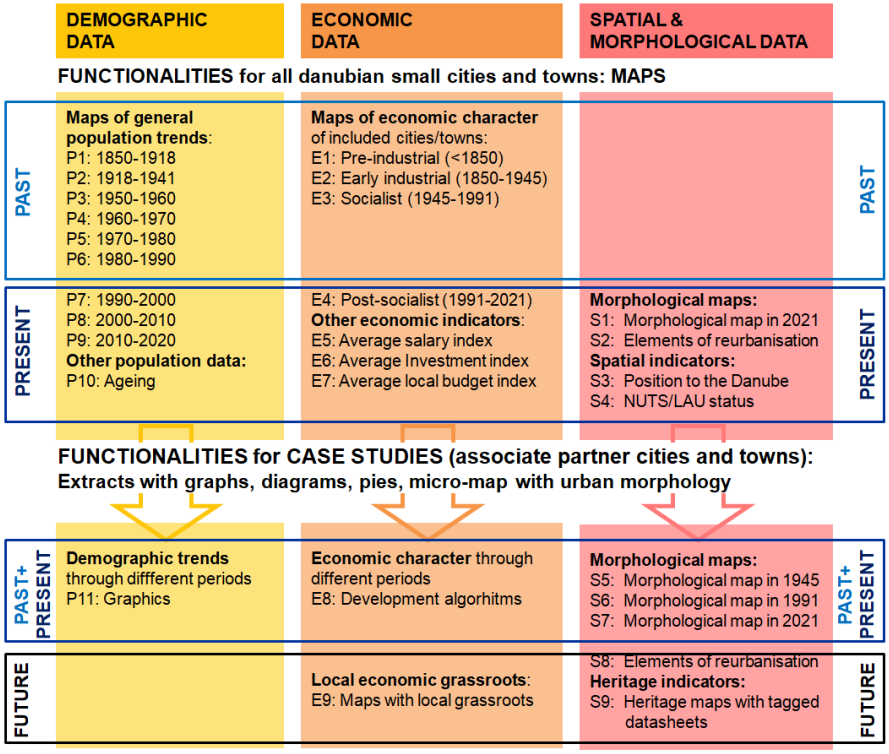

Fig. 9. *The preliminary algorithm of the structure of the DANUrB+ digital atlas of heritage cities and towns along the Danube (Paper authors)*

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