Project Smart SDI: Concept for Improving NSDI for Sustainable Development in Serbia

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Abstract. The recent advancements in the geospatial technologies domain, together with the rapidly growing number of various data collected through the different sources, have launched both global and local initiatives focused on the integration of those data using their locations. In public sector, the aim of these initiatives is to identify efficient approaches for the integration of location information with the public sector non-geospatial data, but also to enhance the usage of public sector geospatial data in general for decision-making and policies management towards the digital and green transformation of today's societies and economies. Thus, an important part of these public sector initiatives deals with the improvement of existing spatial data infrastructures (SDIs), and their integration within the emerging geospatial data spaces and ecosystems intended for the creation of new geospatial knowledge for better understanding of the specific development conditions and informed actions for the SDGs achievement on each location in future. Therefore, in line with the recently adopted European Strategy for data, national SDIs (NSDIs) that are establishing in Europe in accordance with the INSPIRE Directive since 2007 have as well to be improved and integrated into the future common data space for the European Green Deal objectives accomplishment. One of the mandatory or a high value datasets (HVD) that would support directly this new mission of NSDIs is a land use dataset, which is produced and managed following the INSPIRE standards within the spatial and urban planning system of each country. In Serbia, being responsible for the INSPIRE Directive implementation, Republic Geodetic Authority (RGA) has recently adopted the Strategic action plan (SAP) for Serbian NSDI improvement. For starting this SAP implementation, RGA has launched Project "Establishing Smart SDI in Serbia" and developed its concept in partnership with the Swedish counterpart, Lantmäteriet. As main part of this Project, which is supported by the Swedish SIDA, RGA plans generally to implement activities aimed at enhancing usage of the public sector geospatial datasets, particularly those listed as HVDs. Also, Project concept includes digitalization of the land use dataset needed for sustainable spatial and urban planning and development in Serbia, as well as further upgrading of the existing NSDI geoportal, Geosrbija, to a modern platform with the user-centric services and data-driven approach to the decision-making and policies management in line with the Green Agenda for the Western Balkans and SDGs in general.

Keywords: NSDI improvement · public sector geospatial data · land use dataset · sustainable development · Serbia

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O. Gervasi et al. (Eds.): ICCSA 2023 Workshops, LNCS 14105, pp. 549–560, 2023.
https://doi.org/10.1007/978-3-031-37108-0_35

1 Introduction: SDI Evolution

Since their first concept emerged more than 30 years ago, SDI systems' main task has been to provide access to the reliable, standardized and interoperable public sector geospatial datasets and related services, through the geospatial information geoportals to the prevailingly public sector users. In that long period, passing through the different phases of their development on the different administrative levels, so-called jurisdictions [1], these strictly supply-driven systems have been sometimes hard to access and overly rigid for usage by the non-geospatial user communities. Moreover, in recent years, public sector SDIs were even neglecting the new geospatial technologies, new geospatial data sources and large volumes of high-quality geospatial information (from Internet-of-Things, citizen-generated geospatial data, etc.), as well as a growing importance and usage of location for decision-making and daily operations both in public and private sector and for individual purposes [2, 3].

Therefore, relying on the recent advancements in both geospatial and Internet technologies, which today shifts towards Web 3.0 paradigm, it is a time to rethink and restructure public sector SDI systems for embracing the next generation of e-governance processes; user-centric technology platforms and services; application program interfaces (APIs); open data and open analytical software; and new stakeholder collaboration mechanisms. [2, 4] Instead of just providing the standardized public sector geospatial data and services, these future 'beyond SDI' systems as part of the emerging geospatial data spaces and ecosystems should focus on the creation of new insights and a contextual knowledge needed for the evidence-based or data-driven decision-making and policies management aimed at sustainable development on global and local level. For this socio-technical restructuring of existing SDIs to take place in a systematic way, UN-GGIM experts have launched the strategic Project "Integrated Geospatial Information Framework (IGIF)" [5]. As a result, already today the recommendations from this Project lead many countries' institutions and administrations through the digital transformation challenges in the public sector geospatial data and services domain.

Furthermore, the UN New Urban Agenda [6] as well as the Urban Agenda for EU [7] support the use of digital platforms, tools and geospatial information systems for improving a long-term integrated spatial and urban planning, land administration and management. In addition, European Green Deal recognizes the potential of digitalization and digital technologies as the essential enablers for green transformation, while the European Strategy for data emphasizes the digital components as critical ones for both green and digital transformation in Europe. [8] Based on that, it might be even concluded that the green transformation, targeted by the global SDGs and followed by the European Green Deal and Green Agenda for the Western Balkans, would demand the digital transformation, including the improvement of existing public sector SDIs, as a precondition.

Following above described developments, the aim of this article is to present context and Project concept for improvement of the existing national SDI (NSDI) in Serbia. For that reason, after the Introduction, next chapter provides relevant details about the European Strategy for data and its influence on the INSPIRE Directive modernization, which leads public sector geospatial data and related services development in Europe last 16 years. After the European level, the Strategic Action Plan (SAP) for the NSDI

improvement in Serbia is presented, followed by the description of used framework or criteria for defining the Project implementation activities for establishment of so-called Smart SDI. Next two chapters in this article, i.e. Project Smart SDI concept and Expected Project results, provide information on the identified Project impact, main outcomes, planned activities and expected outputs in the next 3 years of Project duration, before article finishes with the concluding remarks.

2 European Strategy for Data and INSPIRE Directive

More than a decade after C. Humby claimed that "data is the new oil", European Commission (EC) in a recently adopted 5-year European Strategy for data provides similar view by saying that "data is the lifeblood of economic development". As consequence, in order to take and keep position of "a role model for a society empowered by data to make better decisions – in business and the public sector", EC in this Strategy concludes that Europe Union (EU) should seize the opportunities offered by the ever-increasing production and use of data. In order to achieve this ambitious vision of EU becoming a leader in data-agile economy, this Strategy assumes a number of legal, technological, organizational and financial/investing measures that should be implemented in order for a single European data space -and Single market for data- to be created in accordance with the European values [9].

Also, despite the first electronic government initiatives and digitalization of public sector in general date back to mid 90s, this Strategy confirms that today there is not enough public sector data available for re-use [9], while data is a central to the digital transformation in Europe [8]. Thus, as part of this Strategy implementation, EC has already adopted the Implementing regulation on high-value datasets (HVDs) under the Open Data Directive [10], since HVDs re-use is associated with a significant benefits for the economy and society in general [8]. So, until the middle of 2024, this Implementing regulation is expected to support opening up of these key public sector reference geospatial datasets for free (like administrative units, buildings, cadastral parcels, land uses, etc.) in the machine-readable format, under the standardized open access licenses and through the Application Programming Interfaces (APIs) (besides a bulk download) [3, 8].

As a key part, European Strategy for data plans for the future single European data space to consist of the nine common European data spaces, including the Green Deal data space. (Fig. 1) For this data space to be functional, appropriate data-sharing tools, infrastructure and platform need to be established; data quality, availability and interoperability, particularly for those datasets identified as HVDs, should be secured; while appropriate governance framework and mechanisms should be created for all its stakeholders. Also, in order to stimulate the future use of data and demand for Green Deal-relevant services, EC is currently running "GreenData4All" and "Destination Earth" initiatives, which results would provide input for the INSPIRE Directive modernization and simplification [8, 9].

This forthcoming change of the INSPIRE Directive would lead also to evolvement of the NSDIs from complex and highly specialized geospatial data frameworks into the flexible, open, agile and self-sustainable national data ecosystems. [8] After improvement,

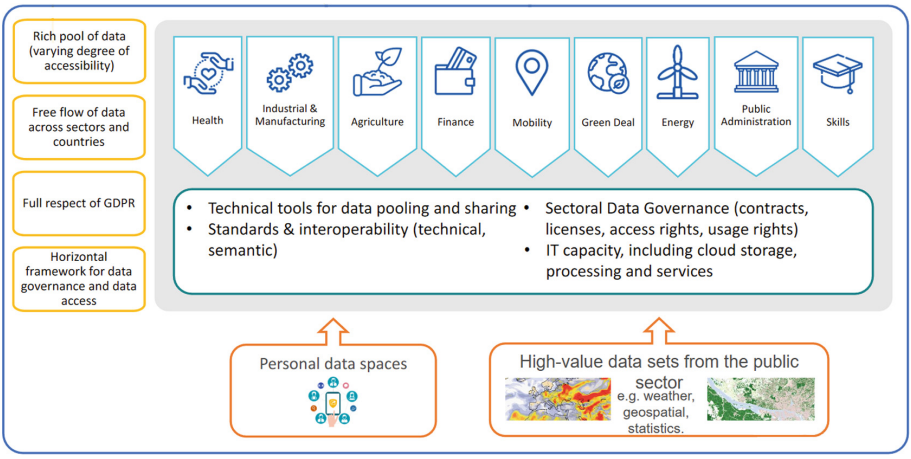

Fig. 1. High-level architecture of the common European data space consisting from the nine large sectoral data spaces[1] (source: Eurogeographics)

these future NSDIs are expected to blend within a larger data space on the European level, where different data users would be able to easily discover, access and use data for different purposes, like research study, policy-making or a business application. In addition, geospatial HVDs that would be part of these future NSDIs should provide a powerful means for integrating and combined use of the existing public sector non-geospatial datasets with the other geospatial datasets for gaining the new geospatial insights and knowledge that would be otherwise difficult to get [2, 4, 9].

Finally, based on the foreseen advantages, INSPIRE Maintenance and Implementation Work Program 2021–2024 [11] defines concrete first actions for transition of the INSPIRE into a sustainable data ecosystem for the environment in Europe. This Work Program includes thus actions on a technical level (like data encoding and sharing), but also actions related to the legal level (like avoiding over-specification and adoption of a simple licensing framework) and organizational (governance) level (like making communities of data users to be an integral part of the governance structure together with data providers).

Once modernized NSDIs become operational part of the geospatial data spaces and ecosystems in Europe, the improved availability and accessibility of various geospatial data would feed the novel application areas, such as Artificial Intelligence [12] and Digital Twins [13], which are important for the future sustainable spatial and urban planning and development in general.

2.1 Land Use Dataset and NSDI Improvement

The leading UN-GGIM's IGIF experts predict that by the time awareness about location as a common feature of virtually all information and, thus, a common basis for integration

[1] https://eurogeographics.org/wp-content/uploads/2022/02/7.-INSPIRE-Geoportal-JORDI-ESCRIU.pdf

of information from different sources and contexts would increase. [3] This is particularly important for the spatial and urban planning that relying on a data location and new geospatial technologies can deliver their long-term vision of planning as "a unique place-based systems approach to coordinate multisector efforts to deliver zero-carbon, environmental net gain, a circular economy and a green industrial revolution for a fairer society" [14].

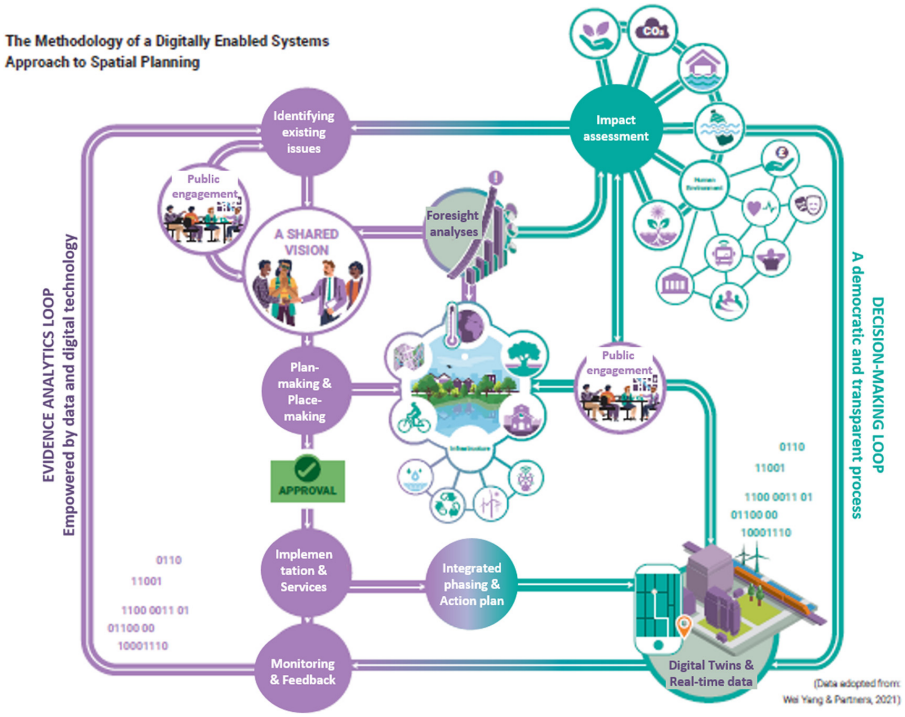

Fig. 2. Integrated digitally enabled spatial planning methodology: The new cyclic methodology for a digitally enabled approach to spatial planning would connect the decision-making loop with the evidence analytics or insight/knowledge creation loop [14]

On one side, this means that land use datasets as a main output of the spatial and urban planning process in each country, and one of the geospatial HVDs, would directly contribute to the capability of future NSDIs to support the meaningful data integration and getting the new geospatial insights and knowledge for the Green Deal achievement in Europe. On the other side, since decisions in the spatial and urban planning aimed at the sustainable development require the new methods and data advancement [14], improved NSDIs would in return additionally strengthen the planning process in every country. This new approach to the spatial and urban planning, which would be supported by Web 2.0 and emerging Web 3.0 paradigms, would trigger also emergence of a new, dynamic and people-centric cyclic planning methodology (Fig. 2), and shifting of the

current Planning 1.0 and 2.0 paradigms towards Planning 3.0, where the more responsive planning systems would dominate [4].

Finally, despite that spatial and urban planning and development are strongly tied to the information and communication technologies advancement, elements of previous planning paradigms (Planning 1.0 and 2.0) would likely to persist for many years to come. [4] However, once improved, NSDIs would strongly support sustainable development goals achievement, particularly on the local level, by creating the favorable conditions for centralizing data on one place –on emerging new organizational structure, so-called 'platform'- for the people-centric and data-driven decision-making and policy management [15].

3 Strategic Action Plan for NSDI Improvement in Serbia

In order to systematically improve the current NSDI into a modern SDI system, which would make public sector geospatial data and services open and easier to access by the different users, who would use them to satisfy their own and needs of society and economy in Serbia in general, RGA has adopted the Strategic action plan - SAP [16].

This document is developed using the UN-GGIM's IGIF project recommendations [10] and results of the beforehand prepared studies "Geospatial Alignment to Policy Drivers in the Republic of Serbia" and "Socio-Economic Benefits of Serbian NSDI"[2]. Therefore, aimed at the comprehensive transformation of the current NSDI, the SAP identifies the Key Action Points (KAP) for each of the nine IGIF's strategic pathways (Governance and Institutions; Policy and Legal; Financial; Data; Innovation; Standards; Partnerships; Capacity and Education; Communications and Engagement). Implementation of these KAPs would support accomplishment of the vision (Fig. 3), mission and identified goals for the future modern NSDI in Serbia, namely Smart SDI [16].

VISION

- To establish a value-based "SMART SDI" that strongly facilitates the access, sharing and use of geospatial data and services, responds to the current and future stakeholders needs for geospatial information, enables to apply the most relevant modern (smart) solutions, strengthens the national/regional cooperation and economic development, and enhanced quality of living conditions

Fig. 3. Vision for the Serbian NSDI transformation [16]

Among the overall 35 KAPs there are differences in the timing, cost and risk associated with their implementation. Besides that, variations among the KAPs relate to their mutual relationships or dependencies, important for the efficient and effective delivery of the expected outputs, as well as for successful achievement of the defined outcomes and common vision statement.

[2] https://en.rgz.gov.rs/scope-of-works/socio-economic-benefits-study-of-nsdi-impact-on-the-society-in-the-republic-of-serbia.

4 Framework for Project Concept Definition

In order to improve existing NSDI in Serbia, RGA in partnership with its Swedish counterpart, Lantmäteriet, has initiated a Project "Establishing Smart SDI in Serbia", and used the next framework or criteria to define an appropriate Project concept for supporting implementation of a Smart SDI envisaged in the SAP document:

- KAPs activities and outputs that are possible to be implemented in 3-year time, which could be solid basis for further NSDI improvement, i.e. SAP implementation [16];
- Activities identified within the Directive Specific Implementation Plan (DSIP) for INSPIRE Directive for Serbia (part of the Negotiation Chapter 27)[3];
- Specific needs and development priorities of the RGA and Serbia in general, particularly those included in the Sustainable Urban Development Strategy 2030 [17] and Program for the e-Government development in Serbia in period 2023–2025[4];
- Goals and priorities of the Strategy for Sweden's reform cooperation with the Western Balkans and Turkey for 2021–2027 [18]; and
- INSPIRE Maintenance and Implementation Work Program 2021–2024.

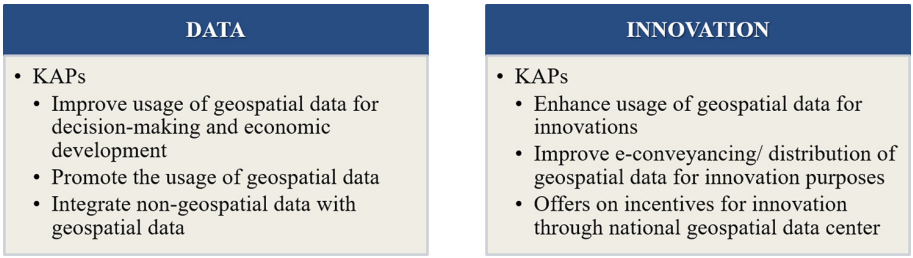

Fig. 4. Selected KAPs for implementation by the Project "Establishing Smart SDI in Serbia"

Following the criteria listed above, two SAP's strategic pathways (Data and Innovation) and their KAPs listed in the Fig. 4 have been selected as a good starting point for the improvement of NSDI in Serbia in general.

Besides KAPs in the Fig. 4., the activities defined within the other SAP strategic pathways would accompany them as part of the comprehensive socio-technical system approach to the transformation of NSDI into the modern SDI system in Serbia. These activities include: improving cooperation with the local self-governments (Strategic pathway: Partnerships); building capacity of all relevant NSDI stakeholders (Strategic pathway: Capacity and education); promoting the added value of the geospatial data usage (Strategic pathway: Communication and engagements); etc.

[3] Access restricted.

[4] In adoption procedure.

5 Project Smart SDI Concept

In order to comply with the previously described geospatial data and technologies trends for the public sector in Europe, and implement the relevant European policies and other development priorities as part of the Serbia EU integration process, RGA together with Lantmäteriet have launched the already mentioned Project "Establishing Smart SDI in Serbia" (Project Smart SDI). This Project, which is today still in the concept form, is going to be implemented in period January 2023 - December 2025, and its activities would be budgeted by the Swedish SIDA with up to 25 million SEK.

The first phase of this Project implementation, so-called Project inception phase, would last until the middle of the first Project year (2023), and would include detail Project planning[5] according to the SIDA project methodology.

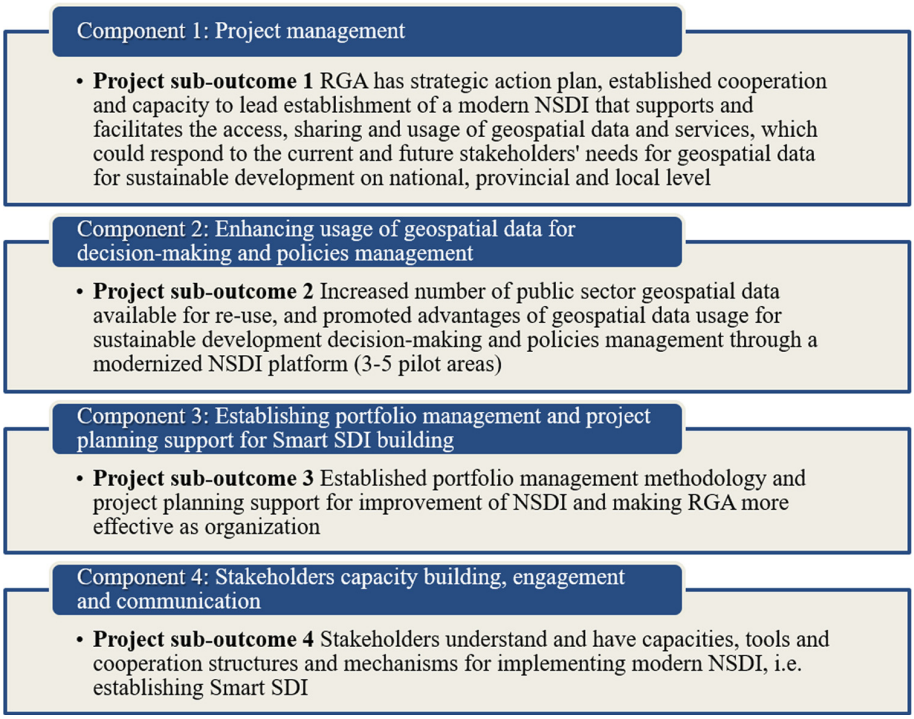

Fig. 5. Project components with their sub-outcomes

Project impact or main outcome to be reached after the 3 years of Project implementation is defined as:

National, provincial and local level public administrations in Serbia are making efficiently and transparently decisions in democratic and socially inclusive manner about

[5] Project concept is currently under elaboration by the RGA and Lantmäteriet, so the final list of Project activities was not available at the moment of writing this article.

development activities that improve quality of work and life environment for all citizens through sustainable usage of available land and other natural and manmade resources, processes and services.

The Project main outcome would be achieved by the implementation of different activities grouped under the four Project components that are focused on the accomplishment of four Project sub-outcomes presented above in the Fig. 5.

6 Expected Project Results

While the outcomes of Component 1, 3 and 4 could be generally described as supportive ones for both Project implementation and establishing the right culture and capacity of the social subsystem for modernizing NSDI in Serbia, the outcome of Component 2 would directly contribute to the transformation of current NSDI system. In other words, the assumed outputs from the Component 2 are expected: 1) to create advantages of the future NSDI model and enhance usage of geospatial data and technologies for decision-making and policies management towards the sustainable development; and 2) to stimulate implementation of the other KAPs defined in the SAP document in coming years.

Due to their importance for the technical perspective of planned NSDI modernization, the expected activities and three main results from the Component 2 are outlined below.

Creation of a New Public Sector Geospatial Dataset by Digitalization
Creation of a new public sector geospatial dataset, namely land use dataset, which is categorized as HVD, is planned to be one of the main Project outputs. Since the Project time constraint, this dataset is planned to be created by digitalization of the land uses data for 3–5 pilot spatial and urban plans within the jurisdictions of selected local self-governments, following the relevant INSPIRE standards. Advantages of this pilot land use dataset, and its capacity to support the evidence-based or data-driven sustainable development decision-making, would then be promoted through use case(s) already identified in the SAP, like: transformation and standardization of spatial and urban planning process (targeting SDG 11); process of property legalization (targeting SDG 1.4); support infrastructure projects implementation (highways, railways, infrastructure objects etc.); etc.

Creation of New Public Sector Geospatial Dataset by Integrating Existing Non-geospatial with Geospatial HVD Dataset
This project output would include creation of a new public sector geospatial dataset by integrating one of the already available RGA's HVDs with existing public sector non-geospatial data using their location information, like statistical data, data on energy passports for buildings, SDG indicators data, etc. Also, advantages of the geospatial dataset(s) created in this way as well as their usage for the different purposes, i.e. use cases, would be promoted.

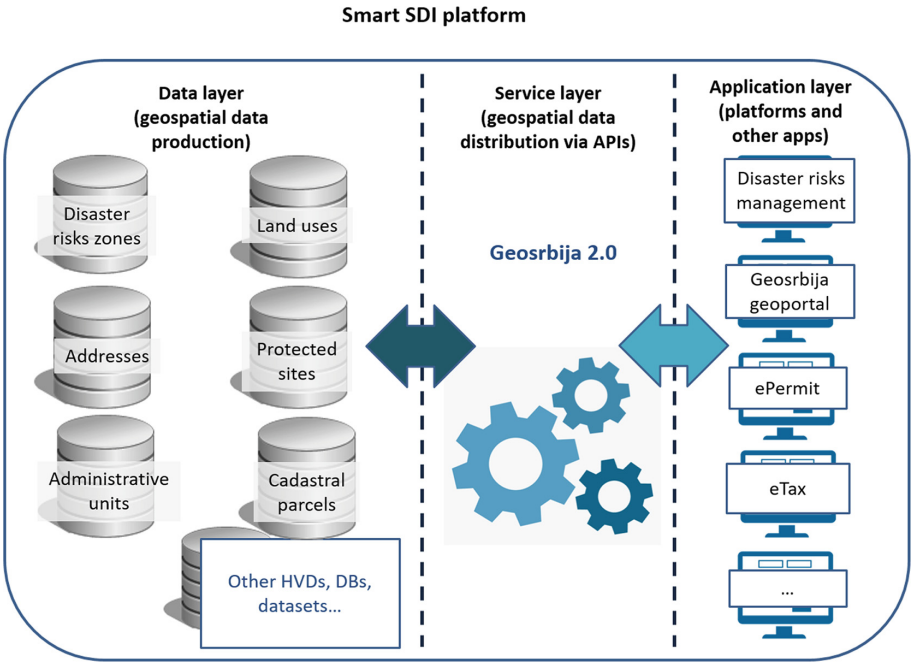

Fig. 6. Future Smart SDI platform

Smart SDI Platform

In line with the increasing demand for re-usable public sector geospatial datasets and services, Project results would include further improvement of the existing NSDI geoportal, Geosrbija, towards the establishment of a modern NSDI platform advantages. This improvement or upgrading of the current Geosrbija geoportal would be focused on establishing the user-friendly platform with the user-centric services, data sharing tools based on APIs and new collaboration services for stakeholders (for co-creation, crowdsourcing, etc.), in line with the SAP solutions as well as foreseen results of the "GreenData4All" initiative, i.e. modernized INSPIRE Directive. (Fig. 6) This upgraded platform, along with the other simplifications and modernization on organizational, legal and financial levels as described in the SAP, should form a solid basis for future green transformation-oriented data space and ecosystem establishment in Serbia towards the Green Agenda for the Western Balkans (and Green Deal) accomplishment.

Finally, besides these three Project outputs on the technical level, other planned Project results would include building appropriate organizational and legal framework for the NSDI modernization, like: establishment of appropriate governance framework for Smart SDI stakeholders; capacity building of RGA and other stakeholders; promotional events for building awareness on the importance of geospatial data; etc.

7 Conclusions

In order to the improve access and enhance usage of the public sector geospatial datasets and related services by the increasingly diversified end-users community, which today demand location-based information to satisfy their various needs, RGA has launched the 3-year Project "Establishing Smart SDI in Serbia". Concept of this Project is based on the recently adopted SAP for the improvement of NSDI in Serbia, which structure and content followed results of the UN-GGIM's IGIF project, as well as provided strategic directions of the European Strategy for data and INSPIRE Directive, related to existing NSDIs modernization and simplification. These improvements of NSDI are needed to support integration of all available public sector data that can contribute to the right decision-making and policies management towards the evolving digital and green transformation in Europe and on global level, which connects today the increasing number of stakeholders from the different sectors, both in developed and developing countries. Once NSDIs and other geospatial initiatives improve and integrate into the future sustainable geospatial data spaces and ecosystems, the new advancements in the geospatial technologies domain are expected to provide a new boost to the sustainable development and SDGs accomplishment on each location, by creating the new geospatial insights and contextual knowledge for the right decision-making. In this aspect, specific focus in future would be on the spatial and urban planning that, due to the support by rapidly developing geospatial and related technologies, would become truly dynamic and more responsive.

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