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Digitally-enabled Development for a Sustainable Future in Eastern Europe

Engaging Stakeholders in Eastern Europe for a Sustainable Future

Edited by Milan Kilibarda, Alexander Kotsev, Vlado Cetl

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Joint Research Centre

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The report is edited by Milan Kilibarda, Alexander Kotsev and Vlado Cetl

1 Introduction

Digital technologies are profoundly changing our societies. They produce innovation in all sectors of the economy, including agriculture, industries and services. Digital technologies are expected to be a strategic policy area for a number of years to come and there is an urgent need to be able to identify and address current and future challenges for the economy and society, evaluating impact and identifying areas requiring policy intervention. The Joint research center has produced a report on digital transformations in a selection of policy areas covering transport, construction, energy, and digital government and public administration (Baldini et al., 2019). Emerging trends such as the Internet of Things (IoT) and data proliferation combined with digital platforms and artificial intelligence altogether act as key enablers for digital innovation. At the same time, innovation cycles are accelerating, services innovation is gaining importance and collaborative innovation matters even more. Sector-specific dynamics are driven by differences in opportunities such technologies offer for innovation in products, processes and business models, as well as differences in the types of data needed for innovation and the conditions for digital technology adoption (Paunov, 2019).

Digital technologies act as a catalyst to development and, if harnessed, can help reverse negative trends in the Eastern European region. Still, good practices are fragmented and rooted to a particular, often local context, which does not permit the region to fully benefit from the multitude of opportunities. Considering those bounding conditions, the organizers of the conference brought together a variety of stakeholders, representing the public sector, civil society, academia, and business, in order to (i) exchange good practices, (ii) establish partnerships, and ultimately learn from each other.

The phenomenon of digital transformation is very broad, therefore, the attention of the event focused on the following domains: regional and spatial planning, next-generation farming, smart cities and governance of land tenure.

Within this context, the international conference on "Digitally-enabled Development for a Sustainable Future in Eastern Europe", co-organised by the Republic Geodetic Authority (RGA), European Commission Joint Research Centre (EC JRC), the World Bank (WB), United Nations Food and Agriculture Organization (UN FAO), United Nations Committee of Experts on Global Geospatial Information Management (UN GGIM) and United Nations Economic Commission for Europe (UNECE), was convened in Vrdnik, Republic of Serbia, from 18-20 September 2019. The Conference was opened by the Honourable Minister Nenad Popović, Minister Responsible for Innovation and Technological Development, and hosted by the Republic Geodetic Authority, the conference included more than 200 participants from 20 countries, and international organisations.

With more than 40 speakers contributing, participants discussed the impacts of digital technologies from global, regional, national, and local perspectives; and provided examples demonstrating digital transformation and good practices in Eastern Europe, with a focus on sustainable data sharing and utilisation. These examples were framed by progress on, and the linkages between, the emerging Integrated Geospatial Information Framework (IGIF), the INSPIRE Directive, and National Spatial Data Infrastructures (NSDIs) being developed and managed by countries.

The highlights of the 31 presentations of the event are included in this JRC report, emphasising the focal and the common points among the core topics of the conference. The content of the report is divided into the following four groups of abstracts:

- **Transformative technologies**. This part starts with an overview of disruptive technologies followed by topics related to geospatial intelligence, blockchain, artificial intelligence applications in agriculture, and ends with an abstract related to digital transformation and data-driven innovation in the EU.
- **Integrated Geospatial Information Framework and INSPIRE**. The second part of the report covers novelties related to the Infrastructure for Spatial Information in Europe (INSPIRE), the Integrated Geospatial Information Framework (IGIF) in general, its linkages to INSPIRE, and the progress in the establishment of NSDIs in Ukraine, Georgia and Moldova.
- **Digital transformation in Serbia**. Part three provides good examples of digital transformation in Serbia in the public sector with an emphasis on emerging practices in the Republic Geodetic Authority and from the private sector showing examples of digital transformation in agriculture.
- **Digital transformation – Good practices from Eastern Europe.** The final group covers several concrete examples of digital transformation related to blockchain, smart cities, agriculture, education, cybersecurity, video identification and NSDI in Eastern Europe.

2 Conference highlights

2.1 Transformative technologies

2.1.1 Disruptive technologies and their impacts

Prof. Joep Crompvoets, KU Leuven, Belgium

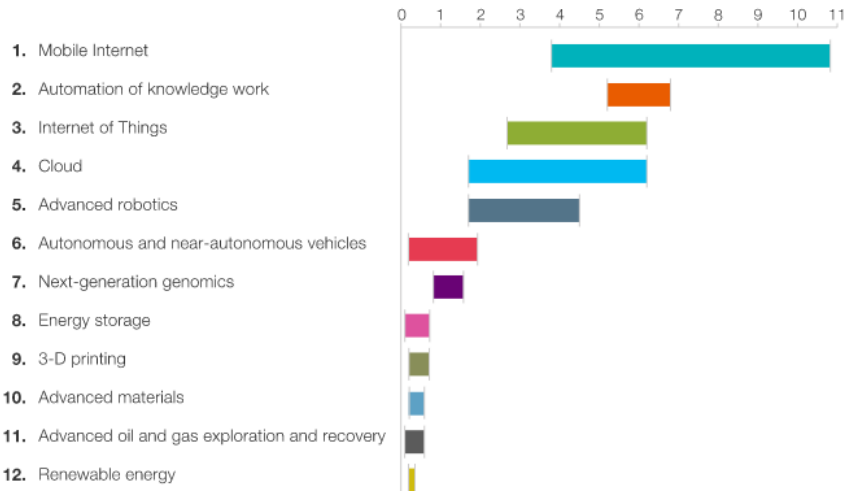
Disruptive Technologies can be defined as technologies that unexpectedly displace established technologies.

Overall, disruptive technologies are new and they may turn out to be valuable. Although, it would be wise not to expect miracles and radical changes from these technologies.

Concrete impacts generated by the usage of disruptive technologies could be achieved by appropriate investments in education, network expansions, relevant data, and analytics tools.

A current buzzword in our society is Disruptive Technologies, which can be defined as technologies that unexpectedly displace established technologies. The PC, e-mail, cell phones, and social media are past examples of technologies that make the existing ones obsolete. The following technologies are considered as the current disruptive technologies: Mobile internet, Cloud technology, Internet of Things, Renewable energy, advanced robotics, and 3D printing. Many of these technologies are strongly location connected. In order to review the impact of these geo-technologies, it is important to understand what is really meant with disruptive technologies and ask ourselves if these technologies are really so disruptive. The presentation aims to explore what the implications of disruptive (geo)technologies are for individuals, organisations, economies and governments. Overall, disruptive technologies are new and they may turn out to be valuable. Although, it would be wise not to expect miracles and radical changes from these technologies. Finally, it is important to think carefully about how to use specific disruptive technology. Successful usage with a certain level of impact could be achieved by appropriate investments in education, network expansions, and relevant data and analytics tools and skilled people to use them.

Figure 1. Estimated potential economic impact of technologies across sized applications in 2025, $ trillion, annual



Source: McKinsey Global Institute

2.1.2 Access and analytics, Unlocking geospatial information

Iain McInnes, Maxar

"Satellites can cover way more ground at a much faster pace than humans, drones or aircraft. While satellites provide imagery, it is the scientists on the ground who turn it into something useful." (Dr. Andrew Davidson, Earth Observation, Agriculture and Agri-Food Canada)

Earth observation has a unique vantage point, providing the context and location intelligence required for the planning, use of and development from a plethora of interconnected devices and services.

Today, the geospatial sector is undergoing some profound changes. Thanks to the power of the cloud platforms, extensive experience in image processing and innovative machine learning approaches, users can now extract information at scale from geospatial data.

Geospatial Big Data converts millions of square kilometres of imagery to structured information that can be queried, indexed, and leveraged to provide deeper insight and understanding. Computer vision algorithms can locate every car, plane or baseball field, identify every building and map all the crops and minerals on the surface of the Earth. When the computers cannot figure it out, Maxar turns to the crowd.

Over the last 16 years, Maxar high-resolution imagery has been an indispensable source to extract geospatial information accurately and timely all over the world. Thanks to a world-class constellation of high-resolution imaging satellites, Maxar has constantly pushed the boundaries in providing extremely accurate data and new ways to see the planet we live in.

Our planet is changing at a rapid pace, creating challenges that have global impacts; understanding this change is essential if we want to save time, resources and even lives. Earth observation has a unique vantage point, providing the context and location intelligence required for the planning, use of and development from a plethora of interconnected devices and services.

What if you could not only see the world on a daily basis but also understand it? Geospatial Big Data converts millions of square kilometres of imagery to structured information that can be queried, indexed, and leveraged to provide deeper insight and understanding. Every day, Maxar collects over 4 million sq.km of high-resolution imagery, complete with super-spectral information. This creates an immense opportunity not only to see the globe but also to understand it. Computer vision algorithms can locate every car, plane or baseball field, identify every building and map all the crops and minerals on the surface of the Earth. When the computers cannot figure it out, we turn to the crowd.

Figure 2. Analysis Ready Clarity, car counting example on the left and crowdsourcing example on the right.

Car counting example: False positives/negatives reduced by 33%!

Crowdsourcing example: Lighting pole extraction error decreased from 50% to 10%!

Source: Iain McInnes, presentation during the "Digitally-enabled Development" conference, 18.09.2019

Today, the geospatial sector is undergoing some profound changes. The ability to rapidly analyse large amounts of data together with its increasing availability is bringing new users and creating innovative applications that a few years ago were not feasible. Thanks to the power of the cloud, extensive experience in image processing

and innovative machine learning approaches, users can now extract information at scale from geospatial data. During this presentation, I will explore some of the use cases that advanced machine learning and AI is enabling and demonstrate how space derived earth observation information can map and shape our understanding of the world through Maxar's GBDX big data platform.

2.1.3 Artificial intelligence for agriculture

Carlos Bravo, United Nations Food and Agriculture Organization (UN FAO)

There have been tremendous improvements in the tools used to develop AI-based technologies, such as machine learning. In addition, there is now a large availability of stored data from IoT sensors and smartphones.

AI is important for agriculture to improve production efficiency in order to overcome the challenge of feeding a continuously growing population. AI in agriculture can be divided into three categories: (i) advisory services (chatbots, mobile apps, forecast & simulation); (ii) precision agriculture (combination of services interconnected); (iii) automation/robotisation.

Currently, AI in agriculture still requires men to design strategies. The challenge for the coming years is to design platforms and develop technologies that can suggest and implement the best strategies for the farmer.

Other challenges faced by AI developers are: (i) how to make it available for everybody? (ii) how to make jobs better and not fewer jobs? How to avoid machines biases? How to solve data ownerships, privacy and tenancy issues?

Figure 3. John Deere solutions on precision agriculture

Source: Carlos Barvo, presentation during the "Digitally-enabled Development" conference, 18.09.2019

2.1.4 Blockchain technology and distributed secure document storage

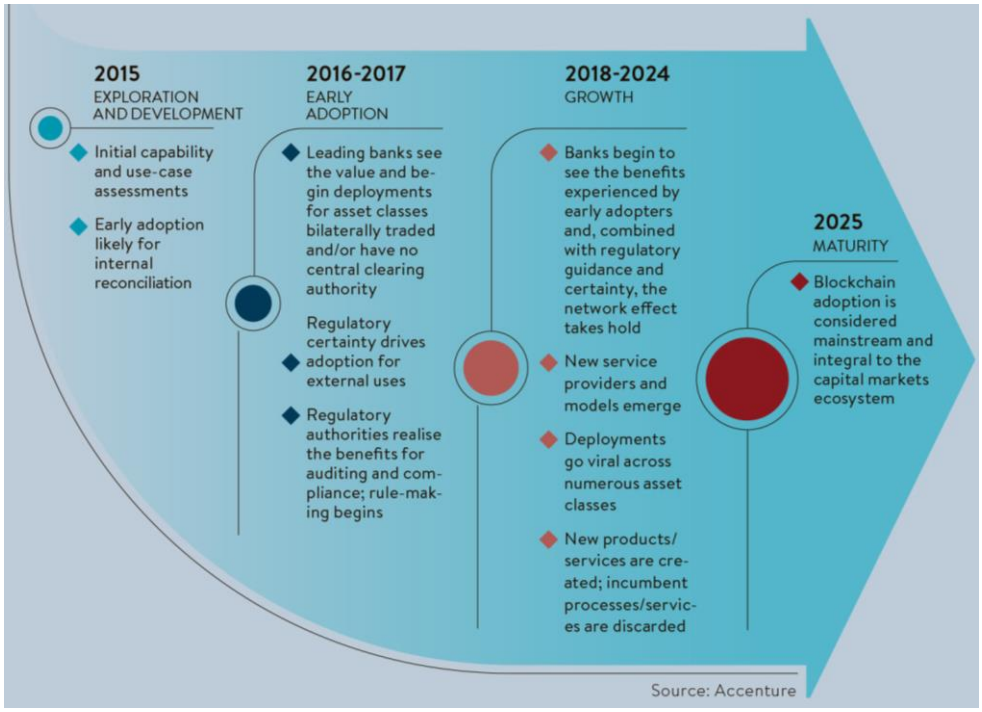
Prof. Dušan Gajić, University of Novi Sad

A blockchain is a distributed data structure, which implements a distributed ledger. It is composed of a chain of cryptographically linked blocks containing sets of transactions. It can be used for efficient management of transactions of assets or other data without the need for the central authority in which everyone needs to trust.

Blockchain is unique among distributed databases for the following reasons: (i) It only allows changes if several parties independently can agree on which changes need to be made (ii) it distributes all the data among multiple peers; (iii) every change is stored permanently and is cryptographically protected from being altered and can't be deleted without destroying all the data.

Storage of land registry documentation represents an almost perfect use-case to prove blockchain's potential as these documents are the principal guarantors of ownership over real estate (87% of the world's total wealth). Blockchain can provide new value for solutions for the storage of land registry documentation through the improvement of the following features: (i) replication, by using a distributed file storage system; (ii) counterparty-guaranteed integrity; (iii) tamper-resistance; (iv) access and leak control.

Figure 4. Possible blockchain technology adoption development



Source: Accenture https://www.raconteur.net/business-innovation/the-future-of-blockchain-in-8-charts

2.1.5 Digital transformation and data-driven innovation. A European Union perspective

Alexander Kotsev and Vlado Cetl, European Commission, Joint Research Centre

Right now, we benefit from many more sources and types of data such as big data, real-time data, personalized and high precision data.

The public sector has a new collaborative role to ensure safe data-driven innovation, including coordination of data sharing arrangements and quality assurance (i.e. validation and certification)

Several are the examples of European data portals: European Data Portal, EU Open Data Portal, JRC Data Catalogue, INSPIRE Geoportal.

Open data are not enough, as they are often heterogeneous, thus we need standards and tools to support the implementation of data.

It is crucial to be able to access open data in an easy way through Application Programming Interfaces (APIs) that enable machine-to-machine communication.

API solutions can facilitate governmental interaction in multiple ways both internal and external stakeholders such as business actors and consumers.

Context

The potential of digital technologies, if harnessed, would be instrumental for improving the quality of life of citizens, the growth of our businesses, and the protection of our environment at all levels, ranging from the local to the global. At the same time, if the opportunity to benefit from new developments such as big data, AI, and robotics, is missed governments will fail to meet the high expectations of citizens.

A lot has already been done by the EU and its neighbours in harnessing the potential of digital technologies. When entering into office in 2014, the Juncker Commission identified the completion of the Digital Single Market as one of its 10 political priorities. It is built on three pillars:

- better access for consumers and businesses to digital goods and services across Europe;
- creating the right conditions and a level playing field for digital networks and innovative services to flourish;
- maximising the growth potential of the digital economy.

Since then, 30 legislative proposals on the Digital Single Market were made, and 28 of these have been agreed upon by the co-legislature. The impact is already visible in the areas of Digital Connectivity, Digital Culture, Digital Future, Digital Life, Digital Trust and Digital Shopping.

Horizon 2020 was the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (between 2014 and 2020) – in addition to the private investment that this money attracted. The ICT innovation strategy under Horizon 2020 focuses on ensuring that the rapid changes occurring in ICT technology develop into tangible benefits for European citizens.

Emerging Trends

The new European Commission focuses on six headline ambitions for Europe over the next five years and well beyond (von der Leyen, 2019). Within the context of the Vrdnik event around the topics of Digital Transformation and Sustainability, the following two play a particularly prominent role:

- A European Green Deal
- A Europe fit for the digital age

Under these headlines, many of the concrete aims of the incoming Commissions and the priority projects for its first 100 days in office are highly relevant to the goals of your workshop. Firstly, becoming the world's first climate-neutral continent is the greatest challenge and opportunity of our times. It involves taking decisive action now. We will need to invest in innovation and research, redesign our economy and update our industrial policy. To help us achieve this ambition, the new Commission will propose a European Green Deal in its first 100 days in office. This will include the first European Climate Law to enshrine the 2050 climate-neutrality target into law.

Secondly, Europe should aim at grasping the opportunities from the digital age within safe and ethical boundaries. Digital technologies, especially Artificial Intelligence (AI), are transforming the world at an unprecedented speed. They have changed how we communicate, live and work. They have changed our societies and our economies. Data and AI are the ingredients for innovation that can help us to find solutions to societal challenges, from health to farming, from security to manufacturing. A report by the EC JRC investigates the topic of AI from a European Perspective (Craglia et al., 2018).

At the same time, we need to rethink education by using the potential the internet provides to make learning material available to all, for example by the increased use of massive open online courses. Digital literacy has to be a foundation for everyone. Europe mainly through its Erasmus+ programme (EC, 2019a) is working on improving digital skills for both young people and adults.

Clearly, the policies of the new Commission will also be accompanied by funding programmes that have been proposed as part of the next long-term EU budget – the Multiannual Financial Framework:

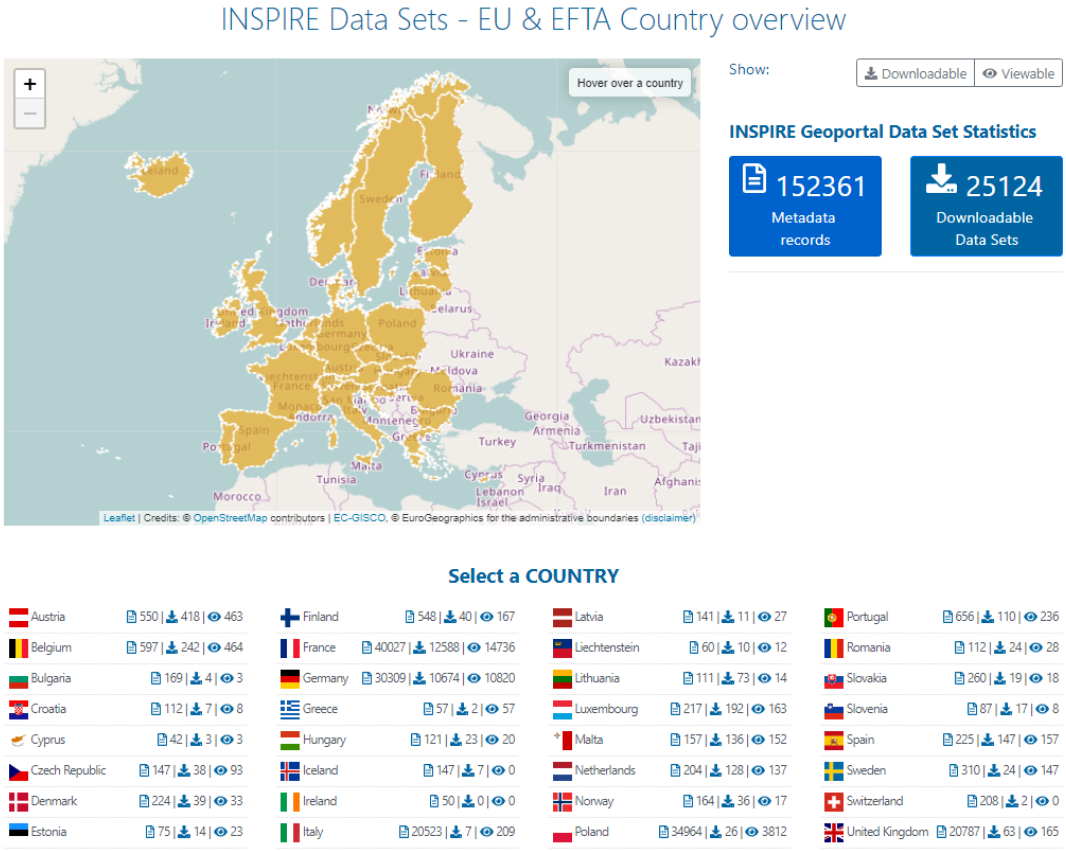
- Horizon Europe – an ambitious research and innovation programme to succeed Horizon 2020 that is conceptualised around the concept of well-defined missions such as 'adaptation to climate change including societal transformation', 'cancer', 'Healthy oceans, seas, coastal and inland waters', 'climate-neutral and smart cities', and 'soil health and food' (EC, 2019b),
- the Digital Europe Programme – a dedicated programme focused on building the strategic digital capacities of the EU and on facilitating the wide deployment of digital technologies, to be used by Europe's citizens and businesses. It will boost investments in supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society. Its goal is to improve Europe's competitiveness in the global digital economy and increase its technological autonomy.

Digital Data

Within this complex techno-economic landscape, data plays an increasingly important role. Data has become a crucial part of the economy, not only in the ICT, but in all sectors. Not only are the volumes of data exponentially increasing, but also the heterogeneity of the sources is higher than ever. Over the past two decades, data infrastructures have been set up across Europe to support the sharing and reuse of data, e.g. for geospatial data through INSPIRE (see Cetl et al, 2019), or open government data. The establishment of the Copernicus programme with its six core services is contributing substantial volumes of observation data and information products that help users build innovative products. When fully operational, Copernicus will generate more than 25 PB of data and will thus comprise the largest environmental satellite system ever built (Bai et al., 2017).

While those infrastructures helped unlock considerable resources from the public sector (see, e.g. the EU INSPIRE Geoportal - Figure 5) emerging trends such as 'data ecosystems' and 'data spaces' bring under the same umbrella a plethora of actors not limited to the public domain (e.g. citizen scientists, private data sources and data integrators, cloud providers). It is still to be seen how those emerging trends are scaled and spread across Europe, but for sure that would require the collaborative effort of multiple stakeholders at all levels of data governance ranging from the local all the way to the European and global.

Figure 5. INSPIRE Data Sets – EU Country overview



Source: INSPIRE Geoportal, https://inspire-geoportal.ec.europa.eu/

2.2 Integrated Geospatial Information Framework and INSPIRE

2.2.1 What's new in INSPIRE

Alexander Kotsev and Vlado Cetl, European Commission, Joint Research Centre

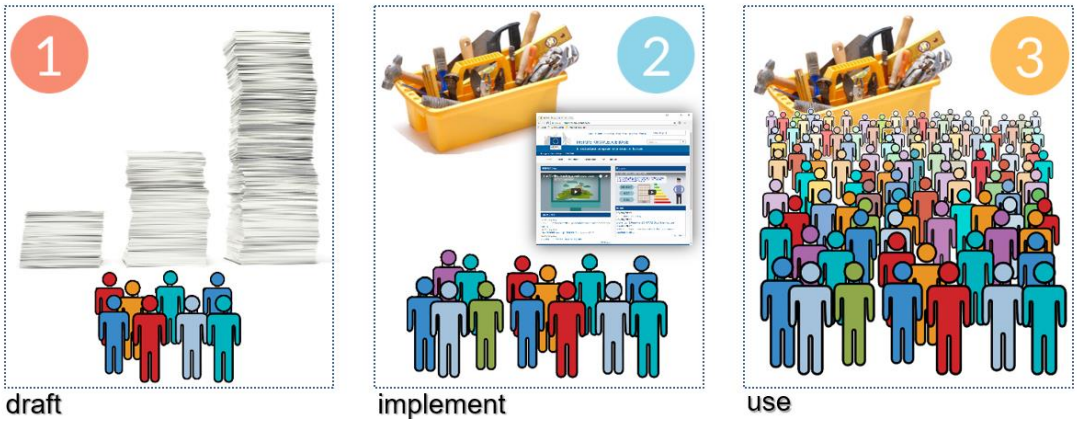
A proposal for an EC Regulation on the "alignment of reporting obligations in the field of environment policy" was adopted on 31 May 2018. The adoption of the alignment proposal is replacing the tri-annual implementation report by an annual update of the summary report (country fiche).

The new INSPIRE reporting decision was adopted in August 2019. The aim is to simplify & streamline monitoring and reporting, support a better comparison of the implementation progress across Member States. As well, it reduces the number of indicators from 48 to 19 calculated based on the metadata for spatial data sets and spatial data services already created and published by Member States.

INSPIRE short term goals (2019-2022) are: (i) build a basic EU capacity for sharing data to build on; (ii) to finalise ongoing work regarding IR updates, Geoportal and validation tools, and simplification of network services to support existing and emerging technologies; (iii) showcase the usage of priority data sets and wider core data sets in European and National use cases; (iv) data sharing and licensing.

After 2022 INSPIRE will work towards developing a spatial data ecosystem for sustainability, exploring the options to align or merge with other digital initiatives and enlarging the scope including other partners. As well, to create a package of measures and a new multi-annual work programme to implement them.

Figure 6. Inspire phases of development



Source: Alexander Kotsev, Presentation at the Digitally-enabled Development conference, 19.09.2019.

2.2.2 Integrated Geospatial Information Framework and linkages to INSPIRE-Unlocking benefits

Greg Scott and Tomaz Petek, United Nations Committee of Experts on Global Geospatial Information Management

The Integrated Geospatial Information Framework (IGIF), developed by the United Nations Statistics Division and the World Bank, provides a basis, a reference and a mechanism for countries when establishing or strengthening their national geospatial information management arrangements and related infrastructures.

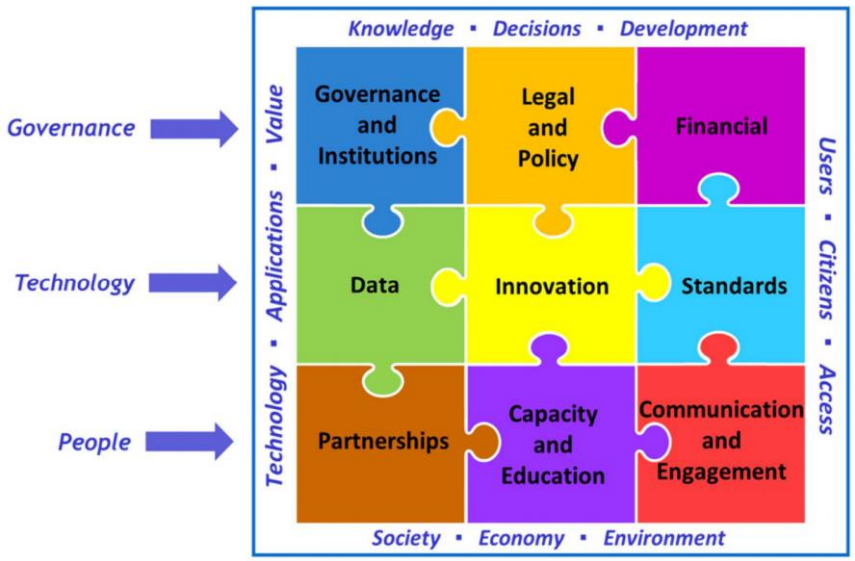
The IGIF comprises a 3-part document set as separate, but connected, documents: (i) the Overarching Strategic Framework, fully developed following a global consultation' (ii) the Implementation Guide are developed for in' (iii) The Country-level Action.

The IGIS makes concrete recommendations on establishing national geospatial information management and how to use the resulting information. As well, it calls for partnerships with civil society, businesses, and academic institutions who have access to relevant data and technology.

The activities of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) and the work of UN GGIM Europe Working groups focusing on increasing data interoperability and harmonisation by proposing core geospatial data, which meets essential user needs, are described here. This paper also provides the main characteristics of core data with a focus on the recommendation for content. This activity aims to help decision-makers (from governments, data producers, national coordination bodies, etc.) to define their policy regarding the improvement of existing data and the production of new geospatial data. It addresses digital data.

In August 2018, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) adopted the Integrated Geospatial Information Framework (IGIF), which was jointly developed by the United Nations Statistics Division and the World Bank under a collaborative arrangement. The IGIF comprises three separates but connected documents. The Overarching Strategic Framework has been completed and adopted by UN-GGIM at its eighth session in August 2018.

Figure 7. Nine strategic pathways for the Framework



Source: Greg Scott, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

The Integrated Geospatial Information Framework provides a basis, a reference and a mechanism for countries when establishing or strengthening their national geospatial information management arrangements and related infrastructures, or to coordinate activities to achieve alignment between and across existing national capabilities and infrastructures. The Framework aims to translate high-level concepts to practical implementation guidance and does this by leveraging seven (7) underpinning principles, eight (8) goals and nine (9) strategic pathways as a means for governments to establish and maintain more effective geospatial information management arrangements. The Implementation Guide will provide the specific guidance and

recommends actions to be taken by the Member States to establish, improve or strengthen their national arrangements in geospatial information management, systems and infrastructure.

Integrated Geospatial Information Framework is:

• UN and World Bank collaborative roadmap to help governments develop, access, and use geospatial information to make effective policies and more accurately direct aid and development resources.

• Makes concrete recommendations on establishing national geospatial information management and putting that information to use.

• Calls for partnerships with civil society, businesses, and academic institutions who have access to relevant data and technology.

2.2.3 Integrated Geospatial Information Framework - How it works?

Rumyana Tonchovska, Food and Agriculture Organization (FAO) of the United Nations,

Kathrine Kelm, World Bank, Andrew Coote, ConsultingWhere Ltd.

The scope was to develop a methodology that can provide concrete directives for designing and implementing country action plans.

The IGIF country-level implementation follows a three-step approach: (i) Diagnostic, which includes an initial assessment and a country diagnostic report; (ii) action plan that follows a socio-economic analysis and a geospatial alignment to business drivers; (iii) implementation phase.

The diagnostic phase is crucial to identify government's top priorities and to propose to them which data sets or technologies could help them reach their goals within the current mandate (2-3 years).

IGIF has been also implemented from national to municipal level. Examples are the city of Tirana in Albania and the city of Ho Chi Minh in Vietnam. The municipal level allows for targeting more specific goals and needs.

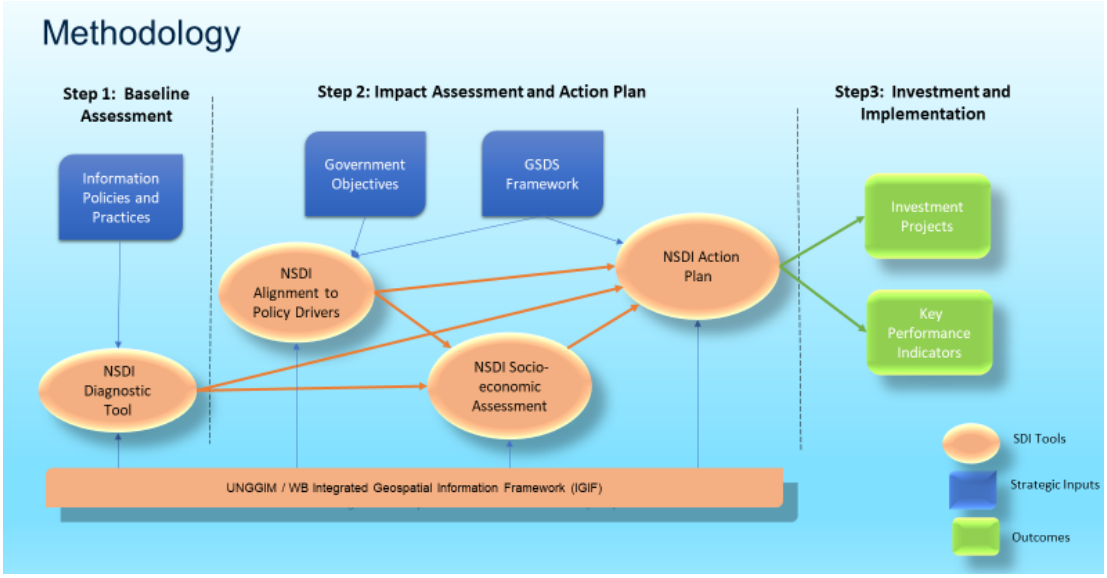
The future steps include to update the templates for Country-level Action Plans as per the IGIF Implementation Guide by May 2020, and to develop/implement e-learning and training programs as well as capacity building activities.

The maturity of the NSDI varies from country to country. Therefore there is a need for an initial quick assessment of the current stage of development of NSDI, including all aspects: policy and legal framework, capacity, data availability and data quality, standards, technology, the capacity to use the NSDI and the financial resources needed.

The Methodology developed and tested by the World Bank and the FAO to facilitate country-level action plans in several countries builds upon the previous work done by the World Bank, UNGGIM and the FAO.

The figure below illustrates the relationship between the analytical tools used to arrive at the Action Plan. The symbology shows the analytical tools (in orange), key inputs (in blue) and outcomes (in green).

Figure 8. IGIF country-level implementation methodology



In summary, this methodology has been applied as follows:

Step 1: Baseline Assessment

A single integrated tool is used for this purpose:

Analytical Tool 1 - NSDI Current State Diagnostic: this provides an assessment of the "as is" position of geospatial information and spatial infrastructure in the country including policy, financial, human capacity and technical perspectives.

Step 2: Impact Assessment and Action Plan

Three tools are used to build a prioritized, cost-justified roadmap for the NSDI:

Analytical Tool 2.1 - NSDI Alignment to Government Policy Drivers: this tool is used to relate Government's strategic objectives and international commitments to specific spatial use cases and prioritize them based on how they support and accelerate achieving these objectives.

Analytical Tool 2.2 - NSDI Socio-economic Analysis: this tool delivers an assessment of the economic business case for investment in SDI from both qualitative and quantitative perspectives. It is informed by the outputs of the two tools outlined above.

Analytical Tool 2.3 - NSDI Action Plan: builds on the previous deliverables to create a costed roadmap for SDI enhancements, presented as a series of interdependent policy interventions and implementation projects. This report is the output of this analytical tool.

Step 3: Investment and Implementation

Once the Action Plan is approved in terms of scope and priorities, then work will commence to identify sources of funding, commencing with the SLDM program itself. Individual actions will also need to be specified in detail to support implementation and Key Performance Indicators KPIs) defined.

IGIF National and Subnational Action Plans

The FAO and World Bank are supporting several countries to develop their country-level Action Plans in line with the Integrated Geospatial Information Framework, using the above methodology. Based on the experience in several countries templates for the analytical tools are being developed as well as training materials to guide countries in their efforts to develop their National Spatial Data Infrastructures.

IGIF - Country-level Action plan. Example from Guyana

The Cooperative Republic of Guyana is engaged in a project, administered by the Food and Agriculture Organization (FAO), titled Mainstreaming Sustainable Land Development and Management (SLDM). Within this project, an Action Plan has been developed, following the above-described methodology.

Country context

Geographical Information Systems (GIS) have been in use in Guyana for decades for managing and analysing spatial data on land resources/use status and trends by many sectors. However, it is widely recognized that the country has not built an infrastructure but a series of disconnected "silos" of Information. There has been a lack of "institutional interoperability" most notably manifest in the reluctance to share information with impacts on the capacity of various actors to make informed land administration, management and investment decisions.

Baseline Assessment

A detailed assessment of the current state of NSDI in Guyana was conducted using what is referred to as the Diagnostic Tool. The diagnostic questionnaire was completed after interviews with over 30 different stakeholders including both suppliers and users of geospatial information.

The main strengths in the current situation, although the scores are still low, can be seen in:

- Policy and Strategy: scored relatively high because the draft geospatial policy exists in draft mode and is close to approval. There are also some encouraging stakeholder engagement initiatives, although not formalized. Further, open data is considered within the NSDI policy, although it is not yet clear whether it will be implemented.

- Legal component: scored relatively well due to the existence of the necessary underpinning laws. The stated policy of the NDMA supports the accessibility of digital data if it is accessible in paper form.

The main weaknesses are:

- Education/capacity building: Guyana has insufficient staff capacities and skills to support the creation and maintenance of a sustainable NSDI system. There are also only limited formal education and training plans and programs for providing a rapid injection of suitably qualified staff. Knowledge on the benefits of an NSDI is increasing, however, it is still at a low level in user organisations.
- Socio-economic/financial: is scored low mainly because the business model for geospatial information for Guyana is not clear, yet crucial for incentivizing investment. However, an analysis of socio-economic benefits and the return of the investments in NSDI activities is part of this study for which some credit is given.
- Core Data: is scored low due to the limited and uncoordinated digitisation of fundamental datasets, and low level of automation of business processes.

Strategic Alignment with Government Policy Drivers

The following key themes were identified as those where the NSDI use cases can have the most significant impact on national and departmental objectives:

- Green State and Low Carbon Development – Guyana's overarching development framework;
- Sustainable Land Management
- E-Government
- Sustainable Development Goals
- Climate Change and Disaster Risks Management
- Environmental Management
- Enhancing Human Capacity
- Managing Economic Growth

Each task in the Action plan is tied back to one or more use cases identified by the strategic alignment analysis to clearly demonstrate the national importance of the NSDI.

Socioeconomic and Environmental Benefits

A wide range of potential strategic and quantifiable economic benefits have been identified, in short, these include:

Economic

- Increased rate of granting leases to state land, leading to higher Government rental income
- Cost savings in transport, energy and coastal defences design and construction
- Improved billing rates for utilities
- Land market growth – reduced threat of development of a shadow (unregulated) market
- Increase revenue from forestry and mining concessions
- Improved agricultural production
- Reduced Data Procurement Costs
- Enhanced Support for Aviation Industry in Drone management

Societal

- Additional jobs and economic growth from new software products and services
- Reduced numbers of Land and Property-related Court Cases
- Improved water services through better planning and lower costs of maintenance
- Improved Sustainable Development Goal (SDG) reporting
- Enhanced preparedness and response for flood and other disaster risks

Environmental

- Smarter and more sustainable Urban Development Planning and agricultural land use
- Better support for Climate Change Adaption
- Reduced rates of land degradation
- Improved control of aquifer pollution from mining

Guyana Action Plan

The results from the above analytical tools have been used to set up the priority areas of intervention and develop an Action plan, which covers over 30 key actions grouped according to the nine IGIF strategic pathways and addressing 15 fundamental data themes, as well as to identify KPI for each of the strategic pathways, critical for the success.

Lessons Learned

The methodology adopted worked well at the national and subnational levels. The adaption of the methodology to suit a municipal context was relatively easy. In many ways, the municipal SDI is easier to define than the National SDI as it is easier to articulate and involves less "moving parts". Further, there were some very obvious and critical applications of geospatial data in the Local Government context and so there is often a good level of understanding of the issues. This we observed in both this study and that in Ho Chi Minh City (Vietnam).

Wide stakeholder engagement during the diagnostic of the current situation was critical in enabling the project team to gain an understanding of the national situation that would have been extremely difficult, if not impossible, to achieve without in-country visits.

The specific assessment of how geospatial might optimally assist meeting Government/Municipal and International policy objectives helped to focus discussion with senior decision-makers.

The socio-economic analysis was important for guiding the selection of priorities for investment. It was hampered to some extent by lack of data, necessitating substantial reliance on benefits transfer using evidence from global and other comparable studies. This work will also help the creation of the business case for SDI, so important to underpinning discussion with politicians and funding agencies.

The proposed SDI action plans are useful tools for the identification of "quick wins" capable of completion within the first several years, which will help build confidence.

Finally, yet importantly, the level of support needed and, in these cases provided, by the host country/City public and private sector has been essential to the success of this work. It should not be underestimated how important high-level champions are to long-term initiatives such as SDI creation.

2.2.4 Integrated Geospatial Information Framework - Country-level assessment and preparation of Action Plans (Serbia)

Darko Vučetić, Republic Geodetic Authority, Serbia

The Republic Geodetic Authority has designed a strategy for the period 2016-2020. Its overall goal is to support the economic reform of the Government by effective provision of information in the sector of real-estate and geospatial related activities for the fast, easy and rightful decision-making at all strategic levels.

The Government of the Republic of Serbia will monitor and support the development of NSDI through goals set in the strategic documents: (i) Government action plan, (ii) strategy for public sector reform, (iii) economic reform program, (iv) action plans, and (v) programme for the e-Government development.

The Serbian Government has run the Integrated Geospatial Information Framework Spatial Data Diagnostic tool twice. The first time in 2016 and the second time in 2019, showing significant improvements especially regarding the key criteria of socio-economic impact, use of NSDI/applications, and innovation potential.

The examples of NSDI platform usage include: (i) updating address register street system, (ii) updating waste dumpsites register, (iii) register for archaeological sites, and many more.

Figure 9. Level of autonomy in surveyed European markets, showing Serbian low level of autonomy.

Source: Darko Vucetic, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.2.5 Integrated Geospatial Information Framework in Moldova: State of play 2019

Maria Ovdii, Agency for Land Relations and Cadastre of the Republic of Moldova

The Directive 2007/2/EC of the European Parliament establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) has been transposed at the national level by Law 254 on National Spatial Data Infrastructure, that has been adopted by the Parliament of Moldova in November 2016.

Integrated Geospatial Information Framework (IGIF) Diagnostic Tool was applied in Moldova in May 2019. IGIF Questionnaire was sent to 22 public entities, which are responsible for the development of spatial data sets. As a result, the Agency for Land Relations and Cadastre of Moldova obtained: (i) Completed 22 questionnaires based on interviews, (ii) Scores for IGIF 9 categories, (iii) Draft Assessment Report, (iv) List of priority sectors and datasets for socio-economical assessment.

The category that got the highest score is data (64), while innovation got the lowest score (20).

The development of NSDI in Moldova achieved significant progress in recent years; thanks to donor support of the Norwegian Ministry of Foreign Affairs (NMFA) through the Norwegian Mapping Authority (Kartverket). The assistance from Norway has significantly contributed to improvements of public services. One major goal of this cooperation is to support Moldova with reference data, which are urgently needed to solve problems connected to property registration, the security of tenure, land conflicts resolution, decision making at all levels and good Land Governance. The available geospatial reference data are available on the portal https://moldova-map.md.

The Directive 2007/2/EC of the European Parliament establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) has been transposed at the national level by Law 254 on National Spatial Data Infrastructure, that has been adopted by the Parliament of Moldova in November 2016.

The Agency for Land Relations and Cadastre of Moldova (ALRC) is positioned as a national coordinating of National Spatial Data Infrastructure (NSDI), organization of geospatial data use, production, management and reporting to the Government. In order to monitor the process of NSDI development, and identification of lacks, Kartverket recommended ALRC to apply Integrated Geospatial Information Framework (IGIF) Diagnostic Tool, which was developed by UN-GGIM and the World Bank. The scope of IGIF Diagnostic Tool was to identify:

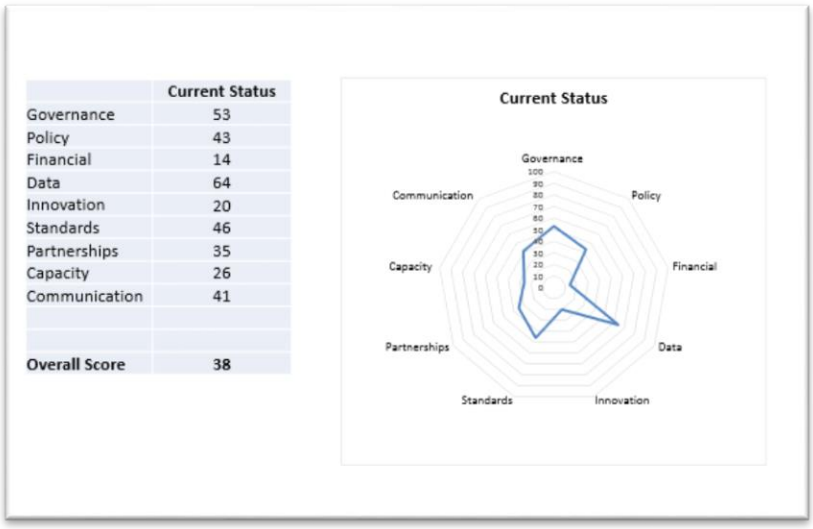
- Existing NSDI components
- Missing NSDI components
- Improvements
- Necessary Investments for the biggest benefits.

The IGIF Diagnostic Tool was applied in Moldova in May 2019. IGIF Questionnaire was sent to 22 public entities, which are responsible for the Development of Spatial Data Sets. Each institution has completed the Questionnaire and performed their own scoring. After that, it was calculated the average of the scores and inserted in an excel table. As a result, ALRC obtained:

- Completed 22 questionnaires based on interviews
- Scores for IGIF 9 categories
- Draft Assessment Report
- List of priority sectors and datasets for socio-economical assessment.

The main objective of the given report is to describe the latest research related Integrated UN Geospatial Information Framework in Moldova: State of play 2019.

Figure 10. IGIF Spatial Data Diagnostic Result displaying Republic of Moldova current status



	Current Status
Governance	53
Policy	43
Financial	14
Data	64
Innovation	20
Standards	46
Partnerships	35
Capacity	26
Communication	41
Overall Score	**38**

Source: Maria Ovdii, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.2.6 Integrated Geospatial Information Framework: country assessment of Ukraine

Dmytro Makarenko, State Service of Ukraine for Geodesy, Cartography and Cadastre

NSDI is still not implemented in Ukraine because of the (i) institutional and political instability resulted in challenges when developing of legal procedures; (ii) insufficient awareness about benefits of geospatial information utilization; (iii) "social" aspect of geospatial domain, meaning that land, medical or mention reform have more clear social benefits; (iv) low mobility of state authorities after that the reorganization was completed.

The IGIF adoption at the UN-GGIM meeting in 2018 was considered to be the perfect trigger to accelerate the discussion about NSDI in Ukraine. Ukraine has already performed the first country assessment and it is about to develop the action plan to be implemented. The total score of the initial assessment of Ukraine is 44, where communication scored the lowest and data components the highest.

The State Service of Ukraine for Geodesy, Cartography and Cadastre (StateGeoCadastre) is a national mapping and cadastre agency with quite a broad number of functions and responsibilities: topographic and mapping activities, state land cadastre administration, development of the National spatial data infrastructure, control for agricultural land use and providing the administrative services to the citizens.

From a historical perspective, Ukraine has a long timeline in terms of geospatial data development that started in the early 90s from the establishment of a State Committee on GIS under the Cabinet of Ministers of Ukraine. The following years till the current time were characterized by substantial developments as well: TC 103 "Geographical information/Geomatics" was established (1995), Ukrainian-Swedish project on NSDI institutional development (2000), Scientific manual about the NSDI Strategy (2006), Cabinet of Ministers Resolution on the Concept of NSDI law (2007), several literation of the NSDI draft law, State standards of Ukraine "Geographical Information/geomatics: geographical information – master model" (2011), JICA funded project for NSDI creation for the pilot territory, a set of standards for geographical information.

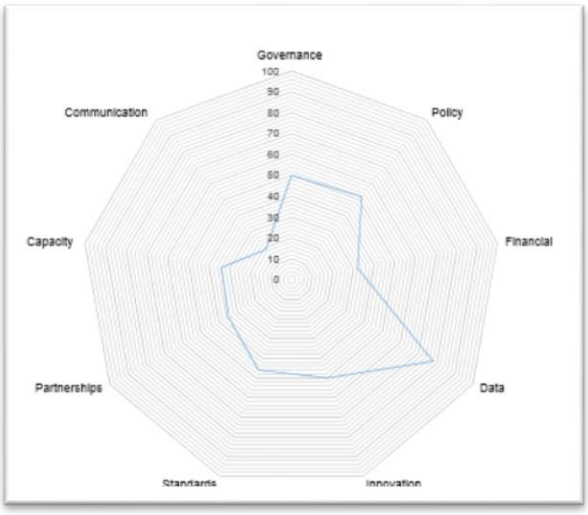
Why then NSDI is still not implemented in Ukraine? There are some critical reasons identified:

- Institutional and political instability at that period resulted in challenges of legal procedures;
- Insufficient awareness about benefits of geospatial information utilization;
- "social" aspect of the geospatial domain, meaning that land, medical or mention reform have more clear social benefits;
- The low mobility of state authorities after the reorganization has been completed.

Taking this into account IGIF adoption at the UN-GGIM meeting in 2018 was considered to be a perfect trigger.

Based on IGIF it became possible to make assessment and preparation for NSDI development in a common manner among all developing countries. Ukraine has already done the first country assessment and is about to develop the action plan to be implemented. This report will include a brief overview of Ukraine's situation according to each of the nine pathways introduced.

Figure 11. IGIF Spatial Data Diagnostic Result displaying Ukraine's status



Source: Dmytro Makarenko, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

Governance and institutions

The StateGeoCadastre is recognised on the national level as an NSDI leader due to the following advantages:

- StateGeoCadastre maintains the most data sets, comparing to other data holders,
- Is responsible for "development" of NSDI according to the Law on Topographic, Geodetic and Mapping Activities,
- Good expertise in geospatial information
- Leading (chairing) the Subgroup on NSDI coordination
- Representation of Ukraine internationally, acting as a "window" between European and global community and Ukrainian reality
- The StateGeoCadastre is acting internationally as a beneficiary, and not as benefit producer – with consuming guidelines and other strategy documents and explaining them to the Subgroup members and other stakeholders.

Structure of the Subgroup for coordination of NSDI development demonstrates that this is not expected level to be recognised as national "Coordination Committee", so it is considered as preparatory background for the high-level CC in the future. At the same time, the low level of involvement from stakeholders is a huge challenge for the Subgroup.

Policy and legal

There is no single geospatial policy in the country at the moment, and the term "geospatial" or "NSDI" sounds too difficult. There is a Concept for NSDI development that was created by the scientific domain, there is a draft law, there is a prototype of the NSDI system, but still, the public understanding of the principles is rather low which in turn results in low support of these initiatives.

It is more acceptable for the society to use terms such as "map", "cadastre", "coordinates", "waterways", "land cover", and "orthophoto". That means that separate components of the NSDI are clear and widely used and even may have big support from a societal point of view. The conclusion is clear - a separate geospatial, data-oriented policy is needed. At the same time, it is necessary to raise interest and incorporate it into public use.

In terms of legal development, it is considered that three key elements of NSDI should be introduced: NSDI Strategy, Law and Order on implementation.

Financial

The Government of Ukraine finances some complementary parts of NSDI, like GNSS system development, digital maps updating, cartographic and geodata funds development.

The operational model of NSDI that was developed is clear. The players are identified (Cabinet of Ministers of Ukraine, Ministry of Agriculture, StateGeoCadastre, Coordination Committee, NSDI administrator and other data

holders), financial mechanisms to create NSDI are also clear: local and state budgets along with the donor support. The main challenge is in data pricing. No pricing principles for data sets and services have been identified yet, but it is clear that this system should be self-financed.

Data

Data is one of the strongest pathways in Ukraine. Many of the fundamental data sets are created and maintained, but in different formats, systems, on central-local-regional level without the participation of NSDI regulator. The main challenge for StateGeoCadastre at the moment is how to make participants cooperative? It is impossible to force; the mutual interest should be granted.

However, while going into details the following lists of fundamental data were faced: one that was proposed in the NSDI draft law, fundamental geospatial data adopted by UNGGIM and Core reference data from INSPIRE WG. They all are interlinked, but still – what option should be chosen in Ukraine? To address this issue, we decided to develop an online questionnaire to the members of the NSDI subgroup just for surveying of the opinion. But the final results do not have enough representation from the participants at the moment.

Innovation

There is a Ministry responsible for innovations and digitalisation in Ukraine that was created by the new Cabinet of Ministers in September 2019. Unfortunately, geospatial data were not included in the Strategy of Digitalisation and Digital Economy development. That is the problem of raising awareness and communication among the data holders and government. The need for collaborative approach instead of a competitive one is clear.

Standards

Standards are extremely important as they ensure the interoperability of geospatial data. However, standards in Ukraine are not mandatory as of now. Only direct reference from the legislation act makes their use mandatory.

A new set of standards was developed by the scientific and production team of StateGeoCadastre, which were adopted in 2019. However, while the NSDI subgroup meeting it appeared that data holders have not deep knowledge about the application of the standards, and StateGeoCadstre initiated a set of seminars for data holders.

Partnerships

The partnership between state institutions exists, but it does not have a systematic character. Bilateral cooperation on some separate projects is in place. Another challenge is a cooperation between central and municipal level: a lot of GIS and geospatial projects are being implemented on the municipal level for Conglomerated Territorial Communities in Ukraine, but without the involvement of StateGeoCadastre as NSDI regulator.

Capacity and education.

Capacity and education are also controversial in terms of NSDI in Ukraine. Leading universities in the country provide good technical programs, especially in terms of geodesy and GIS. Still, continuous professional training for geospatial data and NSDI is critically important. With the support of international partners, some training courses were organised, but they did not cover the needs of all data holders. StateGeoCadastre is also aiming to demonstrate the best worldwide approaches to a wider audience in Ukraine. For the last 5 years, five international conferences were organised, where representatives from 17 countries, UNGGIM, Eurogeographics and the EC JRC were representing their experience.

Communication and engagement.

In the media environment, there are many active reforming initiatives, proposing open geospatial data policy, the free exchange of data, etc. Sometimes NSDI is considered a big data storage that belongs to one organization, which is of course not the aim. In addition, this is the weakest pathway, and the response of StateGeoCadastre is to clarify the benefits to each stakeholder group (public, private, NGO and citizens).

The total score of the initial assessment of Ukraine is 44 with the weakest communication and strongest data components. Taking this into account StateGeoCadastre is going to continue working under different parts of NSDI, including:

- national geospatial strategy development,
- separate action plans introduction,

- updating the digital topographic maps in different scales,
- standards applications,
- subgroup activities support,
- legal support of the geospatial activities.

2.2.7 Spatial data infrastructure (SDI) diagnostic tool country assessment - Georgia

Mari Khardziani, National Agency of Republic Registry, Ministry of Justice, Georgia

For decades, there have been geodata issues remained unregulated in Georgia, without a relevant legislative framework in place. In most cases, non-harmonised data were creating, not compatible with the datasets of other institutions; therefore not fit for informed decision-making.

As a first step towards the implementation of IGIF, the country assessment has been conducted by the working group of the National Agency of Public Registry (NAPR), consisting of representatives from different structural units: Geodesy and Cartography Division, Spatial Information Division, Addressing Division, etc.

The results of the country assessment show that: (i) The first major step toward institutionalization of NSDI development was the adoption of the Government Decree on October 9, 2013, which provided the basis for the creation of the Government Commission on the development of NSDI, (ii) the financial strategic pathway is the weakest point among the 9 strategic pathways of IGIF (iii) single national geodetic reference and coordinate system and well-functioning GeoCORS covering Georgia (accuracy ca. 1.5 cm.) are in place.

The next step towards the implementation of IGIF is the regional workshop that was held in Georgia on October 1-3, 2019, with the support of the Norwegian project "Maps for Sustainable Development in Georgia" and the project implementing agency - Norwegian Mapping Authority.

Context

The context matters: the country where the SDI assessment was done - Georgia is located on the crossroads of Europe and Asia, belongs to the upper-middle-income category with a population of over 3,723,000. Since the independence of Georgia, after the fall of the Soviet Union, geodata issues remained unregulated, without a relevant legislative framework. In many cases, government institutions, local municipalities, the private sector, and research institutions were creating non-harmonised data, not compatible with the datasets of others. There were also cases of duplicated data, and in most cases these data were not updated, leading to obsolete, invalid data - not fit for informed decision making. Meanwhile, certain developments regarding geodata took place by some government institutions, including the National Agency of Public Registry (NAPR)[1], which became one of the leading institutions concerning geodata related processes, being responsible for cadastre, address registry, geodesy and cartography. However, it was needed to introduce the nationwide unified policy on geospatial information and relevant legislative and technical framework for creating, sharing and maintenance of geodata – to develop NSDI. To this end, the first major step was the Government Decree adopted in October 2013, which provided the basis for the creation of the NSDI Government Commission and since 2015 intensive works were carried out. Nonetheless, the pace for NSDI development is quite slow and there are still several issues to be handled and activities to be taken. Outstanding challenges include the need to easily, and for as many users as possible find, understand and use geographical data and to support evidence-based decision making by relevant authorities in order to contribute to the economic sustainability and growth of Georgia.

The Integrated Geospatial Information Framework (IGIF) can help set realistic action plans, implement activities accordingly and move "towards e-economies, e-service and e-commerce to improve services to citizens, build capacity for using geospatial technology, enhance informed government decision-making processes, facilitate private sector development, take practical actions to achieve a digital transformation, and to bridge the geospatial digital divide in the implementation of national strategic priorities and the 2030 Agenda for Sustainable Development"[2].

The first step toward the implementation of the IGIF - the country assessment was conducted by the working group of National Agency of Public Registry (NAPR)[3], consisting of representatives from different structural units at NAPR: Geodesy and Cartography Division, Spatial Information Division, Addressing Division, etc. Several working meetings took place, and after getting the final score it was re-checked and verified.

1 National Agency of Public Registry (NAPR) – a legal entity of public law under the Ministry of Justice of Georgia. It was established in 2004 as property registering authority and responsible for cadastre. Its institutional capacity has been increased and currently, it is operating over 10 registries, including key registries – immovable property registry, business registry, address registry and it is responsible for cadastre, geodesy, cartography and spatial data.

2 http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf

3 NAPR is operating key registries, such as immovable property registry, address registry, business registry (in total – 13 registries) and is responsible for cadastre, geodesy, mapping and is National Coordinator for development for NSDI.

Country Assessment

Strategic Pathway: Governance and Institutions

The first major step towards the institutionalization of NSDI development was the adoption of the Government Decree on October 9, 2013[4], which provided the basis for the creation of a Government Commission on the development of NSDI. The role of a National Coordinator was assigned to the NAPR (Charter, Article 4).

The NSDI governance model was created consisting of three levels:

- GC - at the policy level (representing all ministries at Deputy Minister level, and representative of National Statistics Office),
- Secretariat at the technical management level and providing administrative and technical support to the GC and WGs.
- Thematic working groups (Charter of GC on NSDI, Article 7). WGs may be composed of representatives from relevant ministries, state authorities, organization and independent experts (Charter, Article 6) and they represent the operational level, conducting activities for NSDI development defined by GC.

Thus, the NSDI governance model is in place and some WGs (e.g. PR, Legislative, Education) and NAPR have carried out many activities toward NSDI development. Though in order to increase its effectiveness it is needed to modify and make the structure more flexible and viable with more engagement on the GC side, mandating the institutions to allocate relevant employees/professionals, having ToRs for GC, Secretariat and WGs with clear and detailed description of roles and responsibilities, and establishing monitoring and reporting mechanisms.

Strategic Pathway: Policy and Legal

The strategy and action plan on NSDI, initially developed with the support of donor-funded projects (Sida/Lantmateriet, GIZ), are in place. They are not formally approved by the GC, but are followed. However, the non-existence of formal accountability slows down the implementation pace. The weak point of the strategy is that it needs to be clearly linked to government policy and priority goals.

The relevant legislative framework is not yet in place concerning geodata and NSDI development. The draft Law on NSDI, drafts of government decrees on metadata, geodata categorization and other important documents have all been elaborated. However, as they have not been yet approved/adopted, currently their fulfilment is not mandatory/obligatory for other institutions.

Data protection and cybersecurity laws are in place, though they do not specifically cover geospatial data. Licensing of geodata and open data policy on geodata also needs to be addressed.

Strategic pathway: Financial

The financial strategic pathway is the weakest point among nine strategic pathways of IGIF.

Although the NAPR and other institutions have their business models, a common business model ensuring the effective functioning of the NSDI has not been yet elaborated. NAPR infrastructure is in place to support ongoing maintenance and exploitation of SDI to a certain extent, though it is not sufficient and strengthening and improvements are required. In addition, a coherent and sustainable pricing/licensing structure for SDI datasets/services are needed to be developed in view of the NSDI goals.

Economic justification or assessment supporting business case also has not been prepared and no social-economic analysis has been done, which would clearly show higher officials the benefits (especially quantifiable ones) of sharing geodata and the importance of having integrated geodata management framework for efficient government services and evidence-based decision making.

Strategic Pathway: Data

Currently, a single national geodetic reference and coordinate system and well-functioning GeoCORS covering Georgia (accuracy ca. 1.5 cm.) are in place. The ICT infrastructure is under development for sharing and distribution of national geospatial data as well as for capture, management and maintenance of national geospatial data. There is an increasing trend of using open source products (for instance, mapping databases based on PostgreSQL), though building relevant human capacity is needed.

Data themes are defined in the draft law on NSDI and are based on INSPIRE and ISO, though as the law is not yet adopted, they have no mandate.

Most critical datasets were created (orthoimagery, land parcels, addresses, transport network, etc.) covering partly or fully Georgia and complying partly or fully the standards. Many of these datasets either have quality issues or need an update.

4 https://matsne.gov.ge/ka/document/view/2044006?publication=2

Consequently, the most critical and priority at the moment is to have core datasets fit for purpose and to elaborate and implement the production, update and maintenance plan for these core data themes. It will allow us to offer data/products to the public and private sectors and reach out to decision-makers.
To this end, we have been greatly supported by Norwegian projects and generally, the donor support is highly needed to create all the core datasets.
Another critical issue is to finalise the Geoportal as soon as possible. Currently, Geoportal V. 1.0 is available with 118 datasets and 21 services of five authorities (NAPR, National Agency for Cultural Heritage Preservation of Georgia, National Environmental Agency, Tbilisi Municipality, National Statistics Office) published along with metadata (based on the National Metadata Profile developed in compliance with INSPIRE/ISO). The metadata catalogue is in place. It is the web authentication module that needs to develop as soon as possible to make the Geoportal fully functioning.

Strategic pathway: Innovation
Georgia's Innovation and Technology Agency (GITA - established in 2014) is functioning. The institution is mandated to coordinate and mediate innovation and technology development in Georgia. Its main objectives are to provide the legal framework for innovation, help build an infrastructure for innovation, provide access to finance for innovation and start-up programs, facilitate R&D commercialization, etc.
Currently, it does not cover geodata issues, though it should be engaged for promotion and providing incentives for innovation using geodata, especially concerning universities and the private sector. It will be helpful also for bridging the digital divide and development of web-based services to citizens.

Strategic Pathway: Standards
Today the standards used for geospatial data and metadata are based on ISO/TC 211 and OGC. These standards usually are followed in the procurement of geospatial software and services (Norwegian-funded project on the creation of orthophotos, digital base maps, Tbilisi Municipality project on orthophotos, etc.) as well. Currently, no law or regulation is mandating the use of geospatial standards, though the draft law on NSDI covers this aspect and recognizes that NSDI should be consistent with international standards. Once the national standards are adopted based on international or regional standards or by the relevant technical committees, they are registered at the Georgian National Agency for Standards and Metrology, which is a member of ISO.

Strategic pathway: Partnership
Without cooperation and partnerships, data sharing is not possible, which is fundamental to building IGIF.
The spatial datasets inventory was carried out by NSDI WG, which identified that there were duplicated datasets (e.g. hydrography, roads network), which means duplicated costs and efforts. The only way for government institutions to avoid it is to abandon the silo approach and collaborate. Such cooperation is increasing lately (for instance, NAPR and Road Department under the Ministry of Regional Development and Infrastructure, NAPR and Cultural Heritage Agency, NAPR and Tbilisi Municipality). Sharing information on geospatial related activities and active communication are supportive in this regard.
Intensive international collaboration is also very important for capacity growth and sharing best practice examples - not to reinvent the wheel and to take into account the lessons learnt from other countries' experiences and build relevant capacity.

Strategic Pathway: Capacity and Education
Human capacity, skilled human resources are essential for the successful implementation of any system. The situation analysis was conducted and the NSDI educational strategy was developed in October 2016, aiming to achieve the strategic objective of having Higher education institutions in the field of GIS to implement research and education programs that meet the Western European standards and requirements of the Georgian society; though currently, the situation has not progressed significantly. There are needs for advanced professional workplace training and high-quality formal education.

Strategic Pathway: Communication and Engagement
The Communication WG has been quite active, conducting numerous meetings at different institutions and producing NSDI materials. The activities were successful in raising awareness concerning geodata and NSDI. Though to reach the decision-makers, the most important audience and making more prioritized the NSDI development on their agenda remains a challenge that should be addressed.

Figure 12. IGIF Spatial Data Diagnostic Result displaying Georgia current status

Source: Mari Khardziani, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

Towards the implementation of IGIF

The next step towards the implementation of the IGIF will be a regional workshop that will be held in Georgia on October 1-3, 2019, with the support of the Norwegian project "Maps for Sustainable Development in Georgia" and project implementing agency - Norwegian Mapping Authority (Statens Kartverk).

The representatives of different government institutions from Moldova, Ukraine, Kyrgyzstan and Georgia will be represented and the work sessions will lead to the elaboration of realistic action plans. Plans should be aligned to policy drivers and eventually leading to the implementation of the IGIF, which will enable us to turn the key challenges that the country is facing now with regard to geodata related issues to a success story.

2.3 Digital transformation in Serbia

2.3.1 New approaches of using technologies for smarter decision making in Serbia

Darko Vučetić, Republic Geodetic Authority, Serbia

Serbia faces a big challenge. More than 4.5 million buildings are not registered in the national cadastre.

The Republic Geodetic Authority will provide reliable and updated geospatial and property data, in a standardized and readily accessible manner, for the sustainable social and economic development of the Republic of Serbia.

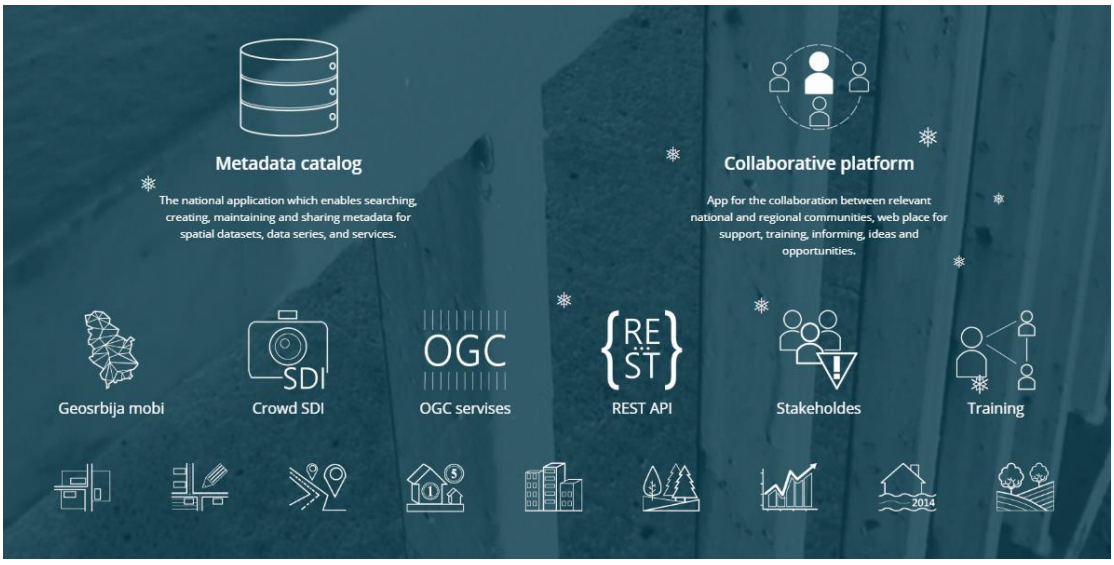
The Republic Geodetic Authority strategy has been developed for the period 2016-2020 with the overall goal of supporting the economic reform of the Government by the effective provision of information in the sphere of real-estate and geospatial related activities for the fast, easy and rightful decision-making at all strategic levels.

The Information System for Real Estate Cadastre (ISREC) is a system of key importance for the RGA's operational mission as it is going to implement all relevant functions towards the provision of the full support to the registration and transactions directly related to the real estate cadastre in the Republic of Serbia.

Within the ISREC an E-Desk information system will be implemented as a unique central system for connecting entities, through which official obligation documents for cadastral registration are submitted, and electronic certificates or other cadastre acts can be requested.

Another example of a platform based on innovative solutions for smarter decision-making is the GeoSpatial Platform GeoSerbia.

Figure 13. GeoSerbia – Geospatial Platform services



Source: Darko Vucetic, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.3.2 Digital transformation in agriculture

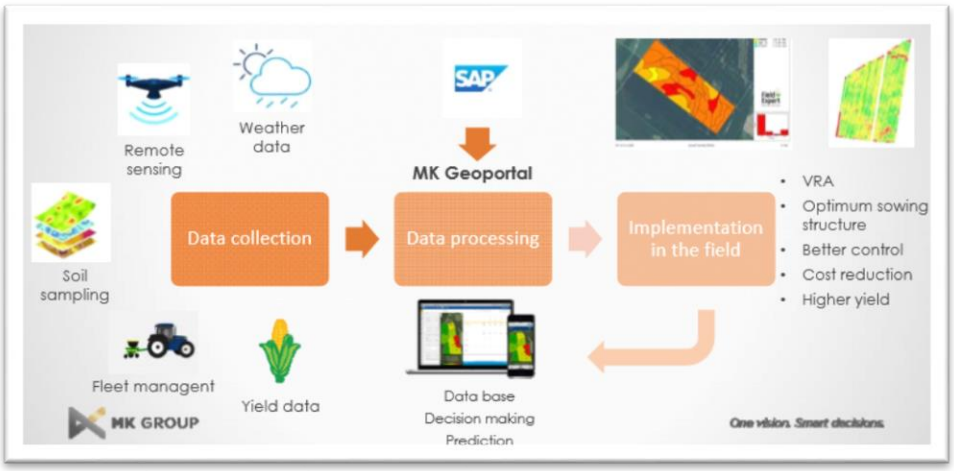
Aleksandar Bijelić and Strahinja Marjanović, MK Group, Serbia

By using advance application with geo-maps features we can precisely map our fields and transport routes from factory to field: (i) Shows location of fields, workers position and weather conditions (ii) Fully automated transportation operations through "UBER-izing" our transport fleet with all truck drivers receiving fully digital work orders and documentation (iii) Currently "UBER-izing" field machinery with ability to knows real-time data, with current working condition of equipment

By switching to digital signature on standard tablets in agriculture MK Group is: (i) Speeding up the process for final field list contract management by 30%, (ii) Increasing the reliability of the process, (iii) Eliminating errors in contract creation, signage and transportation of documentation by 20%, (iv) Reducing the costs of operations for final field list contract management for 10%, (v) Reducing the usage of paper

MK's future challenge is to develop a geoportal as a communication tool between the companies of the Group to share all the registered geospatial data and analysis. By using a geoportal, MK will be able to precisely map their fields and transport routes from the factory to the field.

Figure 14. Precision agriculture at MK group



Source: Aleksandar Bijelic, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.3.3 Geospatial for Improving Tenure Governance. Serbian RGA Experience

Jelena Matić Varenica, Republic Geodetic Authority, Serbia

The law on the state survey and REC has defined the obligation for the owner to report any changes on its real estate within 30 days, unfortunately, that does not happen because of socio-economic reasons. Thus, the Republic Geodetic Authority (RGA) has received the official duty to monitor the changes in real estate.

Firstly, the RGA had to perform a tenure government analysis using geospatial data. The preconditions were accomplished by the end of 2016 with the digitisation of all cadastral plans, the procuration of up-to-date VHR satellite imagery of 40/30cm GSD for the national territory, and the storage of data in a homogeneous coordinate system.

The results of the analysis showed a large disagreement between the real field situation and the cadastral plans, with an average of 35% in the suburban areas.

Based on the tenure governance analysis, RGA has created technical specifications for evidence on buildings that are not registered in the RED and started data collection for evidence through the comparison between VHR satellite imagery data, DCP data, and archive imagery.

At the end of 2018, a new law on object legalization establishing that evidence on buildings that are not registered in the REC to be established and made available through the NSDI digital platform.

Figure 15. Tenure governance analysis using geospatial data, DCP vs field situation

Source: Jelena Matić Varenica, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.3.4 New Central Information system for Real Estate Cadastre in Serbia

Danka Garić, Republic Geodetic Authority, Serbia

ISREC will implement all relevant functions towards the provision of the full support to the registration and transactions directly related to the real estate cadastre in the Republic of Serbia

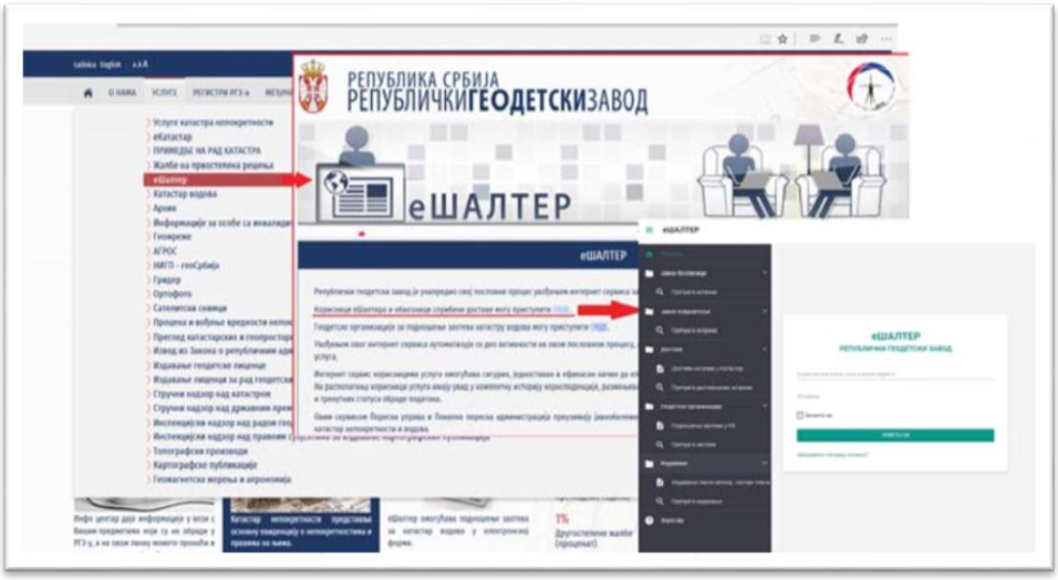
The long-term objective is to provide fully electronic transactions in the real estate cadastre, both internally within the RGA and in communication with clients

Since the beginning of the implementation of the Law until September 10th, 2019, the entities had submitted 378,626 requests for registration in the Real Estate Cadastre via e-FrontDesk, which indicates the efficient implementation of the Law and justifies the reform implemented.

Currently, a detailed functional specification is being developed and accepted, as well as the development of the interactive component has started. The deadline for the system completion, including the territories of 19 municipalities is set for the end of 2020.

The ISREC project infrastructure and architecture will be compatible with EU standards and it will offer efficient production, maintenance and distribution of geospatial data over the territory of the Republic of Serbia.

Figure 16. E-front desk



Source: https://esalter.rgz.gov.rs

2.3.5 Economic development driven by Geospatial data - Register of investment locations for local and regional authorities

Nemanja Paunić, Republic Geodetic Authority, Serbia

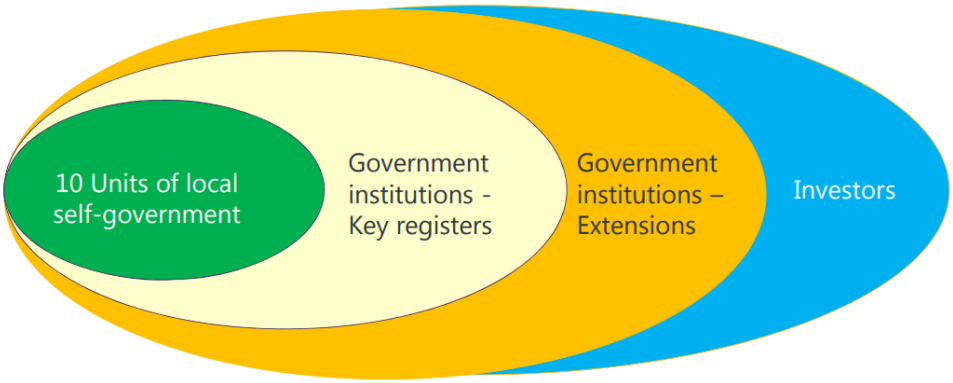
Improvement of Investment Environment in Serbia is developed in cooperation with RGA, the Swedish Government and LandMateriet, from December 2018 until June 2021.

The project aims to support the RGA and Serbia in the establishment of the National Register of Investment Maps (NRIM) for the creation, maintenance and monitoring of investment locations for the territory of the Republic of Serbia with a platform for stakeholder communication and decision-making.

Furthermore, the project aims to support the RGA in the establishment of long-term sustainable cooperation with local government administrations (municipalities) and other public administrations responsible for spatial data.

The project has five main components based on the core parts of the NRIM: national Investment map model, the system for data collection, capacity building of local-governments and RGA, location pool, public monitoring and visibility tool, and a component for management and administration of the project.

Figure 17. Improvement of investment in Serbia project approach and steps 2018-2021



Source: Nemanja Paunić, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.4 Good practices from Eastern Europe

2.4.1 Blockchain for governments - from concept to reality

Mariam Turashvili, National Agency of Public Registry, Ministry of Justice, Georgia

It might be very surprising, but before all these well-developed countries, Georgia was the first that started using Blockchain technology in public services[5]. It was the first government in the world to institute Blockchain-based property transaction verification protocol

Having completed the pilot project successfully NAPR kept exploring the possibilities of the system and launched the phase 2 of its Blockchain direction, which aims to introduce trust contracts into the property transfer process so that parties will be able to perform two actions (property registration and money transfer) in one transaction.

Blockchain technology is a great tool for limiting governmental control over information and processes, which as a result gives better access to free information and simplified, cost and time effective processes

What is Blockchain? You have heard this question numerous times. Answers vary, Blockchain is a distributed ledger, Blockchain is an immutable database, Blockchain is the asset management platform, Blockchain is the solution giving the new dimension to democracy, Blockchain is a value-exchange protocol, etc. Within that context, what are the words associated with Blockchain? Transparent, incorruptible, cost-effective, secure, unalterable, decentralized, trusted, etc. Who faces the biggest challenges in terms of transparency, corruption, security and all of the above-mentioned? GOVERNMENTS. Governments are the ones who manage the assets in the country, governments are the ones who are expected to fight against corruption, governments are the ones who need the trust to be re-elected, governments try to decentralize service delivery, to provide cheap, fast and secure services.

What is decentralisation in terms of Blockchain?

- decentralised communication – which allows peers to communicate without being controlled[6];
- decentralised legislation – where smart contracts are introduced, which means parties can draw up the agreement which is self-enforcing, self-executing, irreversible and eliminates the engagement of third parties[7];
- decentralised industry – the best example could be the energy industry, we all see how aging power systems are failing to respond the demand; another example could be 3D printers, we already observe their development and they will completely change housing industry or healthcare in terms of organ implanting, etc.[8]; and finally,
- decentralised finances – corporate, private money, which creates a competitive environment with the systems managed by central banks.

The development, in general, brings new challenges for the governments, first in terms of cyber-security – illegal usage of personal data, cyber-attacks, disinformation, etc. and except cyber-security, in some cases, they face the problems related to bureaucracy, corruption, backdoor manipulations, etc. Governments have no other choice, but to become more flexible, to become smarter, especially when they see that the traditional, centralized mechanisms of problem-solving and trust enhancing do not work effectively anymore.

Here comes the Blockchain - one of the solutions which brings the new era of democracy as it is transparent and incorruptible digital ledger, distributed database, where no centralised version of stored information exists for a hacker to attack, which is not controlled by single entity and "a mechanism to bring everyone to the highest degree of accountability"[9] together with being cost and time effective considering automation of the processes and elimination of intermediaries.

5 www.napr.gov.ge

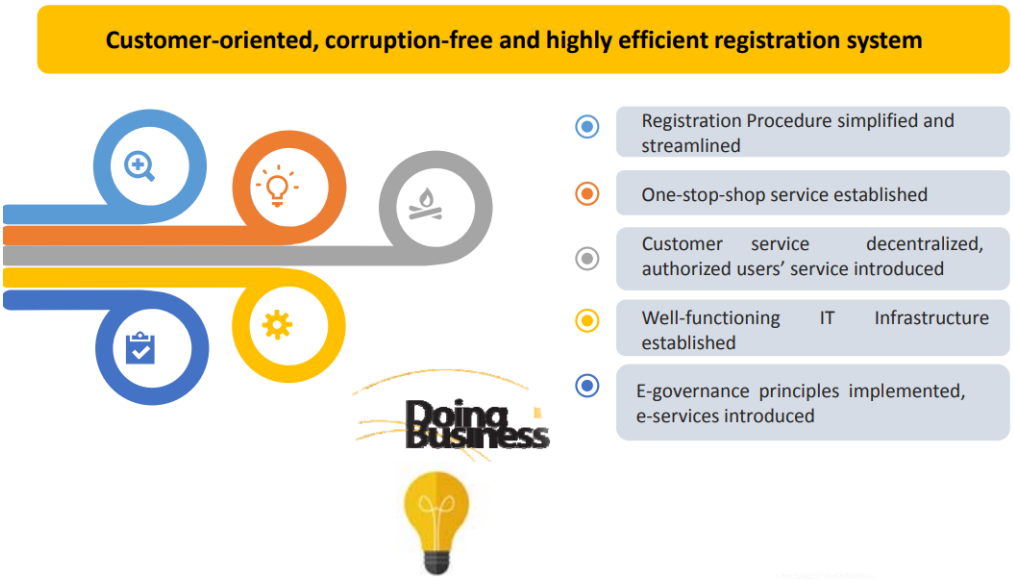
6 Russia vs Telegram - https://cointelegraph.com/news/telegram-digital-resistance-the-open-network-and-russias-ban

7 General information: Buterin, V. (2014) "A Next-Generation Smart Contract and Decentralized Application Platform". https://github.com/ethereum/wiki/wiki/White-Paper.

8 Park, H.S. (2017) 'Technology convergence, open innovation, and dynamic economy', "Journal of Open Innovation: Technology, Market, and Complexity"

9 Ian Khan – TedX Speaker, Author, Technology Futurist

Figure 18. Achievements of the National Agency of Public Registry in Georgia



Source: Mariam Turashvili, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

Governments on every continent are exploring the possibilities of Blockchain and are experimenting in many different fields. The most prominent examples[10] are:

- Estonia – trying to improve its E-Estonia program, which connects government services in a single digital platform and integrates the most sensitive data from healthcare, judiciary, legislature, security and the registries. This way the information is protected from corruption and misuse;
- Switzerland – The Swiss city of Zug has digitized ID registrations built on the Blockchain and has completed an e-voting trial.
- USA – started exploring the possible applications first for the Food and Drug Administration with the purpose of securely sharing patient data and improving the level of transparency and security in health data processing and later for the Department of Homeland Security to test the Blockchain capability to protect data collected by Border Patrol cameras and sensors.
- Sweden – wanting to digitize everything in order to enhance trust from the citizens. The pilot project of bringing the land register onto the Blockchain is successfully completed.
- Dubai (UAE) – declaring the desire of becoming the first government in the world to conduct all of its transactions using Blockchain, etc.

It might be very surprising, but before all these well-developed countries, Georgia was the first which started using Blockchain technology in public services[11]. It was the first government in the world to institute Blockchain-based property transaction verification protocol.

Georgia is the young democracy with the history of state corruption and the absence of private property. By 2018 Georgia had managed to radically reduce red tape and corruption, had largely liberalized its economy and had improved the business environment. Works on exploring Blockchain technology started in 2016, the project was implemented by the National Agency of Public Registry, which always puts the main emphasis on using the potential of new technologies. The primary reason for choosing Blockchain Technology for Georgia was providing a higher level of security and protecting ownership rights[12].

Having completed the pilot project successfully NAPR kept exploring the possibilities of the system and launched the phase 2 of its Blockchain direction, which aims to introduce trust contracts into the property transfer process so that parties will be able to perform two actions (property registration and money transfer) in one transaction. The introduction of classical smart contracts still remains as the main goal of NAPR to give the possibility to

10 https://www.computerworlduk.com/galleries/applications/how-governments-are-using-blockchain-3680393/ (last seen on 30.09.2018)

11 www.napr.gov.ge

12 Harvard Business School, Georgian case study "Blockchain for Government" – Mitchell Weiss, Elena Corsi, January 12, 2018

citizens to complete the transaction of sale and purchase agreement in a trusted environment by clicking one button on the smartphone.

Governments should not create problems to solve them with Blockchain later, but the technology has grown to the point that it can now be applied to any need of a trusted, accurate record. Attempts from the governments to make systems work better, to become more transparent and accountable should be supported and appreciated.

What are the possibilities for the governments? The applications are wide-ranging, as the potential of Blockchain continues to be discovered. Blockchain technology is impacting and often redesigning traditional business methods. The technology can be used in numerous fields: Notary services, verification of Apostilles and legalized documents, Legal enforcement; Taxation; Bills and payments; Legislation records; Security and Safety; Border Control, Cyber protection; Education (student enrolment, grading, diplomas); Healthcare; Land recording; Welfare distribution; Agriculture; Environment protection (protection of endangered species); Waste management; Digitized IDs for natural persons and legal entities; E-voting, etc.,

Blockchain technology is a great tool for limiting governmental control over information and processes, which as a result gives better access to free information and simplified, cost and time effective processes. By implementing Blockchain technology, governments might limit themselves, but on the other hand, they gain much more freedom in terms of security, trust-related issues or public pressure.

2.4.2 Digital transformation of Croatian cities – case studies Požega and Zagreb

Darko Šiško, City of Zagreb, and Josip Lisjak, City of Požega, Croatia

The sector for Strategic Information and Research was established in 2017 within the administration of the City of Zagreb with the goal of integrating spatial information and city statistics into a single decision support system.

The success of the newly established office resulted in numerous projects: (i) accessibility analysis of city railways, (ii) 3D city model, (iii) multi-criteria analysis for new city hippodrome, (iv) dashboard application with locations and information on city investments in public and social infrastructure

The significance of informed decision making in the cities is growing as shown by the Zagreb case. Nonetheless, further improvements are required in the integration of spatial information, statistics and data from official registries.

In the city of Požega, there are several separate projects implemented. Some of the examples are as follows: GIS system for communal taxation, Spatial register of properties owned by the City of Požega, Cadastre of telecommunication lines, Agriculture Land Administration Programme was made using GIS multi-criteria analysis, etc.

The city management of Požega is continuously developing and performing digitalisation activities towards digital transformation. Accordingly, the project was designed and applied to the national Call for proposals for Smart City activities, and the subject is the Smart Road Maintenance system.

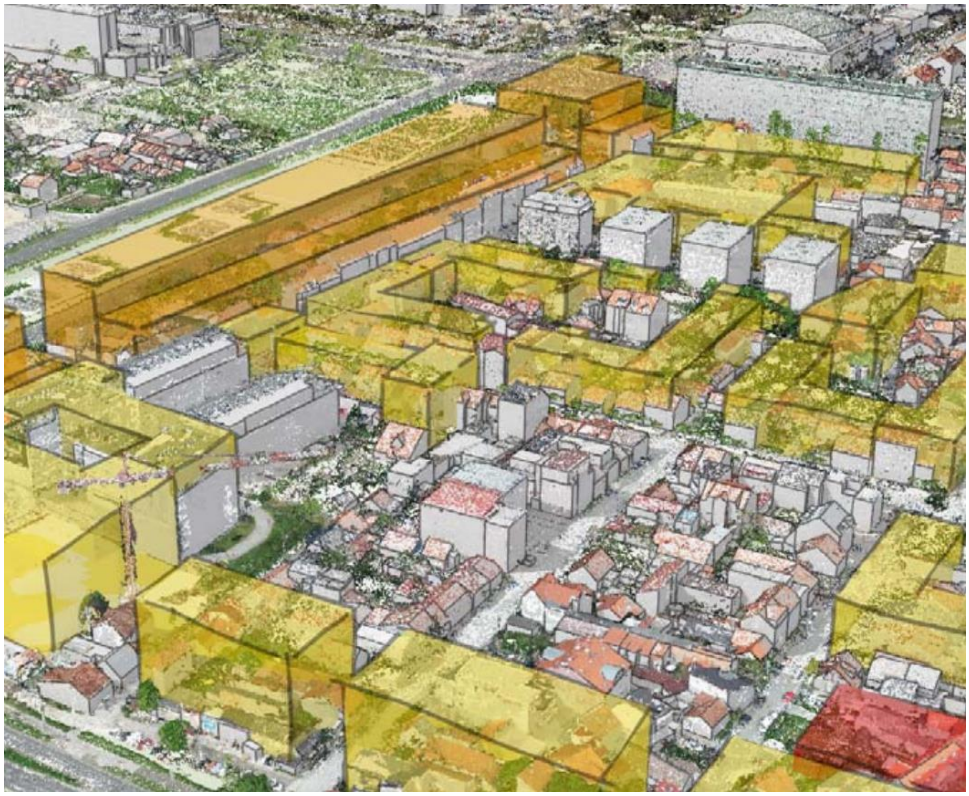
Case study Zagreb

Digital transformation in city planning is reflected in increased transparency of planning procedures, improved communication with citizens, better planning tools and techniques, and decision making based on multi-criteria analysis of digital data. The availability of digital spatial data, harmonized and accessible through spatial data infrastructures, is becoming a critical factor in the good preparation of urban projects, which is a prerequisite for their successful implementation.

The City Office for Strategic Planning and Development is responsible for city planning in the City of Zagreb administration. Within this office, strategic planning, spatial and urban planning and development of urban projects are carried out. To support these processes, the Sector for Strategic Information and Research was established in 2017, integrating spatial information and city statistics into a single decision support system. As a result of such an organization, many successful projects of spatial analysis in city planning have been implemented. Some examples are:

- Accessibility analysis of city railways for the planning of new stations and lines;
- Spatial distribution of private touristic apartments as the basis for new city touristic tax;
- Multi-criteria analysis to determine a new site for the city hippodrome;
- Dashboard application with locations and information on city investments in public and social infrastructure;
- 3D city model as a tool in urbanism, architecture, traffic planning, emergency management, noise mapping, climate simulations, marketing, education, etc.

Figure 19. 3D city model developed since 2008



Source: Darko Sisko, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

The significance of informed decision making in cities is growing. Integration of spatial information, statistics and data from official registries are needed. Trends and challenges in real life also include the usage of 3D data, Spatial Data Infrastructures, EU datasets and projects (Copernicus, Eurostat, …), the development of user-friendly interfaces (dashboards, story maps …), and the usage of many disruptive technologies (UAV, IoT, VGI, Crowdsourcing, Data science, AI, …).

Case study Požega

The digital transformation of the City of Požega is manifested in several digitalisation processes. These straightforward examples show how city management directly benefits from the digitalisation project.

On the national level, digital transformation affects all stakeholders, form ministries, companies owned by the state, SMEs, and all the way to municipalities. Although, due to the widest range of different authorities, it affects the cities at most. There are many areas to cover in city management processes, like environment protection, road maintenance, physical planning, communal taxation, public hygiene, etc.

In the city of Požega there are several separate projects implemented. Some of the examples are as follows:

- GIS system for communal taxation – this system enables city employees to reach the information on objects owned by the citizens in order to prove the correct taxation in the process of receiving complaints or controlling the recorded financial obligations of owners. The system also has photographs of each property georeferenced and visualised on a web map
- Spatial register of properties owned by the City of Požega – simplifies property management, it is much easier to reach documents about each property and to maintain the objects
- After the implementation of the spatial register of properties, it was possible to implement cadastre of telecommunication lines. This was used to overlap these two datasets, and to calculate using GIS analysis the exact length of telecommunication lines on the parcels owned by the city. After this, the income from right-of-way compensation increased significantly

- The Agriculture Land Administration Programme was made using GIS multi-criteria analysis, and a convenient WebGIS map was implemented and published. With this, the city management reduced the pressure of interested citizens, e. g. farmers to the city offices, and thus released working hours of these employees for other tasks
- Greenery cadastre is in the final phase of implementation. Already in a static spatial database, it was determined that green areas that are under maintenance and therefore payments to the communal company are smaller in area. Therefore, the expenses can be lowered when calculation will be made based on the greenery cadastre instead of current alphanumerical model

The city management is continuously developing and performing digitalisation activities towards digital transformation. According to that, the project was designed and applied to the national Call for proposals for Smart City activities, and the subject is the Smart Road Maintenance system. The planned system is based on Artificial Intelligence, and has the functionality to automatically record all elements of the road, e.g. vertical signalisation, horizontal signalisation, road bumps, holes, etc. The data are collected using a simple smartphone with an installed app, which records a video of the road network. This way, the event occurrence on the road are immediately visible in the system and can be reacted properly. With this, the mobile app for the citizens is planned to be implemented so the citizens can report the problem on the road, with photograph and georeferenced location, rather than calling in with the phone where lots of information are lost or not clearly communicated.

Generally, city management is based on available technologies. Mainly, this is manifested through geoinformation systems, but also other technologies (electronic bikes, LED public lighting, etc.) The advantages of using these technologies are clear and visible - reduction of human errors, remove misunderstanding, remove misinterpretation, enhance transparency. In the City of Požega, they are used as instruments to achieve certain goals, and the goals are: to fulfil the regulations (Law on NSDI, Law on Agriculture land, Law on Communal economy, Law on Environment protection, Law on Roads, etc.), to increase income, to lower expenses, introducing new systems in economy and for the citizens, creating stronger reputation of city government, and finally better efficiency of city administration as well as every local stakeholder.

2.4.3 Good practices for Digital transformation in Ukraine

Andrii Cherin, SE Scientific and Research Institute for Geodesy and cartography, Ukraine

The urban cadastre in Ukraine is developing at a rapid pace. The starting point was the adoption of the Law on Urban Planning of February 2011, which obliged local and regional authorities to create geoinformation systems. Over the past few years, many geoportals were created.

Between 2016 and 2018, a pilot project was implemented which created an NSDI for a territory of 11 square kilometres. Standards and data specifications were harmonised to ISO, and a geoportal with geo services was developed.

The main priorities for the development of the NIGD in Ukraine are the following: (i) legalisation on NSDI, (ii) development NSDI strategy and action plan, (iii) development of NSDI components, (iv) development of urban and land cadastre, and (v) share practical use cases of data utilization.

The Research Institute of Geodesy and Cartography is a leading research organization of the State Service of Geodesy, Cartography and Cadastre. The Institute carries out research works in the field of geodesy, cartography, remote sensing of the Earth and photogrammetry, regulatory support of topographic-geodetic and cartographic works; development and implementation of geoinformation systems. The Institute is defined as an organization that can determine and influence the state scientific and technical policy in the field of topographic, geodetic and cartographic activities.

Background

Now in Ukraine, we are moving from the cartographic to the geoinformation paradigm with a decentralisation approach. One of the main goals is sustainable development and creating an effective NSDI in Ukraine. We use different technical solutions but keep unify basic principles:

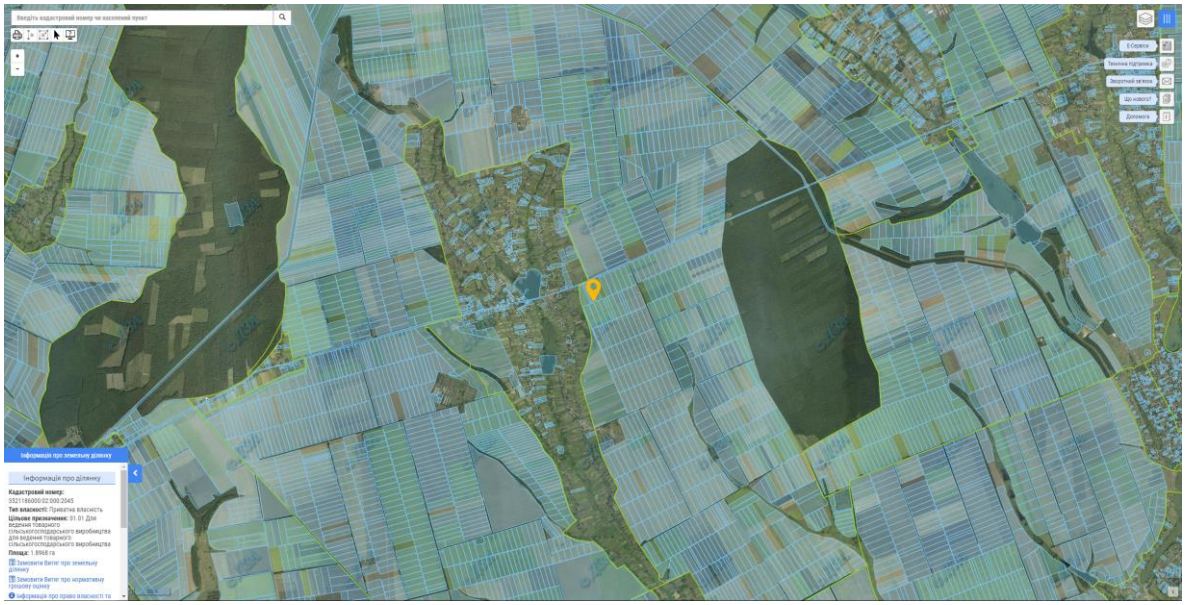
1. The core of the system is the spatial database
2. Coordinated, topological, structurally data consistency
3. Geodata monitoring system, data should be up-to-date
4. Conformity to ISO and INSPIRE standards
5. Geoservices and rules-based access to geodata
6. Work on all devices

The main problems are duplications, big territory, limited resources, and restrictions on data usage, absence of relevant data, and bad data interoperability. Recently some of those problems are being addressed by the digital transformation in Ukraine. The global drivers of digital transformation in Ukraine are mobile technologies, globalization, open data and online services. Local drivers are decentralization - is administrative unit reform, development land and urban cadastre, and development NSDI.

Development land cadastre in Ukraine

For almost 10 years, we have national parcel geodatabse and public geoportal, https://map.land.gov.ua/ which provide different services to all citizens. Now, according to decentralization, land managing goes to local authority and an open land market in Ukraine is desired.

Figure 20. Land cadastre of Ukraine



Source: https://map.land.gov.ua/

Development of urban cadastre in Ukraine

The urban cadastre in Ukraine is developing at a rapid pace. The starting point was the adoption of the Law on Urban Planning of February 2011, which obliged local and regional authorities to create geoinformation systems. Over the past few years, many geoportals were created. The core of a local GIS should be a database with a well-defined structure containing 273 object classes in 19 groups.

Date holders fill the database on partnership principles. Therefore, the system contains a secure private part for data holders. The private part is synchronised with the public open data geoportal. All data keep updated and widely used for management decisions. According to official statistics, the number of requests for official information has decreased by 10x. Cases of any data manipulation have decreased. Another advantage of such systems is the online provision of public services.

Running urban cadastre systems offers economic and social benefits, but requires financial and human resources, and also expertise and knowledge. Therefore, one of the biggest problems is the lack of enough GIS specialists and the high cost and complexity of standardized GIS solutions. Therefore, solutions based on open source platforms such as QGIS, PostgreSQL have been actively developed and used lately. These solutions are ready to use out of the box, have a simple user-friendly interface and are accessible to most users.

The key processes of urban cadastre are data integration from different data producers, topographic monitoring, and urban planning monitoring.

Data integration allows you to get complete information about the object. For objects with spatial localization, you can make join coordinates, according to ISO19111 Spatial referencing by coordinates. However, in most cases, it is necessary to do join by geo-identifiers according to ISO19112 Spatial referencing by geographic identifiers. For example, by allowing the land plot number to obtain information from the register of property rights, the state register of organizations, etc. However, it requires the implementation and use of a unified system of identifiers and a single address registry.

Topographic monitoring involves a continuous process of updating the basic topographic map of the territory based on the results of topographic surveys. All certified specialists are involved in this process: surveyors and designers. The online topographic monitoring service within the urban cadastre contains the following main steps:

- Registration licensed specialist
- Request on the territory of work
- Export of source data on the territory of work with buffer 20-100 m.
- Fixation of the work territory
- Import and automatic validation of results
- Acceptance of works
- Integration to GeoDB

Data validation is following the 'ISO 19157: 2013 Geographic information - Data quality' standard, and contains rules for topological, attribute, domain consistency. After quality control, the data will integrate into the unified geospatial database of territory, during which the old version of the objects is archived and stored.

City-planning monitoring. Ukraine cities last 10 years develop chaotically and their infrastructure is not balanced. According to law, cities must organise urban planning monitoring. However, the real situation changes so quickly and in response we started to use drones for city-planning monitoring, especially for new city districts. That allows:

- The detection of illegal construction
- Identification of inconsistency with urban planning conditions
- Monitoring construction process
- Share new imaginary to GIS specialist

Development NSDI in Ukraine.

A pilot project for the creation of an NSDI in Ukraine was implemented in 2016-2018. The territory of the project covered 11 sq. km. The main components are fundamental data, profile data, technical documentation and standards, geoportals with geo services, and use cases associated with the integration and utilisation data through http://nsdi.land.gov.ua/. Standards and data specification were based on ISO. In addition, a geoportal with geo services: metadata editor, metadata validator, metadata catalogue, geo calculator was developed.

Conclusions

The main priorities for the development of the NIGD are the following:

- Legalisation of NSDI in Ukraine
- Development of an NSDI strategy and action plan
- Development of NSDI component
- Development of an urban and land cadastre
- Share practical use cases of data utilization

2.4.4 Smart City & SDI Strategies Towards Digital City Twins

Dursun Yildirim Bayar, Ministry of Environmental and Urbanization, Turkey

Many Turkish institutional services have been digitalised and integrated, unleashing the potential of digital online registrations. This enabled the digital management of many procedures that are applicable to citizens. Among the many benefits of digitisation, cost efficiency is surely among the most interesting for governments. Digital university registration service, used by 504.000 students, resulted in a net saving of over 43 Million Euro in Turkey.

The Directorate General of Geographical Information Systems prepared the "2020-2023 National Smart Cities Strategy and Action Plan" for Turkey, in order to provide a nationwide vision, an overall strategy and a sustainable development plan towards smart cities. The study is currently the fourth smart cities strategy and action plan in the world.

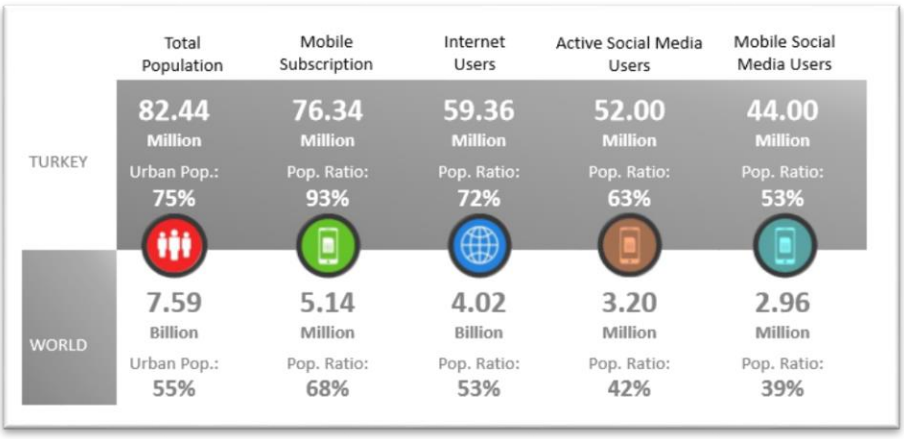
2020-2023 National Smart Cities Strategy and Action Plan is prepared in line with Turkey's National Spatial Data Strategy and Action Plan, which strategic goals are: (i) establishment of institutional NSDI structure, (ii) completing sharing of Spatial Data in the context of interoperability, (iii) disseminating NSDI countrywide, and (iv) establishing a globally competitive GIS industry.

Taking Digitalisation as the driver of sustained growth, the Ministry of Environment and Urbanisation, Directorate General of Geographical Information Systems improved many aspects through establishing a digital infrastructure. Currently, the internet of objects that facilitate the planning, management, construction and smart services of the city is a new concept and a new model in which new generation information communication technologies such as cloud computing, big data and geographic information systems are applied.

Recently, many systems of the institutions in Turkey are being integrated, covering the opportunities of digital registrations through these systems, in order to enable digital management of many procedures that are applicable to citizens. Besides the service efficiency, as an example, In Turkey, digital university registration service saved over 43 Million Euro in 2019, which has been used by 504.000 Students. If only this example is taken into account, cost efficiency that is provided by a single digital service approves the proof of concept of digitally-enabled sustainable growth.

Digital user statistics of Turkey and World show that there would be many more opportunities in improving new working and management models using digital services in all aspects, including urbanisation. This shows the potential for the adoption of new solutions regarding smart cities.

Figure 21. Digital User Statistics: Turkey / World



Source: Hootsuite Report, January 2019

Smart Cities: General Overview

Dense urban areas need different and innovative solutions. In order to provide new solutions in today's world, the smart cities concept brought new definitions for determining the wide extent of this approach. According to ISO 37120, the smart city provides an environment in which "the internet of things that facilitate the urban planning, management, construction and smart services of the city is a new model and concept in which new-generation information technologies such as cloud computing, big data and geographic information systems

are used". European Commission definition is; "A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business."

2020-2023 National Smart Cities Strategy and Action Plan of the Republic of Turkey

The Ministry of Environment and Urbanisation, Directorate General of Geographical Information Systems prepared the "2020-2023 National Smart Cities Strategy and Action Plan", in order to provide a nationwide vision, and an overall strategy and a sustainable development environment in smart cities. The study is currently the fourth smart cities strategy and action plan in the world. According to 2019-2022 National Smart Cities Strategy and Action Plan the smart cities are; "more liveable and sustainable cities that are put into practice in cooperation with partners, using new technologies and innovative approaches, justified by data and expertise and also offering solutions that enrich the life by foreseeing future problems and needs"

As technology would not be independent of sustainability in smart cities, the solutions that will form our future should be different than today. Beyond digitalisation, smart cities bring together many approaches; including geospatial data, technology management and socio-economic factors. By this approach, the vision of National Smart Cities Strategy and Action Plan is determined as "Liveable and Sustainable Cities that Add Value to Life"

The National Smart Cities Strategy and Action Plan Project Outputs include; current situation analysis and determining necessities, Strategy and Action Plan, Maturity Assessment Model, Monitoring-Evaluation Model and System and Smart City Information Sharing Portal (www.akillisehirler.gov.tr). By a multi-stakeholder approach; approximately 150 meetings, 5 Workshops are held with the participation of Over 1000 experts' from national institutions, municipalities, academia and private sector.

The 2020-2023 National Smart Cities Strategy and Action Plan includes 16 components and specifies 4 strategic goals. The strategic goals are; establishing a smart city ecosystem, improving capability, providing interoperability and coordination.

Besides all actions, the main approach is to establish a structure to orient Sensors – Data Collectors – Data Producers, Communication Infrastructure, Artificial Intelligence, Big Data issues and applications layer to be laid on Spatial Data Infrastructures and a integrate with national spatial data infrastructure.

Monitoring and Evaluation Model

The measurement method to be used within the scope of the Monitoring Evaluation Model will be the main tool that will enable the partners of the Smart Cities Ecosystem to monitor and evaluate the progress criteria of the Action Plan and the performance indicators of the actions, as well as the progress and achievements of the Action Plan.

Smart City Maturity Assessment Model

Within the scope of the project, by the implementation of the Smart City Maturity Assessment Model, it is aimed to determine the competencies of cities in Turkey related to smart city governance and implementations by conducting interviews with all partners.

Maturity evaluation pilot studies are carried out in two Municipalities. By realizing the same studies in other cities, the smart city index will be created by comparing the maturity levels of the cities.

National Spatial Data Strategy and Action Plan

The 2020-2023 National Smart Cities Strategy and Action Plan is prepared in line with Turkey's National Spatial Data Strategy and Action Plan, which is also prepared by the Directorate General of Geographical Information Systems. The Strategic Goals of National Spatial Data Strategy and Action Plan are; establishment of institutional NSDI structure, completing sharing of Spatial Data in the context of interoperability, institutional and individual capacity building, disseminating NSDI countrywide and establishing a globally competitive GIS industry.

Leading & Current Projects

The Cloud Urban Information System is established by the Directorate General of Geographical Information Systems and it provides geospatial modules for the free use of municipalities. Local, standard spatial data production, decreasing license costs, improving the service quality of municipalities and providing data infrastructure for smart cities are the main purposes of this Project.

The NSDI Integration Project provides integration to national geoportal and Atlas application by web services and metadata of 32 institutions, 30 metropolitan municipalities. (Atlas Application: www.tucbs.atlas.gov.tr - Geoportal Application: www.geoportal.gov.tr)

The 3D Building and City Topography Project provides CityGML Data production of buildings in all settlement areas of Turkey and 81 Provinces are planned to be completed at the end of 2019. Data (acquired from True Ortophoto Project) that is used in this Project covers an urban area over 40.000 Km^2. It is aimed to establish a model of all Turkey to form Digital Twins, by a comprehensive approach, which will integrate many systems and data in order to form the data infrastructure for smart cities.

2.4.5 Digital development of the Agency for Real Estate Cadastre

Sonja Dimova, AREC North Macedonia

AREC manages digital data which can be divided into three categories: cadastral data, cartographic data and geodetic data. Regarding the cadastral category, the process of digitalisation consisted of maps digitalisation, and harmonization between cadastral maps and cadastral book.

The percent of digitalisation in 2009 was 31%, in 2016 was 83% and at the end of 2018, the percent of digitalisation was 99% for the entire territory of North Macedonia. The process of digitalisation is expected to be over by the end of 2019.

AREC's intention is to follow the new trends in the digital area especially the cloud system, develop a tool for improving the quality of cadastral data, establish advanced scan centre for scanning old cadastral data, develop new register for sale of confiscated property, introduce new digital techniques for data acquisition and processing

Introduction

For the successful implementation of digital development and for the achievement of good results a few things are necessary. These are the good vision on how we can improve our processes in order to satisfy the customers, educated employers who will do it and the knowledge that will help us to implement it. Besides the previously mentioned aspects, we also need the relevant hardware and software, digital data and web services.

Digital data are the basis for development. Existing data can be digitised and transformed into machine-readable raster or vector formats. Finally, web services can publish them on the portal to the end-users.

AREC digital development

AREC has digital data, which can be divided into three categories: cadastral data, cartographic data and geodetic data. The category cadastral data covers all the data related to the real estate. The cartographic category includes data from small-scale topographic maps, smaller than 1:25.000 and geodetic data cover data for geodetic network/points which are the base for any field surveying.

The process of digital development in cartography started in 2004 with the production of state base topographic map in scale 1:25000 in the vector form. Based on this map, the rest of the small-scale topographic maps in scale 1:50.000, 1:100.000 and 1:250.000 are produced. Besides topographic maps, this category includes digital ortophoto, aerial-images, laser data and digital terrain model (DTM).

Regarding the cadastral category, the process of digitalisation started in 1996. This category includes the cadastral maps that are produced in scale 1:1000 for the cities and 1:2500 for areas outside of settlements and villages. During the process of digitalisation, besides maps digitalisation we have made harmonization between cadastral maps and cadastral book (alphanumerical property data). Now, after the process of digitalisation for each property, we have relation one to one between map ad attribute data. This means that attribute data from the map and attribute data from the book are aligned and stored in one database. The percent of digitalisation in 2009 was 31%, in 2016 83% and at the end of 2018, the percent of digitalisation was 99% for the entire territory of our country. We expect to finish the process of digitalisation at the end of this year.

E-cadastre system

The digital cadastral data is stored and managed in one electronic cadastre database, which is connected with the cadastral system specially developed for our purpose. The system uses web services and serves around 700 AREC employers. Beside AREC employees, the system supports external professional users with a special e-front desk tool.

The E-front desk is used by professional users such as ministries, municipalities, notaries, enforcement agents, lawyers, surveyors, banks and other legal entities that need cadastral data. For using the system they must sign an agreement with the AREC. The use of the e-front desk system is free of charge. The number of external professional users is growing up year by year. At the end of 2018, the number of external professional users was 1242. According to AREC reports, the main users are notaries (259), municipalities (236) and private surveyors (230). Together with AREC, the total number of users of the electronic cadastral system is 1900.

In order to make a complete digital production line for the private surveyors, AREC developed a special tool for the production of digital geodetic reports. With this tool, geodetic reports for performing surveying are produced

in xml and gml formats. Both formats are compatible with the electronic cadastral system. Through that approach, we assure compatibility between e-cadastre and field surveying.

The possession of digital data and e-cadastre is crucial for speeding up procedures and processes. Today many cadastral datasets and services are available online, or the user can get data immediately from the front desk.

The intersection point between paper-based and digital management was the first quarter of 2016 when the number of electronic cadastre application was equal to the number of applications in paper form. After the first quarter of 2016, the number of electronic applications is growing. Currently, AREC is receiving applications in electronic form only.

The e-cadastre offers the possibility that the data from the electronic cadastre system can be issued by AREC and also other professional users.

Besides the real estate cadastre related to cadastral parcels, houses and apartments, AREC also established an e-cadastre for utility infrastructure. The utility cadastre is developed as part of the electronic cadastre system. For utility infrastructure, AREC issues utility property list which is a legal document for ownership of utility infrastructure objects, then map of utility infrastructure and other products. The number of applications received in the electronic cadastre on an annual basis is about one million. This number includes also applications received in all cadastral branch offices and the e-front desk.

OSSP (One Stop Shop Portal)

From our perspective, the most important step in digital development is to make digital data available for the end-users. For this purpose, AREC implemented one stop shop portal or e-shop. All AREC digital data from the previously mentioned three categories are published on the portal. Through this portal, every user (natural person or legal entity) can obtain/buy the data.

Before purchasing the data, users can search and view the data. Search can be made by the number of a cadastral parcel, by the number of its property list, or through a selection of the property on the OSSP portal. Using the portal, customers can online order and buy digital products from the cadastre, cartography and geodesy. For advanced users, the portal offers data via web services. For example, the property list or copy of cadastral maps which is a result of the online order, users receive an e-mail as an official legal document that contains a digital signature and a time stamp.

If we analyse the number of received orders on the OSSP portal in 2017 and 2018 included in the AREC annual reports, we can conclude that the number of orders is increased by 84% in 2018. If we compare data issued in 2017 and 2018 we can see that the number of issued data on the OSSP portal has increased by 143.

Related with the type of issuing data, we can clearly see the digital trend. The most requested data is digital data. Interest for analogue data and web services are not large. However, we believe that the future is related to web services and in upcoming years, the use of web services as a new way of utilising online data will increase.

NSDI (National Spatial Data Infrastructure)

Figure 22. National Spatial Data Infrastructure

Source: Sonja Dimova, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

Besides the electronic cadastre system and OSSP portal, AREC has developed a national spatial data geo-portal. AREC is also the institution responsible for the establishment and maintenance of this portal. NSDI geo-portal contains digital data, metadata and web services from different state institutions. The data on this portal is available only through web services. Most of the datasets, which are available on the NSDI geo-portal come from AREC and they are prepared in line with national and by INSPIRE standards. Several state institutions are publishing data on the NSDI geo-portal: the Ministry of Environment and Physical Planning, Ministry of Agriculture, Water and Forest Management, Crisis Management Centre, State Geological Survey, and State Statistical Office. Currently, there are 35 data sets, 37 web services and 72 metadata records available on the NSDI geo-portal.

Other digital developments

Besides the digital development at AREC related to geospatial data, in our institution, we implemented a digital environment for the successful management of human and financial resources. There are software for Enterprise Resource Planning (ERP) and software for the Document management system (DMS).

ERP system integrated resource planning standardized and simplified the procedures that are used on the finance, human resources, analytics and logistics sector and provides management with complete picture of the dynamics of material consumption of AREC resources, enable easier planning of the resources, and the needed for the next period, based on relevant and accurate data. DMS system facilitates internal processes and enables complete digital document management including e-signature.

All previous mentioned AREC electronic systems: e-cadastre, e-front desk, OSSP, ERP, DMS, are connected with each other and interoperable.

This way of digital development enables saving memory, avoids duplication of data and improves the working procedures.

Benefits and next steps

AREC's benefits from the digital transformation include the following: increased work efficiency, reduced time for solving the application/transaction, as well as the creation of better working conditions.

The digital development brings benefits for the users. They have online data and save time and cost for coming physically in order to get AREC data. Also for the users that prefer paper data, they can obtain it in every AREC 29-branch offices as well as in offices of the professional users (notaries, private surveyors, etc.). Property transactions are highly secured through the use of the e-cadastre system.

Conclusions

Despite the fact that AREC implemented digitalisation in different areas and processes, digital development is still not completed. AREC's intention is to follow the new trends in the digital domain, especially related with the following: cloud systems, development of a tool for improving the quality of cadastral data, establishment of an advanced facility for scanning of old cadastral data, development of a new register for sale of confiscated property, and introduction of new digital techniques for data acquisition and processing.

2.4.6 Digital transformation - an educational perspective

Tijana Ilić, EUROGEO

Education in Serbia has been changed last few years. A new Education reform has been implemented in 2018. Starting from 2017-18, Computer science has been made compulsory subject in primary schools from the 5th grade, enabling both students and teachers to gain digital competences.

During 2018, Serbia realized several important projects towards digitisation:

(i) "2000 Digital classrooms": securing 2000 laptops for primary school in Serbia, as well as digital textbooks and training for teachers;

(ii) "21st Century School", founded by British Council, whose aim was to develop students critical thinking and physical computing skills, equipping children with pocket computers;

(iii) "AMRES" Academic Network of Serbia to grant internet access for 96 % of schools in urban Serbia and in 25 rural schools, as well as providing 600 computers.

Digital transformation is the changes associated with digital technology application and integration into all aspects of human life and society. It is the move from the physical to the digital. Digital transformation (DT or DX) is the integration of digital technology into all areas of business, requiring fundamental changes in technology, culture, operation and value delivery. DT is a physical change designed to meet the ever-growing demands of students, school and campus to create a learning environment where everything connects (ALE, 2019). This is an ecosystem that combines technology, service and security to bridge the digital gap to create collaborative, interactive and personalized learning experiences. Putting DT in the education context we realise that DT plays a crucial role and it is very important to create a learning environment. The overall learning environment does play a role in the quality of education a child receives. That kind of environment becomes fun and interactive. Why do we need DT? Because we work with the millennial generation, which is hugely mobile-focused. If we want a quality education, a digital literacy nation, a new digital world requires teachers to adapt and adopt DT. It also helps schools administrative duties to capture all the necessary data at once.

Education in Serbia has been changing in the last years. A new Education reform has been implemented in 2018. Through the new Curriculum for Grammar school, many subjects changed structurally. A new compulsory subject, like Education for Sustainable Development, could be integrated with ICT as well as other subjects. Starting from 2017-18 school year Computer science has been made a compulsory subject in primary schools from the 5th grade. The application of ICT enables both students and teachers to gain digital competences. The aim of these new school reforms is to increase the competitiveness of the market and create a favourable business environment, which will be stimulating and safe for new investments, but also attractive for young professionals.

During 2018, Serbia had realized several important projects: "2000 Digital classrooms" securing through a variety of project activities, 2000 laptops for primary schools in Serbia, as well as digital textbooks and training for the teachers on how to use them; "21st Century School" was founded by the British Council and its aim was to develop students critical thinking and physical computing skills. (Equip children with pockets computer and train the teacher to use them); and "AMRES" Academic Network of Serbia – a project that enabled internet access to 96 % of schools in urban Serbia and in 25 rural schools, as well as providing about 600 computers.

With the aim of modernising, improving and easing the work of all participants in the Serbian education system, most schools created the complex "School Information System" programme, which consists of integrated applications intended for all educational institutions of preschool, primary and secondary education. Thanks to the "School Information System" teachers use an electronic diary, electronic pedagogical notebooks, electronic portfolios for students, an e-programme for printing testimonials, a platform for creating school websites and different education platforms such as Kahoot and Edmodo.

Figure 23. Drivers of digital transformation in higher education

Source: https://www.digarc.com/blog/2018/08/four-drivers-of-digital-transformation-in-education/

The processes described above are supported by EUROGEO. The European Association of Geographer (EUROGEO) is an international NGO, legally based in Belgium and established 40 years ago, with the aim to protect geography and promote the work of geographers. EUROGEO advance the status of geography, organises events/activities for members, produces publications (Springer book series, open public e-journal), makes recommendations on policies, supports geographers, identifies and promotes good practices, research, gives advice on geography lobby at European and national level (has participatory status at Council of Europe and Consultative status at the United Nations). EUROGEO contributed to the sustainable development goals and to Rio+20, Landscape convention and COP21, UNEP Live –open data – and Habitat III – urban planning (single most important international event on cities and future sustainable urban development). Through an open-access journal EUROGEO translate the work of scientist to policy-makers.

2.4.7 A review of cyber-attack trends in Geospatial and Global services

Vladan Todorović, Advance Security Technologies (AST), Serbia

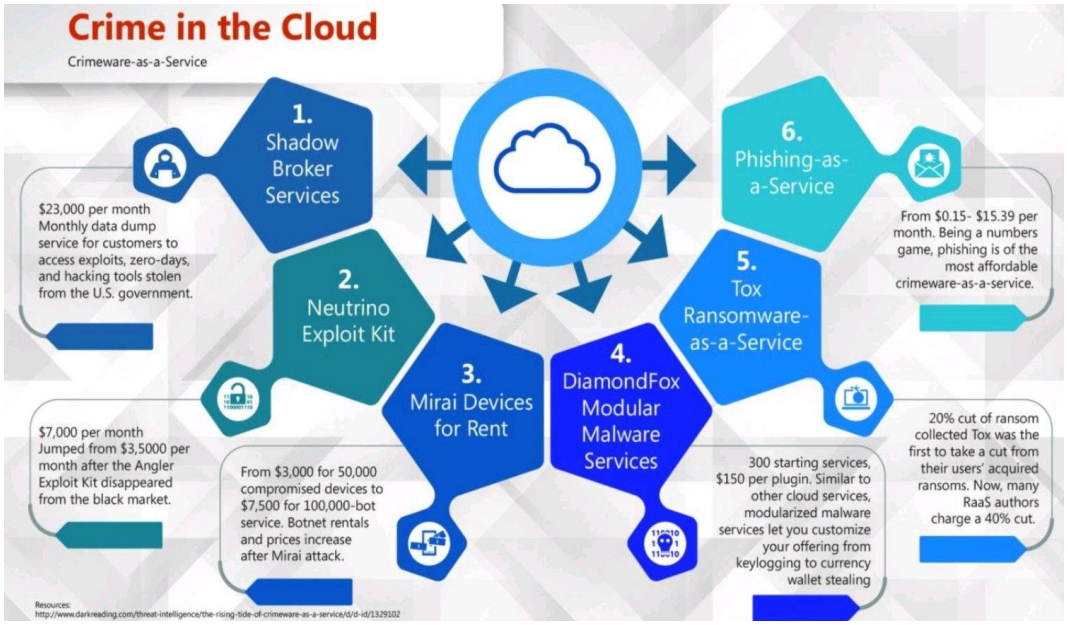
The intensity of the number of cyber-attacks is increasing fast in the last years as the economic value of the stolen information is extremely high and multiple sales of the same file are possible. As well, geopolitical forces are leading countries towards cyber warfare which is not expensive but has great economic and political consequences. This allows also less rich countries to become powerful in cyber warfare.

Cybersecurity today is reactive: someone has to be attacked in order for that attack and attacker to be detect ed. Only days after the attack will be added to an AV/ Next Generation Firewall (NGFW) blacklist and time will pass before AV/NGFW engines are updated. Unfortunately, this approach will never detect specific enemies that are targeting only one person.

The number of potential attack targets is increasing exponentially as attack vectors are constantly evolving, while it is hard to automatically patch and update low-cost devices. Furthermore, with the fifth mobile network generation, allowing for device-to-device communication, every device will be on the net.

In the future, autonomous cyber-attacks will be performed by artificial intelligence as it will allow for extremely low price automated attacks where no human experts are involved in the execution.

Figure 24. a new approach – Hacking As A Service



Source: Vladan Todorovic, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.4.8 Possibilities of applying video identification in information systems

Marko Adžić, Saga, Serbia

A video identification process is an alternative to identifying a client when establishing a business relationship on the premises of a financial institution by accessing an identity card or other identity card document.

Video identification in administrative procedure contains the following steps: client requests for a video meeting, the system sends SMS with OTP and meeting time, client access through web portals with OTP, a procedure of identification with personal document, the system does user identity verification, establishing video calls, exchange of electronic documents related to administrative procedure.

Video identifications in public institutions would: a) increase citizen satisfaction – simplicity, b) save time and money and c) reduce pressure on public administration employees.

The technical specification can be described with key features: WebRTC based solution, available from all devices and search engines, end-to-end encryption of an active video call (citizen to administration), cryptocurrency storage, cloud-based solution – minimal hardware infrastructure.

Figure 25. Conceptual framework of video call

Source: Marko Adžić, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.4.9 Federated information system for SDGs system for IT System for SDG reporting

Jelena Cvetinovic, ESRI Serbia

Federated information system for SDGs system goal is to: (i) provide global understanding of progress on the goals; (ii) empower countries to use and make visible their own data at national and sub-national levels, (iii) Strengthen NSO existing geospatial and statistical data systems, (iv) provide Collaboration with other partners/ agencies within country and globally

WebGIS is a highly innovative platform that provides access to data and gives the opportunity to hubs and communities to collaborate and share data. It is a tool to create a unique informational system.

The implementation of ArcGIS Hubs started in 2017 and by now there are 18 countries using the platform to follow and track the improvements towards the achievement of their SDG targets.

In order to be eligible for donation, the country has to implement national SDG Hub on the ArcGIS platform. Joining a central UN SDG Hub is optional at this moment. Once a country joins the platform they will be able to upload, share and download the data which can improve their data analysis processes. ArcGIS platform represents an open platform in a way that users can leverage open source data analysis tools like Python and R to further analyse their data and share it with the stakeholders.

In the following period, there will be donations for 60 countries to establish their national hub, thus to become able to implement ArcGIS Hub and to use the Web GIS platform

Figure 26. Future steps for FIS4SDGs

Source: Jelena Cvetinovic, Presentation during the "Digitally-enabled Development" conference, 19.09.2019

2.4.10 The IMPULS project – building an infrastructure for the exchange of digital data

Anders Ryden, Lantmateriet, Sweden

In the Western Balkan area, Swedish Sida initiated the IMPULS project to support the participating organisations in addressing these different components, with the aim to establish NSDI's in each participating country, as a base for a regional SDI and in compliance with INSPIRE. The project started in June 2014 and will finish in December 2019.

The IMPULS project, the continuation of the INSPIRATION project, has been moving from more general activities for raising awareness, making analyses and transfer high-level knowledge to increasing practical knowledge, capacity and supporting the actual implementation of the INSPIRE Directive.

Now at the end of the project period, the IMPULS project has experienced substantial progress in the development of SDI's in the region. Five NSDI laws/regulations are in force and one NSDI law is in the procedure of acceptance. Six BO's are nominated as national coordinators and six BO's also have functional structures for coordination.

There has been a substantial increase in the knowledge on INSPIRE data specifications and data has been harmonised for several INSPIRE data themes. Similarly, there has been substantial increase in the knowledge in the area of developing Internet services for data provision.

Human beings have always shared information with each other, from early cave drawings to modern-day digital data using services on the Internet. Given the increasing pressure on land and water resources, planners and policymakers alike have an ever-increasing need for more data, from more sources, to solve every-day problems. Within this background, building an infrastructure for the exchange of digital data (also known as a Spatial Data Infrastructure (SDI)) is a mean to facilitate the access and reuse of data from different sources, to the benefit of planners and policy-makers at all levels in society.

The bottom line is to remove barriers for data sharing between different organisations in a country or region. Examples of barriers for data sharing are;

- legal issues and frameworks that prevent data sharing between organisations,
- charging and licensing issues not allowing efficient reuse of data as receiving organisation may not have the funds necessary to access the data,
- or technical issues such as data are not complete, standards are not applied, poor documentation, etc.

The development of an infrastructure for the exchange of digital data (SDI) aims at successively eliminating these barriers by adopting common standards and frameworks for data sharing.

Figure 27. Sharing data over the internet

Source: Anders Ryden, Presentation during the "Digitally-enabled Development" conference, 20.09.2019

To set up a well-functioning NSDI and remove barriers for data sharing between different organisations in a country, several different areas – components – of an NSDI need to be appropriately addressed. These components are:

- Spatial data
- Services
- Metadata
- Geoportal
- Standards
- Legal framework
- Cooperation
- Competences

Depending on the starting point, a different focus may be put on different components to achieve the desired results, just like a vehicle is assembled by parts of specific types and dimensions to make up a particular car brand.

In the Western Balkan area, Swedish Sida initiated the IMPULS project to support the participating organisations in addressing these different components, with the aim to establish NSDI's in each participating country, as a base for a regional SDI and in compliance with INSPIRE. The project started in June 2014 and will finish in December 2019

The IMPULS project has de facto been a continuation of the INSPIRATION project, which was financed through EU with IPA funding with the aim of promoting spatial data infrastructure (SDI) and prepare beneficiaries to meet the objectives of the EU INSPIRE Directive. The IMPULS project has, however, been moving from more general activities for raising awareness, making analyses and transfer high-level knowledge to increasing practical knowledge, capacity and supporting the actual implementation of the INSPIRE Directive – all focusing on cooperation, hands-on work and sustainability

Lantmäteriet has been the implementing partner working in cooperation with the State Geodetic Administration of the Republic of Croatia (SGA) is the junior partner. The beneficiary organisations in the Western Balkan have been:

- Immovable Property Central Registration Office of the Republic of Albania (IPRO)
- National Authority for Geospatial Information in Albania (ASIG)
- Federal Administration for Geodetic and Real Property Affairs of FBiH (FGA)
- Republic Authority for Geodetic and Property Affairs of the Republic of Srpska (GARS)
- Kosovo Cadastral Agency (KCA)
- Agency for the Real Estate Cadastre of the Republic of Macedonia (AREC)
- Real Estate Administration of the Republic of Montenegro (REA)
- Republic Geodetic Authority of the Republic of Serbia (RGZ)

Outcome statements (i.e. what the project is expected to result in) for the project are:

1. Beneficiary Organisations understand how they contribute to an efficient SDI and have a clear view of the different SDI roles (user, producer and coordinator) and there are mutual respects between agencies having these roles throughout the region.
2. Beneficiary Organisations are using data from other sources, both national and regional, and using the different components in the SDI (metadata, portal, services, etc.) when producing, using and providing data.
3. Beneficiary Organisations are proactively driving the SDI-work and removing obstacles to share data in the region as well as actively developing and promoting NSDI's. Beneficiary Organisations are working in national and regional forums with different organisations as the normal way of working, using the network and roles initiated by the IMPULS project for regular meetings and ad hoc task force when needed.

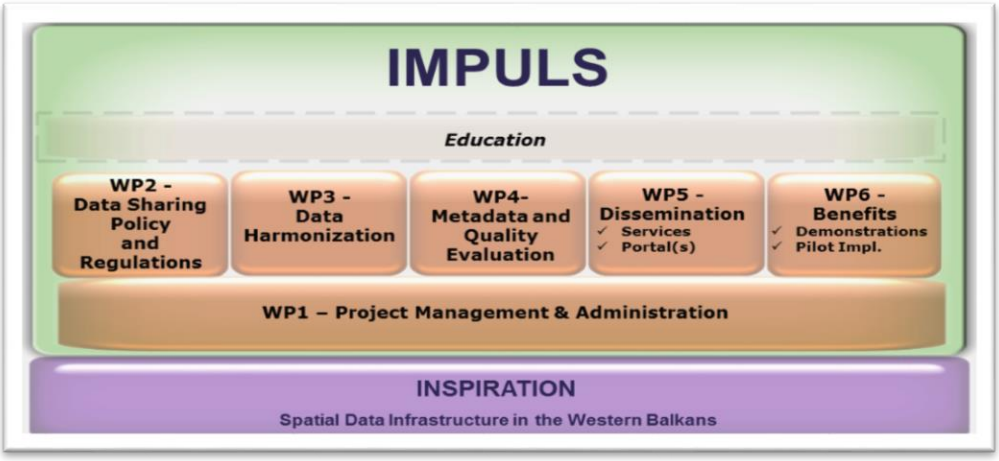
The project activities focused on knowledge raising and practical implementation in the field of organisational and legal prerequisites for SDI, harmonisation of spatial data and in development of metadata, geoportals and services. At the beginning of the project, it was agreed that 90% of the work was to be done by the respective beneficiary organisations and 10% as project activities.

In any project, it is important to clearly define the scope and outputs of different activities of a project and separate them into different work packages. To efficiently address core issues related to the development of NSDI's, the IMPULS project was divided into following six different work packages.

The project started with a kick-off event during which involved staff from all beneficiaries met and get to know each other. This was considered an important start-up activity as the establishment of formal and informal networks would, in a longer perspective, ensure information exchange within the region and sustainability of project achievements.

The biggest engagement of the experts was in the first two project years since workshops were the initial places for transfer of the knowledge raising and preparing beneficiaries for their work. Gradually, the engagement of the experts was decreased, and the engagement of employees increased with the intention to work fully independently by the end of the project.

Figure 28. IMPULS work packages



Source: Anders Ryden, Presentation during the "Digitally-enabled Development" conference, 20.09.2019

Now at the end of the project period, the IMPULS project has experienced substantial progress in the development of SDI's in the region. For instance, five NSDI laws/regulations are in force and one NSDI law is in the procedure of acceptance. Six BO's are nominated as national coordinators and six BO's also have functional structures for coordination.

A Regional Metadata profile has been agreed upon (INSPIRE compliant) and national metadata catalogues have been developed and made available. Metadata according to the metadata profile have also been produced for selected datasets and services, and more are underway.

There has been a substantial increase in knowledge of INSPIRE data specifications and data has been harmonised for several INSPIRE data themes. Similarly, there has been a substantial increase of knowledge in the area of developing Internet services for data provision (both view and download). Also, the requirements from INSPIRE have been introduced and several services are compliant with INSPIRE.

At the beginning of the project, a significant progress marker was also the development (and signing) of a pilot agreement enabling data to be shared cross-border for emergency purposes.

The main challenge now is for the coordinating bodies to widen the scope and include and encourage more stakeholders to take part in the development of the NSDI's, and to support them in their development of metadata, harmonised data and services.

The IMPULS project will be summarised in the IMPULS book "An approach to the development of a regional SDI – experiences from the IMPULS project". The book will be an overview of the activities, lessons learned, and results of a project implemented in the region of Western Balkan (WB) from June 2014 until December 2019. Target groups are the Beneficiary organisations as a recap when approaching and supporting the stakeholders, as well as any other organisations that want to get some inspiration in the are of NSDI development.

2.4.11 Centralization, virtualization and electronic document exchange

Stanko Svitlica, Republic Administration for Geodetic and Property Affairs, Republic of Srpska, BIH

Before 2014 a large number of problems were faced by ICT employees because of: (i) large number of servers, (ii) different application solutions, (iii) few IT staff at Headquarters, while there were no staff at regional offices, (iv) Frequent need to go to regional offices locations for service interventions, and (v) server problems.

For instance, before 2014 local area networks were at the level of the regional office without appropriate equipment, as well there were local servers for each regional office.

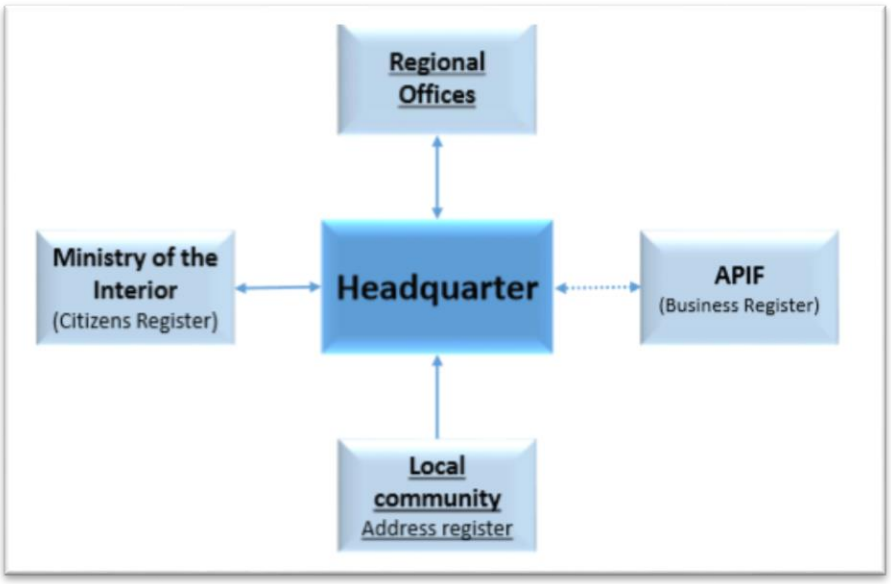
A first step forward was achieved by establishing communication infrastructures, providing all regional offices with VPN connection, establishing an antivirus security centre, and ensuring the ability to monitor and filter the traffic online.

Centralization was a key strategy to overcome problems associated with the outdated system. By having all the databases in one place, it became easier to administrate the database. This also improved data integrity and data security, providing as well better support for internal system users.

The usage of virtualization and backup solutions (VMware and Veeam) reduced the need for strong cooling, lowered power consumption and simplified server maintenance.

Finally, a data-sharing agreement was signed with the Ministry of the Interior (citizen register) and with the Intermediary Agency for IT and financial services (business register).

Figure 29. Electronic data exchange



Source: Stanko Svitlica, Presentation during the "Digitally-enabled Development" conference, 20.09.2019

2.4.12 Digital transformation of the Land Registry and Cadastre in Federation of the Bosnia and Herzegovina

Nedžad Pasalić, Federal Administration for Geodetic and Property Affairs, Federation of the Bosnia and Herzegovina

The Land Cadastre in Bosnia and Herzegovina was established between 1880 and 1884. by the Austro-Hungarian Empire. Based on the established Land Cadastre, was established the Land Book at the end of the 19th Century.

Digitalisation of the Land Cadastre data started at the end of 1970s. In addition, digitalisation of the Land Book started in 2003 with the deployment of the Land Registry software (LARIS).

All official Cadastre data have been digitised according to the Rulebook on Real Estate Cadastre Database (RECDB) and the Data model of the RECDB. Cadastre data have been managed in Oracle (object-relational) Database

Through the implementation of the Land Registration Project (financed by the World Bank loan), 95% of Land Registry data of the territory were digitised by 2012. The rest of the Land Books data were digitised through the implementation of the Real Estate Registration Project (financed by the World Bank loan) in 2015.

The integration of the Land Book and Cadastre ICT systems will be performed through the implementation of the ICT Strategy for Land Registry and Real Estate/Land Cadastre in the Federation of B&H for the period 2019-2029.

The scope of the Strategy is to define short-term (1-3 years), mid-term (4-6 years) and long-term (7-10 years) strategic objectives, projects and activities that will enable further development and advancement of Land Registry and Real Estate/Land Cadastre information systems.

1. History of the establishment of Land Registry and Cadastre

The Land Cadastre in Bosnia and Herzegovina was established between 1880 and 1884 by the Austro-Hungarian Empire. Based on the established Land Cadastre, was established the Land Book at the end of the 19th Century. The Land Cadastre and the Land Book were established for the whole territory of Bosnia and Herzegovina. The new Land Cadastre was established (starting after the Second World War ending 1984) for about 55 % of the territory. The new geodetic survey was carried out and new Real Estate Cadastre was established between the 1984 and 2005 for 17 % of the territory.

2. Phases of Digital Transformation of Land Registry and Cadastre

Digital Transformation of the Land Registry and Cadastre in Federation of Bosnia and Herzegovina has been done through three phases:

- Digitalisation of Land Book and Cadastre data,
- Implementation of the Land Book and Cadastre ICT systems,
- Integration of the Land Book and Cadastre ICT systems.

3. Digitalisation of Land Book and Cadastre data

Digitalisation of the Land Cadastre data started at the end of 1970s. It was digitalised just the alphanumeric part of the Land Cadastre data without vectorization of the cadastre maps. Vectorization of the cadastre maps started in 2003 (without an official Data Model). Alphanumeric data and vectorised cadastral maps were managed separately. In 2008 was put into official use the Rulebook on Real Estate Cadastre Database (RECDB) with the Data model of the RECDB as the part of the Rulebook. The Rulebook prescribed all processes on the RECDB and maintenance of all Land Cadastre data together in the Database based on the object-relational Data Model. All official Cadastre data have been digitised and managed in Oracle (object-relational) database.

Digitalisation of the Land Book started in 2004 with the deployment of the Land Registry software (LARIS). Until 2012 through the implementation of the Land Registration Project (financed by the World Bank loan) were digitised Land Registry data for about 95% of the territory. The rest of the Land Books data were digitised through the implementation of the Real Estate Registration Project (financed by the World Bank loan) in 2015.

4. Implementation of the Land Book and Cadastre ICT systems

Implementation of the Land Book and Cadastre ICT systems was in accordance with ICT/IM Land Registration and Cadastre Strategy for the Federation of Bosnia and Herzegovina (2011-2017). The main objectives of the mentioned strategy were:

- Redesign of LARIS and implementation of the new LR IS,
- Implementation of the Cadastre IS,
- Sustainable maintenance of LR and Cadastre IS,
- Capacity building,
- Establish Cadastre Geoportal,
- Establish LR Web services,
- Establish the Digital Archive.

All the mentioned objectives and ICT Systems were implemented until the end of 2017.

Figure 30. Cadastre Geoportal

Source: Nedžad Pasalić, Presentation during the "Digitally-enabled Development" conference, 20.09.2019

5. Integration of the Land Book and Cadastre ICT systems

The integration of the Land Book and Cadastre ICT systems will be done through the implementation of the ICT Strategy for Land Registry and Real Estate/Land Cadastre in the Federation of B&H for the period of 2019-2029. The scope of the Strategy is to define short-term (1-3 years), mid-term (4-6 years) and long-term (7-10 years) strategic objectives, projects and activities that will enable further development and advancement of Land Registry and Real Estate/Land Cadastre information systems. The ICT Strategy also address ICT systems sustainability, business continuity, capacity development, data harmonization, integration of LRIS (E-grunt) and RECIS (katastar.ba), as well as data exchange and interoperability with Digital Archive System and other relevant public registers: Citizens Identity Protection System (CIPS), Register of Business Entities (RoBE), Address Register (AR), etc.

ICT Strategy defined Short-term strategic objectives (2019-2021) as follows:

- Renewal of HW infrastructure for existing systems,
- Enhancement of existing systems (katastar.ba and E-grunt) towards data interoperability and data exchange with (DA, ARIS, RoBE and IDDEA) based on Web services,
- Establishment of communication infrastructure to support data interoperability,
- Necessary and urgent functional extension and data quality enhancement:
- Katastar.ba – support for public display business process,
- E-grunt – consolidation and management of code data,
- GUI optimization of E-grunt for mobile devices,
- Development and adoption of cybersecurity policy and action plan,
- Capacity building.

As the Mid-term strategic objectives (2022-2025) ICT Strategy defines the following objectives:

- Analysis and design of the system architectures (decentralized vs. centralized vs. distributed vs. integrated). The decision on which the system architecture will be implemented will be made after the creation of a comprehensive feasibility study.
- Land Registry and Cadastre Information System will be:
- distributed systems that ensure horizontal scalability, strong consistency, fault tolerance (reliability) through replication and distributed query processing,
- centralized systems that ensure vertical scalability, strong consistency and fault tolerance (reliability),
- integrated into a single, unified system,
- Redesign and enhancement of communication infrastructure,
- Implementation of cybersecurity policy and action plan,
- Capacity building.

Long-term strategic objectives (2026-2029) are:

- Introduction and implementation of strategic (OLAP) and high potential (Data Analytics/KDD) applications,
- Cloud and SaaS for the deployment of strategic and high potential applications/prototypes based on SaaS cloud services,
- Capacity building.

Regarding the Short-term objectives, the Renewal of hardware infrastructure for existing systems has already been implemented and the tender procedure for enhancement and upgrade of katastar.ba and E-grunt systems have been initiated.

The most important part of the ICT strategy are mid-term strategic objectives, in particular, the implementation of the integrated Land Registry and Cadastre information system, which will practically mean the completion of the Digital transformation of the Land Registry and Cadastre in Federation of Bosnia and Herzegovina.

2.4.13 Agricultural digital transformation

Ordan Chukaliev, Ss. Cyril & Methodius University in Skopje, North Macedonia

In the process of digitalisation of North Macedonia, services were offered particularly to smallholders, as they are the target group that is usually left at the margins of innovative movements.

The average farm size in North Macedonia is about 2 ha and the average plot size is 0.2 – 0.3 ha, 8 times smaller compared to the EU-28 average farm size (16.1 ha). Moreover, the farm is dispersed in many small plots (7-10 on average). Therefore, transferring the know-how directly from other European regions is almost impossible.

Knowledge per se represents another barrier to the implementation of innovations in North Macedonian agriculture, indeed only 4% of the farm holders have some education in agriculture and about 50 % only hold a primary education and lower.

The introduction of digitisation has been tried and partially achieved through several projects. Examples are: (i) farmers support system for irrigation in Pelagonia, (ii) introduction of sustainable farming practices in the Prespa lake watershed, (iii) development of a system for agro-meteo data delivery

Digitalisation for agriculture is the use of digital technologies, innovations, and data to transform business models and practices across the agricultural value chain. Many existing technologies and innovative approaches as Information systems in agriculture, ICT in agriculture, Smart farming, E-agriculture, IoT (Internet of Tractors), Earth observation, Blockchain, low energy and high precision sensors, sensor networks, embedded computers, high-resolution close distance spectral and hyperspectral imagery, big data processing capacities, and many others applied in agriculture can be considered as digitalisation of agriculture and can be used for applying digitalisation in any piece of the agricultural product value chain

Agricultural activities are spread in time and space, thus they are a very interesting subject for advanced digital techniques. Moreover, the farmers need very site-specific information (location, soil, crop, practices and measures applied, meteorological events on their field), therefore, high-resolution data and communication in both directions are required.

The world's first entirely machine-operated crop – a crop sown and tended without a human ever entering the field – was harvested in 2017, (OECD)

The development of precision farming was one of the initial steps in digitalisation of agriculture. Many researchers worked on intensive soil sampling (grid sampling) and created maps that can be used for "precise fertilizer application" in the late 60s and early 70s. This work changed the idea of uniform application of fertilizer across the field to the precision fertilization based on precision soil sampling and new approach of "Farming by Soil" that was driving force for development of the precision farming and new approaches and ides as: variable rate fertilizer spreading, site-specific farming and management zones, use of GPS in agriculture, automated tractor navigation and robots, yield mapping, variable rate herbicide application, variable rate irrigation, proximal sensing of soils and crops, etc. This development was changing the agricultural system and recently OECD reported that the world's first entirely machine-operated crop – a crop sown and tended without a human ever entering the field – was harvested in 2017.

The digitalisation in agriculture can find many applications in various links of the value chain for each agricultural product. However, the process of digitalisation is quite rapid. The most important issue in this process should be local circumstances and all initiatives should be adopted to the end-users. However, big farms and agricultural industries usually are oriented to the services offered by the big companies in this sector, but small farmers cannot afford such expenses.

In the process of digitalisation of North Macedonia, we considered offering the services to smallholders, because they are usually at the margins of innovative movements, but they are the target group that needs the highest level of support. The total number of farmers is 170 580 (Source: State Statistical Office, Farm Structure Survey, 2013). The average farm size is about 2 ha and the average plot size is 0.2 – 0.3 ha. Compared to the EU-28 (average farm size of 16,1 ha), the average farm size is 8 times smaller. Moreover, the farm is dispersed many small plots (7-10 on average). Therefore, transferring the know-how directly from other regions is almost impossible, because the average farm size is usually much bigger (18- ha in the USA, 315 ha in Canada, 133 ha in the Czech Republic, etc.). Moreover, most of the farm holders in North Macedonia are very low educated and their needs are quite different. The structure of the farm holders in the country by their level of education is presented in Table 1.

Table 1. Number of farmers by education level in North Macedonia

No education	Incomplete primary education	Primary education	Secondary education (agricult.)	Secondary education (other)	Higher vocational education (agricult.)	Higher vocational education (other)	University level education (agricult.)	University level education (other)	Master's degree and Doctorate (agricultural sciences)	Master's degree and Doctorate (other)
6 656	17 950	60 055	5 350	66 363	596	4 757	1 201	7 223	202	227

Source: State statistical office

The data in the table show that only 4% of the farm holders have some education in agriculture and about 50 % are with primary education and lower. Therefore, our attempts to introduce the digitalisation of the agricultural sector were full of trials and errors, and we were learning by doing. We will present several cases that illustrate how we were trying to support decision making at the farm level with digital technologies

CASE 1: Farmers support system for irrigation in Pelagonia

Project supported by IPA cross border cooperation with Greece in 2011 (Interactive Farmers Support System for Efficient Water Use Management-RULAND). There is an existing irrigation scheme, covering about 15 000 ha. The project developed databases for soil properties important for irrigation (Bulk density, field capacity, wilting point, soil water retention functions, infiltration), established one experimental site equipped with a meteorological station and soil moisture sensors. Moreover, farmers were welcomed to register as users of the service and to install soil moisture sensors on their field to receive more personalized information on irrigation scheduling. The irrigation recommendation was derived by a model based on evapotranspiration, crop water requirement and soil moisture balance, corrected by soil moisture sensors. Information was delivered through the web site. Unfortunately, this first attempt was almost failure, never more than 100 farmers were registered and slightly the whole system disappeared.

CASE II: Prespa Region

Project: Restoration of the Prespa Lake Ecosystem -Support to the Introduction of Sustainable Farming Practices in the Prespa Lake Watershed (UNDP 2013-15). The project developed the system for recommending in irrigation and in crop protection. The approach was to install seven automated weather stations that were considered as representative for the locality were installed. The irrigation component was similar to our previous experience in Pelagonia. Moreover, farmers were equipped with soil moisture data loggers and trained in using soil moisture data. The crop protection component used meteorological data in real-time for modelling the risk of infection with some diseases. The 70 farmers participated in the testing period. The average irrigation water saving was more than 60%. The number of sprayings decreased from average 10-15 to 5-7 (50% reduction). The system raised big interest among the farmers. The irrigation component is not operational in present, but the crop protection component is active and upgraded to deliver information on Facebook.

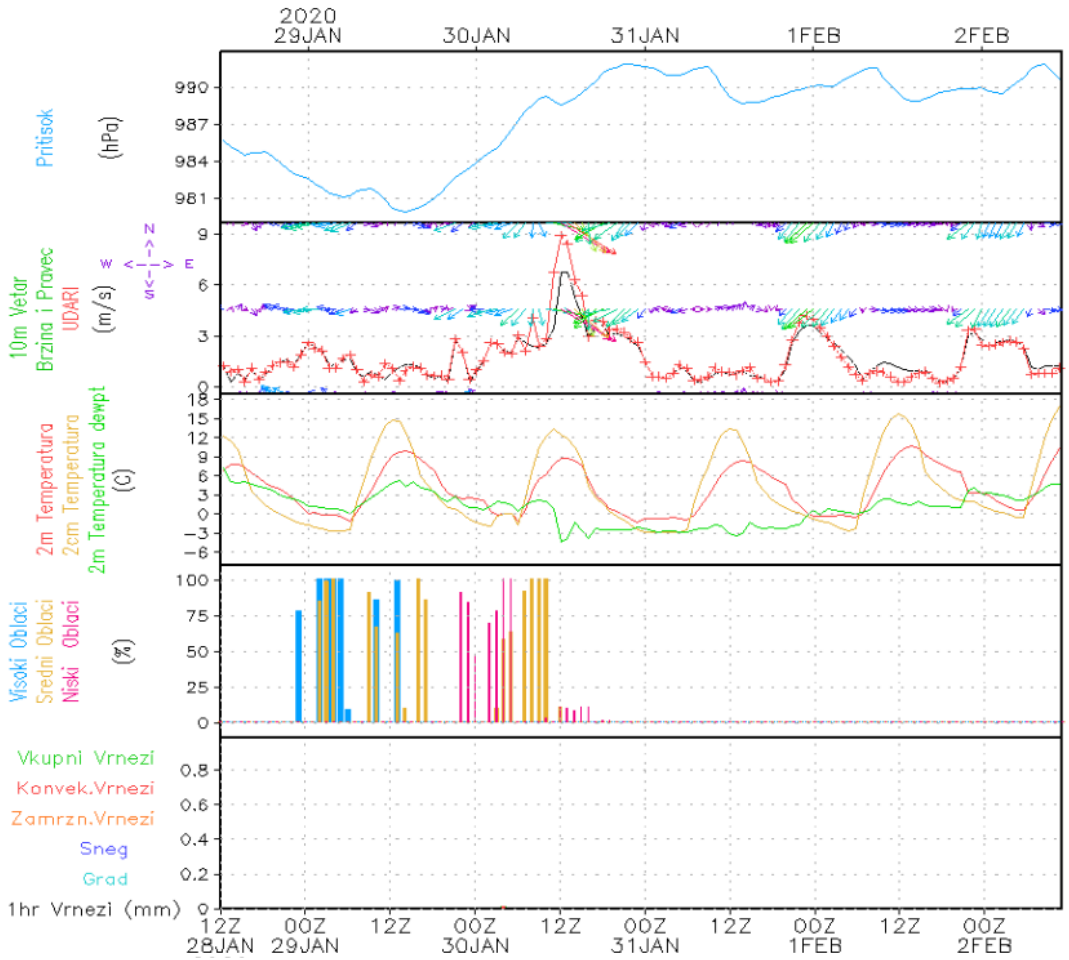
The reason for the success of this project was that we conducted a survey before designing the systems and we know what the problems of the farmers are and what their preferences in information delivery are. Moreover, in the region, there is only one crop pf interest – apple. In addition, crop protection is the highest cost (about 1500 euro/ha). Reducing the number of sprayings for 30% will result in a saving of 500 EUR. Thus, farmers highly appreciated this service. In irrigation, they saved 60% of the water but they do not pay for the water and they can save only about 120 kWh of electricity for pumping that is about 12 EUR. Therefore, they accepted the crop protection system, but not the irrigation system.

CASE III: Strumica River Catchment

Project: Technical Assistance for Introduction of Sustainable Farming Practices in the Strumica River Basin (UNDP 2015-now). The project is trying to replicate achievements from the Prespa Region. There are some improvements, but the region is much bigger, the number of crops is very big, and we cannot cover all crops, different systems of production are applied for the same crop, etc. Therefore, we cannot be happy with the results achieved.

CASE IV: FAO Support developed www.agrometeo.mk

Figure 31. AGRIMETEO forecast



Source: www.agrimeteo.mk

A system for delivering agro-meteo data was developed. Unfortunately, information is available only for 3 Automated Weather Stations installed by the project. Also, phenological observation, weather forecast, and a number of other information are presented. But, the project newer consulted farmers, agronomists or experts dealing with issues in digitalisation of agriculture and repeated the most frequent error in digitalisation. The data is presented in the way that farmers cannot understand it and cannot use it. Just the web site offers something farmers do not need. Moreover, there is no download option and other experts cannot easily transform monitored data in the information required by the farmers.

CASE V: Other activities

We already developed some advanced products that farmers did not appreciate, such as UAV (DRONE with NDVI camera based on the Infagram project) AWS with temperature, relative humidity, wind speed and rain gauge sensors, etc. That was another failure because farmers very good know the variability in their very small fields, and they do not need technologies that will tell them something they already know. In the recent period, we targeted the development of low-cost equipment that would be affordable for small farmers and be installed in fields and provide instant information on the farmer's mobile phone. We started with sensor networks and some innovative approaches for processing the data in information farmers will like or in controlling the processes farmers do not take care of (automated irrigation control, etc.).

Moreover, we are doing some efforts to move from the monitoring of the environment and soil in monitoring the crops and using the crop response to implement digital technologies. We hope that the future will be the Internet of Crops.

2.4.14 Development of National Spatial Data Infrastructure in the Republic of Azerbaijan

Huseyn Hasanov, Service for the State Registry of Real Estate, Azerbaijan

In Azerbaijan, public bodies are obliged to establish an e-service unit in their official internet information resources since 2011. Government organizations are thus required to provide stable and uninterrupted functioning of electronic services.

Also, in 2011, the e-government portal was created. Every participant was provided with an electronic signature certificate and code. With the "one-stop-shop" principle, all participants integrated their services to this portal. Since then, 449 e-services were provided for the portal.

State Committee on Property Issues (SCPI) currently has 41 e-services about real estate registry, cadastre and privatization auctions. Because the legacy information systems contained textual data that were not compatible with the needs of today, GIS-based systems were introduced to the service.

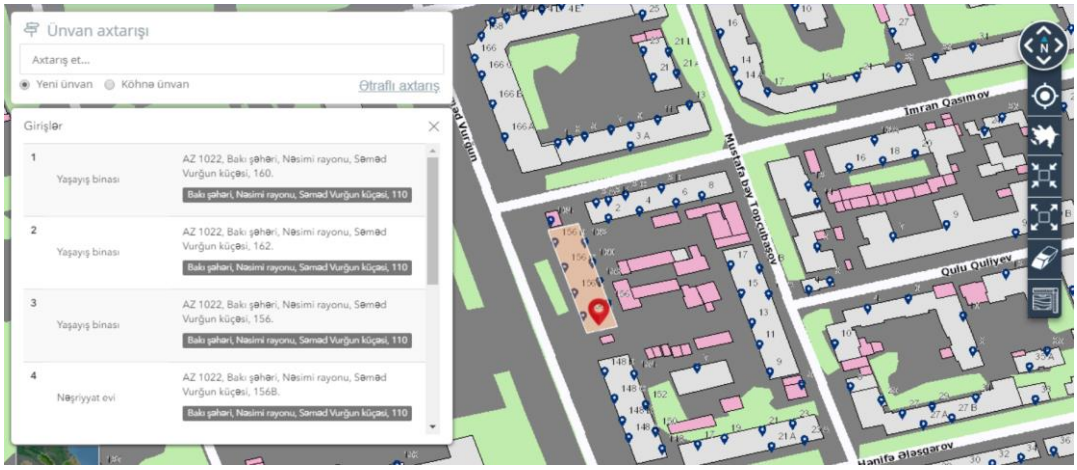
In 2013 AzCAD data model was created and land survey data were collected according to the latest standard. The address Registry Information System was created as a unified address source for government entities.

The main legal base for establishing National Spatial Data Infrastructure in the Republic of Azerbaijan is the Presidential Decree 448, 2018 "Rules for the formation and integration to e-government of national spatial data". SCPI is made responsible for the NSD Information System and SAPSSI for the development of the Geoportal as a subsystem of the E-Government portal.

E-government in Azerbaijan was established in 2011 by the Presidential Decree dated May 23, 2011. By this decree, public bodies are obliged to establish an e-service unit in their official internet information resources. According to the decree, government organizations are required to provide stable and uninterrupted functioning of electronic services. During the same year, the e-government portal was created. Every participant was provided with an electronic signature certificate and code. With the "one-stop-shop" principle, all participants integrated their services to this portal. Since then, 449 e-services were provided for the portal.

State Committee on Property Issues (SCPI) is the government organization responsible for registration, management and privatization of state property, registration of real estate and property rights, conducting of unified cadastre of real estate and address registry. SCPI currently has 41 e-services about real estate registry, cadastre and privatization auctions. For the objective of establishing National Spatial Data Infrastructure, IT infrastructure and spatial databases are necessary. Because the legacy information systems contain textual data that were not compatible with the needs of today, GIS-based systems introduced to the service. For creating a unified cadastre database there was a need to adopt a standard for cadastre. In 2013 AzCAD data model created and land survey data collected according to this standard. Address Registry Information System was created as a unified address source for government entities. In 2008 new address standard formed based on INSPIRE address specification. Address data is distributed to government agencies by web services and web portal created for citizens to search for their addresses. Real Estate Registration Cadastre and Management System is the main system for property ownership, spatial cadastral objects, mortgages, leases, etc. All separate cadastre databases in regional offices were integrated into the new single system. Electronic Land Cadastre Information System is another system for administrative unit boundaries, soil survey and land classification and management maps. This system was created as a complementary system for the change in business processes from institutional adjustments. SCPI is the basic cadastre data services provider. The parcels of cadastre are used as the basic reference unit for all applications and state bodies: Ministry of Agriculture, Urban Planning and Architecture Committee, Amelioration, Utilities, etc. By the end of the year the E-Cadastre Portal, a web GIS application, will be established to support the transactions of public and private immobile (land, building, flats) and real estate data. Information systems marked above have been integrated with several government organizations and integration with more agencies is intended.

Figure 32. Address registry information system



Source: Huseyn Hasanov, Presentation during the "Digitally-enabled Development" conference, 20.09.2019

The main legal base for establishing National Spatial Data Infrastructure in the Republic of Azerbaijan is the Presidential Decree 448, 2018 "Rules for the formation and integration to e-government of national spatial data". The rules established by this Presidential Decree contains definitions for National Spatial Data, for National Spatial Data Information System and the NSDI. NSDI is defined as a set of processes involving the national spatial data sets, metadata, provision of services on national spatial data, technologies, acquisition, formulation, protection, management, exchange and use of national spatial data and metadata, standards, monitoring, and coordination mechanisms. The decree also defines two important parts of an NSDI: the NSD Information System and the Geoportal. The PD splits the responsibilities for the NSDI between State Committee on Property Issues (SCPI) and the State Agency for Public Service and Social Innovations (SAPSSI). SCPI is made responsible for the NSD Information System and SAPSSI for the development of the Geoportal as a subsystem of the E-Government portal. Base data sets for the NSDI are mentioned as the state land cadastre, state register of real estate, geodesy, orthophotos, digital elevation model, transport network, hydrographic network and administrative-territorial division units. Being the operator of NSDI information system SCPI has among others the following functions: the establishment of working groups, submitting annual action plans, create and maintain the NSD information system. As the first phase of establishing NSDI, drafts are being prepared about determining the list and classification of national spatial data, a procedure for monitoring national spatial data, Regulation on the National Spatial Data Information System and standards for spatial data. Determining the initial source of the national spatial data and the list of relevant state institutions is an important task in this phase. Next to that, a number of technical regulations will be prepared in the field of system infrastructure and functionality. Access to the system will be given through the E-government portal and regulations will be fitting within the existing framework of E-government.

3 Conclusions

The international conference on "Digitally-enabled Development for a Sustainable Future in Eastern Europe", co-organised by the Republic Geodetic Authority (RGA), European Commission Joint Research Centre (EC JRC), the World Bank (WB), United Nations Food and Agriculture Organization (UN FAO), United Nations Committee of Experts on Global Geospatial Information Management (UN GGIM) and United Nations Economic Commission for Europe (UNECE), was convened in Vrdnik, Republic of Serbia, from 18-20 September 2019. The Conference was opened by the Honourable Minister Nenad Popović, Minister Responsible for Innovation and Technological Development, and hosted by the Republic Geodetic Authority, the conference included more than 200 participants from 20 countries, and international organizations.

With more than 40 speakers contributing, participants discussed the impacts of digital technologies from global, regional, national, and local perspectives; and provided examples demonstrating digital transformation and good practices in Eastern Europe, with a focus on sustainable data sharing and utilization. These examples were framed by progress on, and the linkages between, the emerging Integrated Geospatial Information Framework (IGIF), the INSPIRE Directive, and National Spatial Data Infrastructures (NSDIs) being developed and managed by countries.

As an overarching local to global development aspiration, the urgent demand to support the implementation of the Sustainable Development Goals (SDGs) through data, technology, innovation and digital transformation, was acknowledged. Some of these digital transformations include Blockchain, Artificial Intelligence, Big Data, smart cities, digital agriculture, and integrated land tenure. These rapid changes in technology bring new opportunities, but they also bring additional challenges, such as cybersecurity, education, and sustainable business models, requiring integrated approaches to meet these new SDG demands.

Due to the disruptive nature of digital transformation, many governments still lack a clear understanding of their future data and technology requirements, especially when needed to address the SDGs and national to global development. In this regard, participants agreed on the need to take the opportunity to leverage these new disruptive technologies to support a better and smarter policy and decision-making – and the SDGs.

Part of the solution is aligning technological innovation and processes with the data and information that we are now able to leverage, doing so in an effective and timely manner, while recognizing that all countries in the region are at different stages of national geospatial development – including their NSDI development.

Another critical part is ensuring and sustaining national leadership and "champions" in geospatial information management, and the continual requirement to raise awareness of the importance of geospatial information as a key strategic asset that leads to valuable and quantifiable knowledge and decisions. National geospatial champions are crucial to drive change, communicate the value proposition, understand the challenges to be overcome, and to create and maintain momentum.

In summary, participants recognized the need to support new and innovative approaches to national geospatial information management; implementing integrated, evidence-based and data-driven decision-making solutions; and maximizing and leveraging national information systems tailored to each country's national situation and circumstances.

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