FINAL REPORT

APRIL 2017

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SDI4Apps portal:	http://www.sdi4apps.eu/portal/
	The world map on the title page was designed by Freepik

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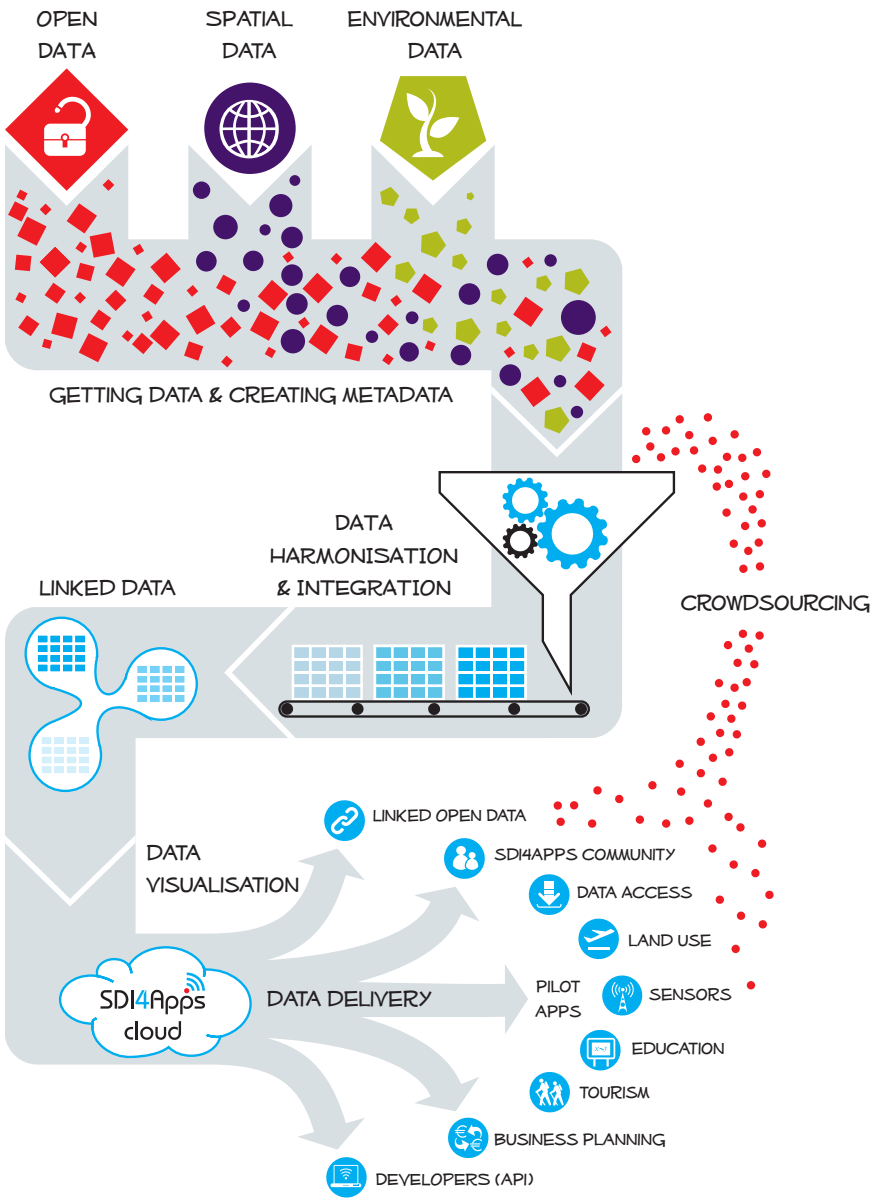
1 INTRODUCTION

1.1 About the project

SDI4Apps was an EU-funded project managed by the University of West Bohemia from the Czech Republic. It was a 3 year project running from April 2014 until March 2017.

SDI4Apps aimed to stimulate innovation and business activities around geographic information and open data. SDI4Apps developed tools that enable easy access to and sharing of geographic data and information by different communities. The communities include general public, researchers, students, mobile application developers and public servants.

The following schema visualises the overall aim of the project which is data integration from various sources (upper part of the schema) and reusing data for various applications (lower part of the schema) including crowdsourcing.



Inspired by the poster created by Lulu Pinney (The Data Journalism Handbook, O'Reilly Media, 2012)

1.2 SDI4Apps Objectives and Pilots

The potential of geographic information (GI) collected by various actors ranging from public administration to voluntary initiatives of citizens is not fully exploited. The advancements of ICT technologies and shift towards Linked Open Data provide a basis for innovation. The establishment of SDIs has largely been driven by the "traditional" GI community and the national and European policies governing this sector.

Geographic information is no longer a separate information space but finds itself as part of a larger European information space where the ultimate objective is the creation of value-added services based on use and reuse of public sector information as defined by the PSI and INSPIRE directives rather than exchange of "layers" between different geographic information systems.

Establishing an infrastructure to meet this new and wider objective puts even greater strain on local authorities and institutions that traditionally were users of GI but now find themselves in an environment where they are expected to be data and service providers, a role that is far more demanding in terms of technical knowledge – and resources.

The main target of SDI4Apps was to bridge the

1. top-down managed world of INSPIRE, Copernicus and GEOSS, and
2. the bottom-up mobile world of voluntary initiatives and thousands of micro SMEs and individuals developing applications.

SDI4Apps adapted and integrated experience from previous projects and initiatives (e.g. Plan4business, EnviroGrids) and built a cloud based framework with open application programming interface (API) for data integration, easy access and provision for reuse.

The specific objectives of SDI4Apps were to:

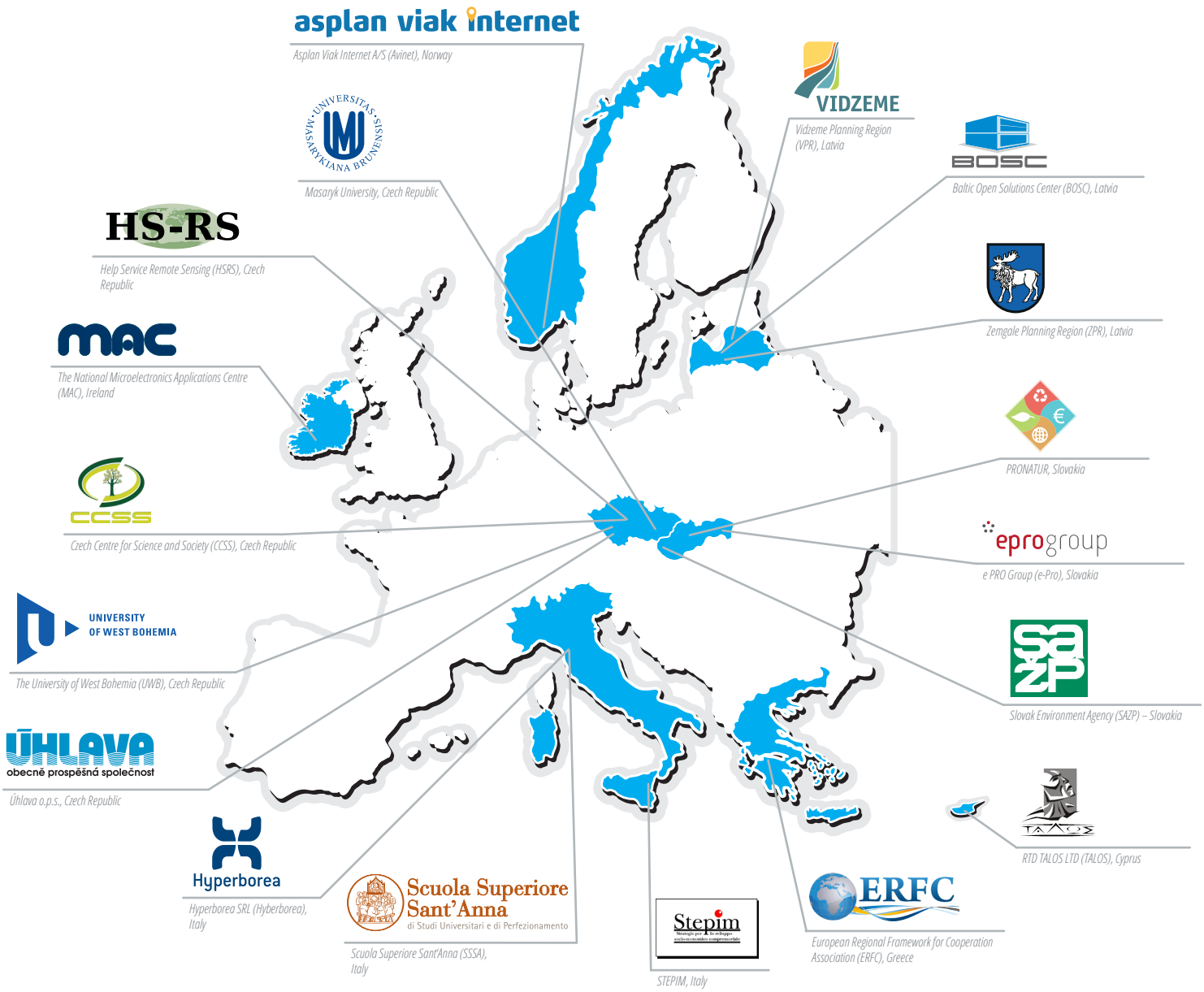
- integrate a new generation of spatial data infrastructure (SDI) based on user participation and social validation,
- support easy discovery and accessibility of spatial data for everybody,
- link spatial and non-spatial data using the Linked Open Data principles,
- support multilingualism of spatial data,
- build scalable cloud based infrastructure for support of SDI initiatives and location based services (LBS),
- integrate in-situ measurements and Earth observation data,
- design open application programming interface (API) supporting integration of spatial data and LBS into applications developed and deployed by non-GI developers,
- test new approaches for data sharing by users through pilot applications,
- attract external developers (mainly from SMEs, students and researchers) to test the newly integrated platform,
- organise contests for application developers supporting wider use of GI data,
- build a sustainable business model for a cloud based spatial data infrastructure.

The use of the SDI4Apps platform was demonstrated through the following pilots:

- PILOT I: Easy Data Access – mobile access
- PILOT II: Open Smart Tourist Data – including VGI
- PILOT III: Open Sensor Network
- PILOT IV: Open Land Use Map Through VGI
- PILOT V: Open INSPIRE4Youth
- PILOT VI: Ecosystem Services Evaluation (ESS Evaluation)

1.3 SDI4Apps Consortium

The project was implemented through the concerted effort of 18 organisations from 9 European countries including universities, public authorities, commercial companies and non-profit organisations.

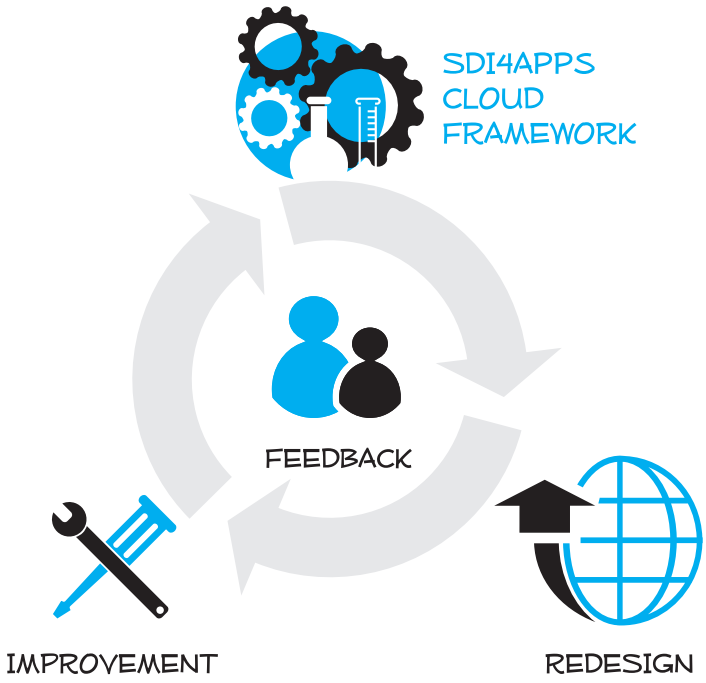


1.4 Project Approach

The SDI4Apps team combines partners covering the entire chain from data providers, technological developers and geospatial data experts to end users. The consortium includes partners involved in living labs which was part of the overall methodology for the platform integration and social validation.

The following user-driven methodology for the SDI4Apps platform was used:

1. Deployment of the SDI4Apps cloud framework
2. User experimentation and social validation in real-world scenarios and pilot applications
3. Feedback from the SDI4Apps community
4. Redesign of the platform
5. Improvement of the SDI4Apps Cloud Framework
6. Back to the second point

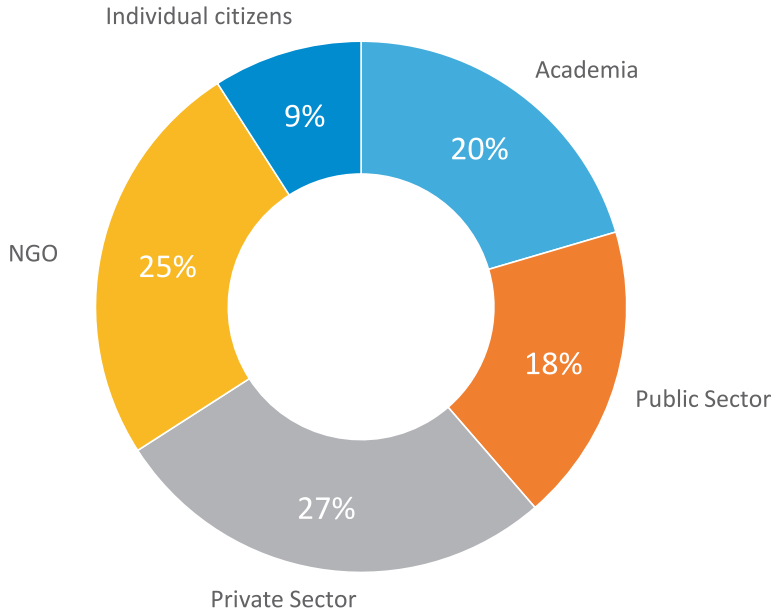


2 SDI4APPS STAKEHOLDERS

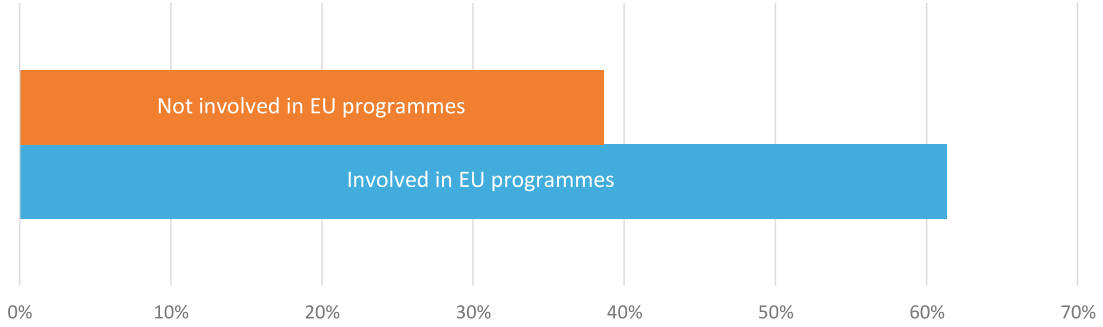
SDI4Apps is a multi-stakeholder project, where 18 partners (public and private organizations) from 9 different countries that provide complementary expertise (both technical and non-technical), have been cooperating for three years in order to build a cloud-based framework with open API for spatial data integration and to populate this ecosystem with six different pilot applications.

In the first year of the project the consortium focused its efforts on creating a technological environment through data integration, pilot applications development and infrastructure deployment activities. Throughout the following two years the consortium increasingly focused on the deployment of the open SDI4Apps platform and on the engagement of external communities through dissemination activities and support for external developers.

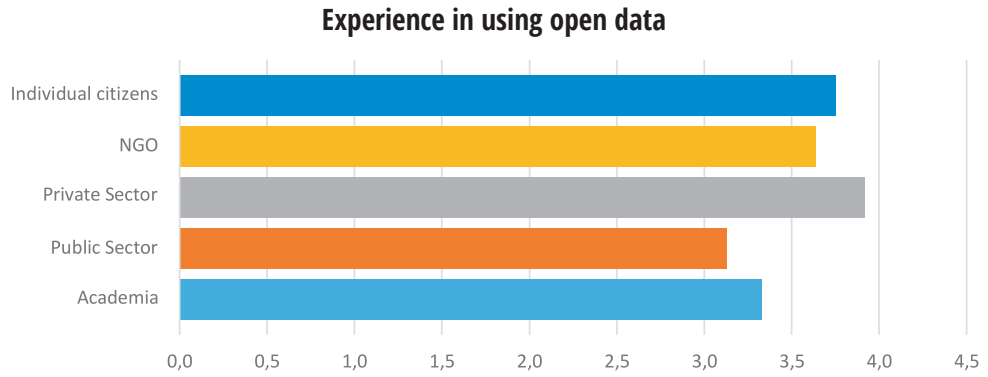
The SDI4Apps external stakeholders' community map depicted in the following image shows a balanced composition among 4 types of actors: Private sector (SMEs, Large companies, clusters 27%), NGOs (25%), Academia (20%) and the Public sector (Central Governments, regions, municipalities, 18%), while the involvement of individual citizens was quite lower, representing only the 9% of the sample. The map of the SDI4Apps community space is a crucial element for successful technology exploitation, business modelling and project sustainability.



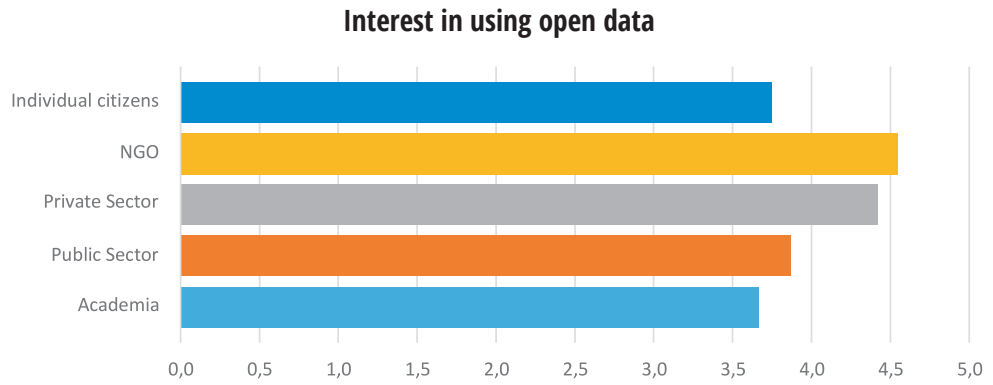
The following figure shows the characteristics of the SDI4Apps external stakeholders as related to their involvement in European programs. As expected, a big majority of the external stakeholders involved in the SDI4Apps project are operating in EU consortia (61%).



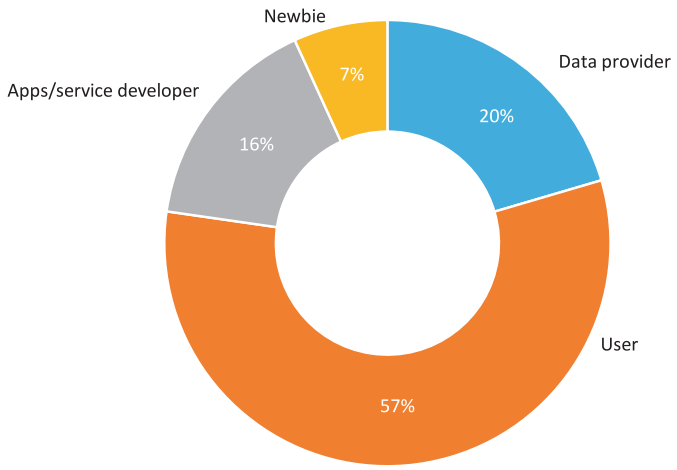
The following figure shows the degree of experience in using open data across different types of external stakeholder communities.



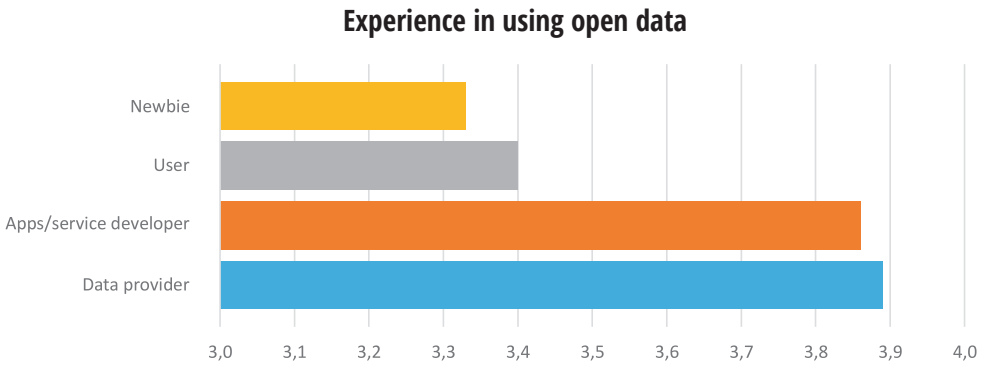
The overall degree of interest in using open data, as shown in the following figure, is high. It confirms that the topic of open data is increasingly gaining momentum. NGOs and the private sector (SMEs and large enterprises) confirm their centrality in the SDI4Apps community space by showing the highest scores in terms of interest in open data.

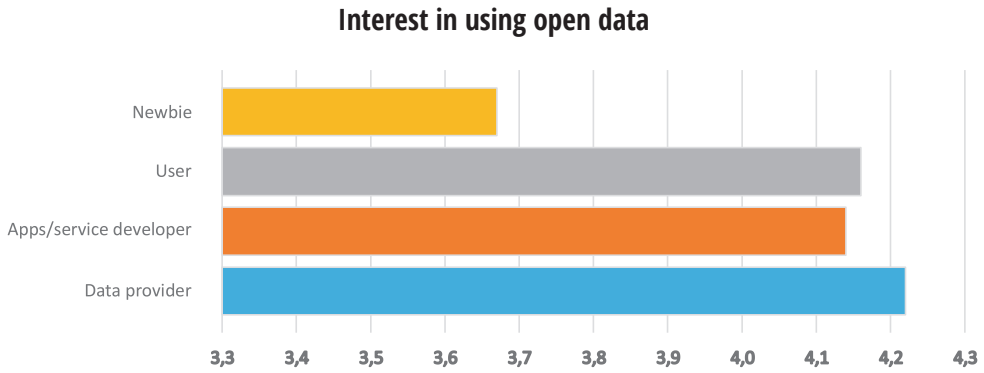


The following figure shows that the majority of external stakeholders in the sample relate to open data as end users (57% of actors in the sample), regardless to the community they belong to. Smaller but balanced portions of stakeholders are rather connected to open data as apps/service developers and data providers. Only 7% of stakeholders in the sample reported themselves as "newbies" in the relationship with open data.



The following figures show the different characteristics of the external stakeholders' community in terms of experience and interest in using open data. Data providers, end users and app/service developers report the highest levels of interest in using open data.





3 SDI4APPS PLATFORM

The SDI4Apps platform consists of a carefully selected set of software components that enable to store, manage, process and publish spatial data.

For an easy installation, the platform is prepared in a way that it can be automatically deployed on any commercial or academic cloud such as Amazon Elastic Compute Cloud, Google Computing Engine, Microsoft Azure, OpenNebula, OpenStack and VMware vCloud. These are *Infrastructure-as-a-Service* clouds that provide virtual data centres for rent. Their customers pay for running virtual computers instead of building their own physical air-conditioned fire-protected computer rooms equipped with uninterruptible electric power sources and rack-mounted servers, which are otherwise needed for providing reliable computer services.

When the SDI4Apps platform is deployed to an *Infrastructure-as-a-Service* cloud, it can provide a *Software-as-a-Service* cloud service. This means that it can provide an on demand access to software from any network-connected device including a desktop personal computer, notebook, smartphone, tablet, smart TV, e-book reader or an Internet kiosk.

In technical terms, the only requirement for deploying the SDI4Apps platform is that the target cloud must provide a virtual machine image with pre-installed the Ubuntu 16.04 Linux operating system, which is the most commonly used operating system in clouds. The SDI4Apps platform is defined in the form of a configuration script that modifies a blank Ubuntu 16.04 installation by adding many software packages specific for working with spatial data.

The software packages include:

- PostGIS - a PostgreSQL relational database with extension providing support for geographic objects
- pgRouting - an extension of PostGIS providing geospatial routing functionality
- GeoServer - a server for sharing geospatial data using open standards defined by Open Geospatial Consortium (OGC)
- MapServer - a geographic data rendering engine
- OpenLink Virtuoso - an engine providing RDF triple store and SPARQL query language for storing and querying Linked Open Data
- MICKA - a spatial metadata editor, metadata catalogue and metadata harvester
- LayMan - a layer manager for showing data layers rendered over a map
- HSLayers-NG - a JavaScript web mapping library
- SensLog - a software component for sensor data management
- generic software including Apache web server, PHP, PostgreSQL, jQuery, Liferay, Java, Python

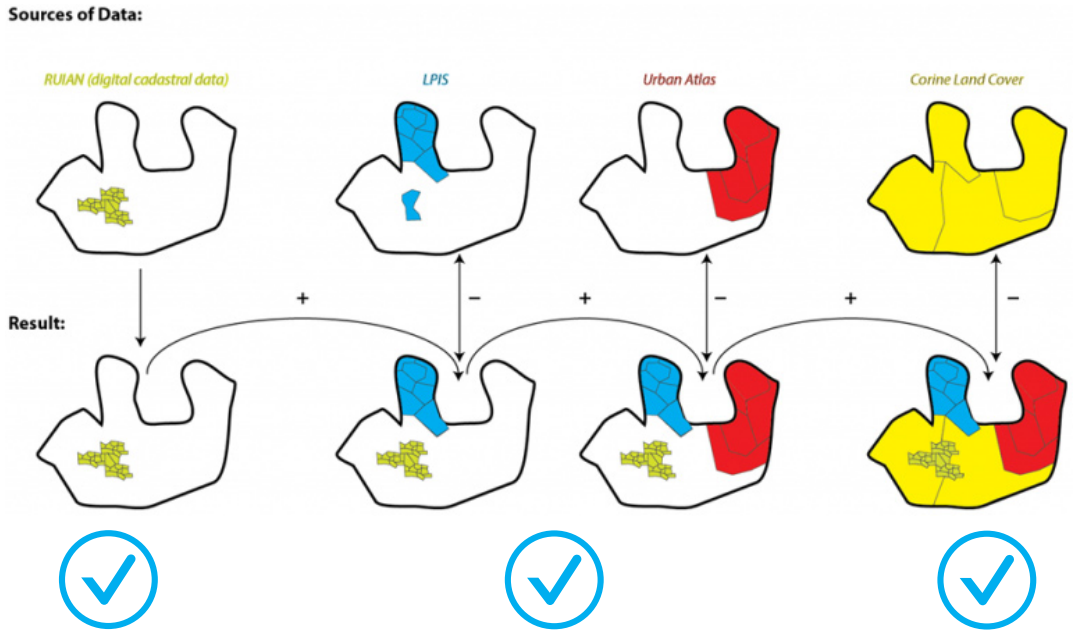
4 SDI4APPS OPEN DATA

4.1 Open Land Use Map

Three large open datasets were developed during the SDI4Apps project in collaboration with other EU projects. One of them is the Open Land Use Map (OLU), which is a pan-European map composed from various open data sources of different levels of details.

The methodology for creating OLU is as follows and is depicted in the following figure:

1. All available open data from a certain territory are collected and stored in a database.
2. These data are harmonized into a common data model based on the INSPIRE data specifications on land use and using the same HILUCS classification.
3. Data of the highest level of detail (usually not covering the entire territory) are combined with data with second highest level of detail and so on (see the figure below).
4. Data are published for download and as a WMS service.
5. Data are updated through crowdsourcing, either online based on remote sensing images or directly in the field through a mobile application (not yet implemented).



OPEN, HARMONISED AND SEAMLESS DATABASE

The dataset is open and available for download in vector format. It is harmonized according to the INSPIRE data specifications on land use and uses the Hierarchical INSPIRE Land Use Classification System (HILUCS). OLU provides a land use map without any gaps.

OPEN AND FLEXIBLE DATA MODEL

The data model is quite simple. It includes the original land use class for any feature and the reference to the original dataset.

COMBINATION OF GLOBAL AND LOCAL DATA

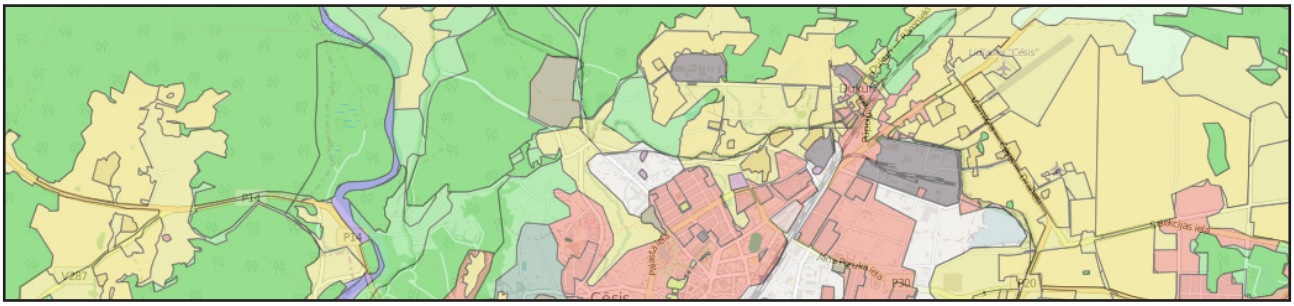
The resulting dataset is composed of global pan-European data combined, where available, with regional or local data.

http://sdi4apps.eu/open_land_use/

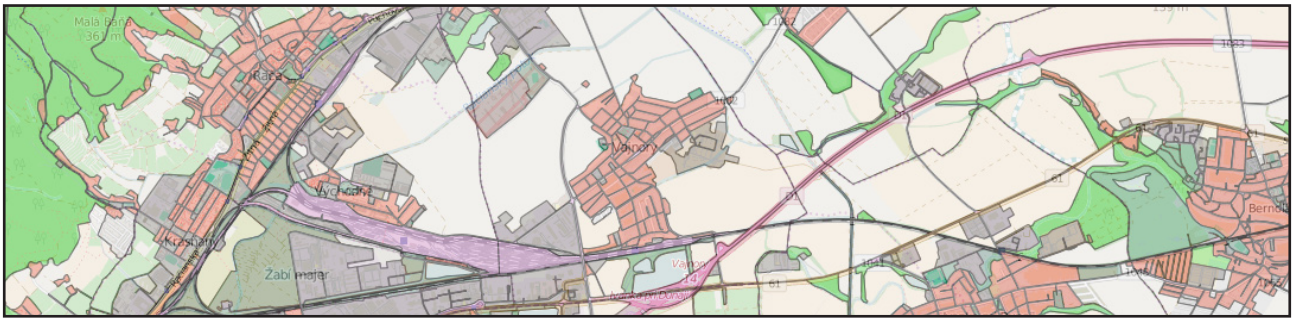
WMS/WFS service: http://gis.lesprojekt.cz/wms/open_land_use/european_open_land_use?

Czech Republic

Latvia



Slovakia



Flanders

4.2 Smart Points of Interest

The second SDI4Apps dataset includes more than 28 million points of interest. A point of interest (POI) is a specific point location that someone may find useful or interesting.

The Smart Points of Interest (SPOI) dataset is the largest open and harmonised database in the world. The SPOI dataset is a seamless and open source of POIs available for download, search or reuse in applications and services. Its principal target is to provide information as linked open data (LOD). SPOI complies with the LOD 5 star rating system and offers data through SPARQL endpoint.

OPEN AND SEAMLESS DATABASE

The SDI4Apps team developed a seamless open database of POIs, which are distributed as 5-star linked open data accessible for all users under the ODbL licence.

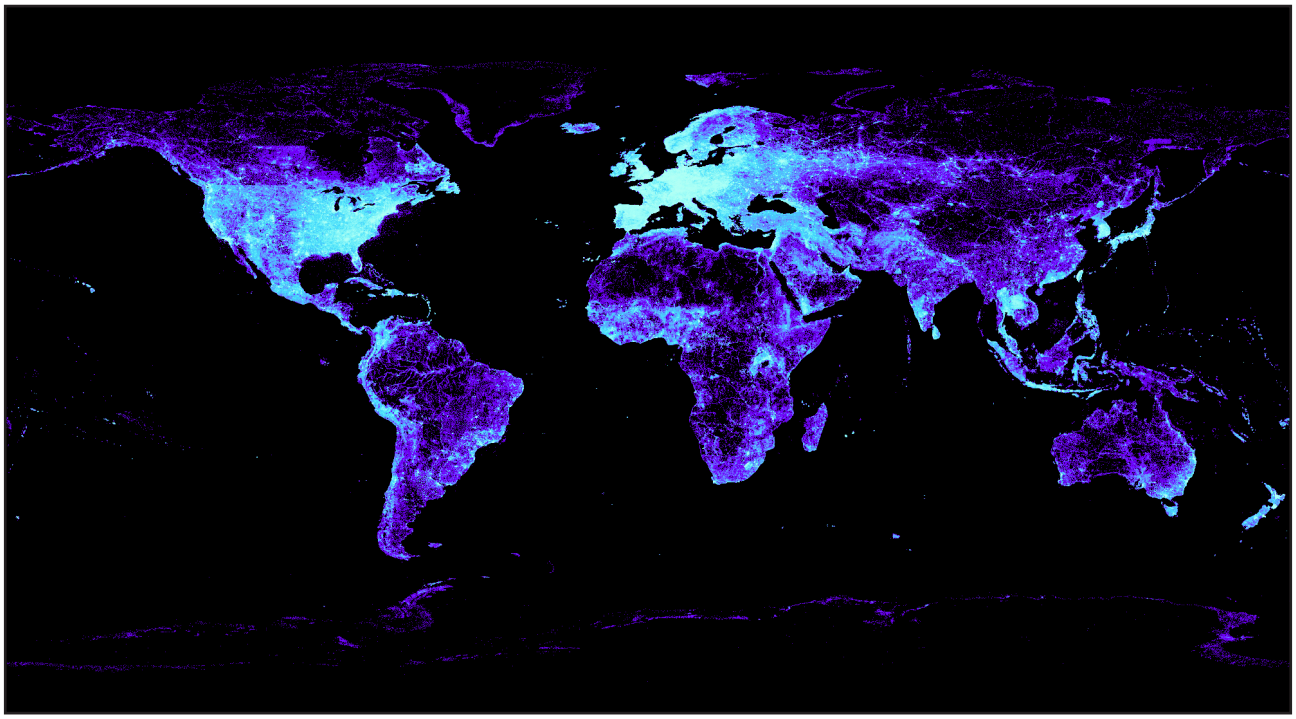
OPEN AND FLEXIBLE DATA MODEL

SDI4Apps designed a data model comprising important information for applications mainly from the tourist sector.

COMBINATION OF GLOBAL AND LOCAL DATA

The SPOI dataset was created as a combination of global data (selected points from OpenStreetMap) and local data provided by the SDI4Apps partners and other open data sources.

http://sdi4apps.eu/spoi/



4.3 Open Transport Map

The Open Transport Map (OTM) is the third dataset developed in conjunction with the OpenTransportNet and FOODIE projects.

The Open Transport Map

- provides a road network which is suitable for routing (navigation),
- visualises average daily traffic volumes,
- serves as a map itself as well as a layer embedded in your map application,
- is derived from the OpenStreetMap,
- is accessible via both graphical user interface and application programming interface (API),
- covers the whole territory of the European Union

OPEN AND SEAMLESS DATABASE

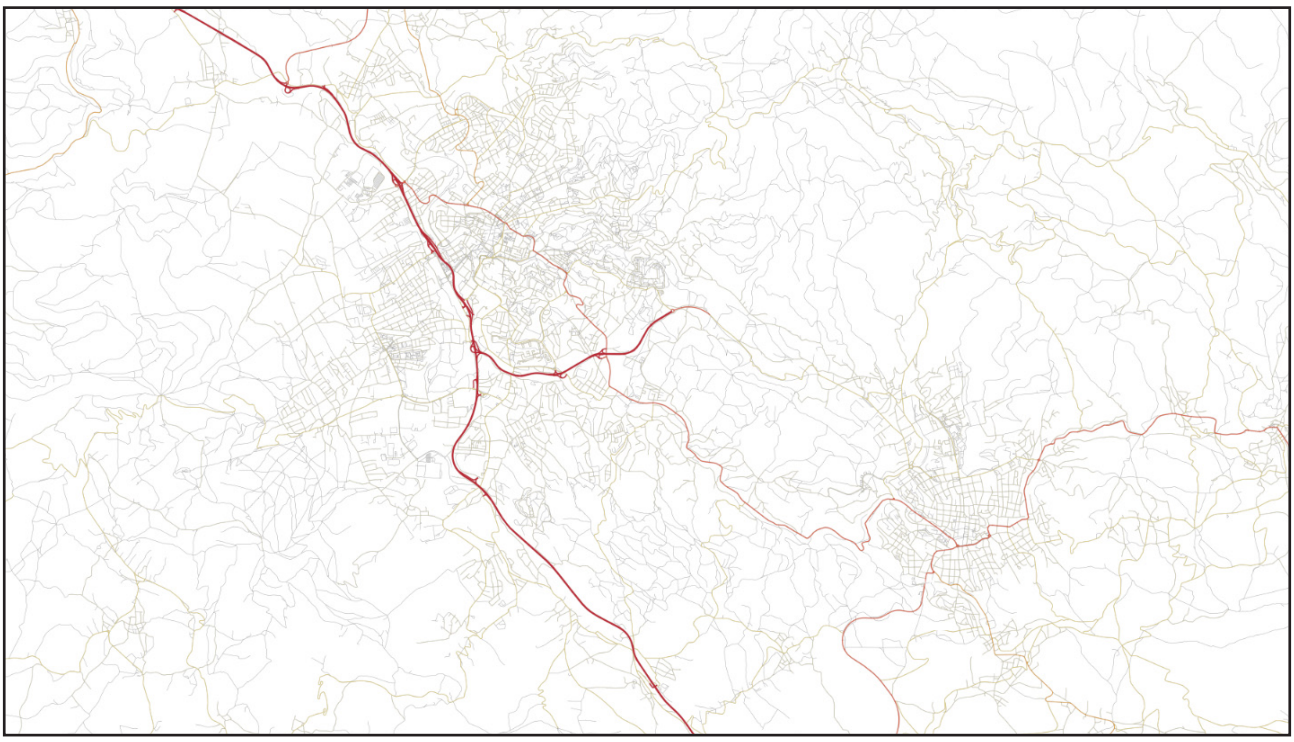
OTM is a pan-European open database containing routable transport network. The data are accessible for all users under the ODbL licence.

OPEN AND FLEXIBLE DATA MODEL

The OTM data model is based on the INSPIRE data specifications for road network.

COMBINATION OF GLOBAL AND LOCAL DATA

The core dataset was derived from the OpenStreetMap. This map is being updated by other data sources of better quality.



5 SDI4APPS APPLICATIONS

5.1 Tourism for Conservation and Protected Sites Apps

The following two sets of apps are focused on the Burren National GeoPark on the west coast of Ireland (www.burrennationalpark.ie). Social validation/co-design meetings and discussions with the GeoPark stakeholder groups identified the following user services as providing the most immediately useful benefit/added value to enable "Tourism for Conservation" and protect heritage sites in the park and beyond. Both services use open data and are built on the SDI4Apps enablers and cloud-based scalable platform.



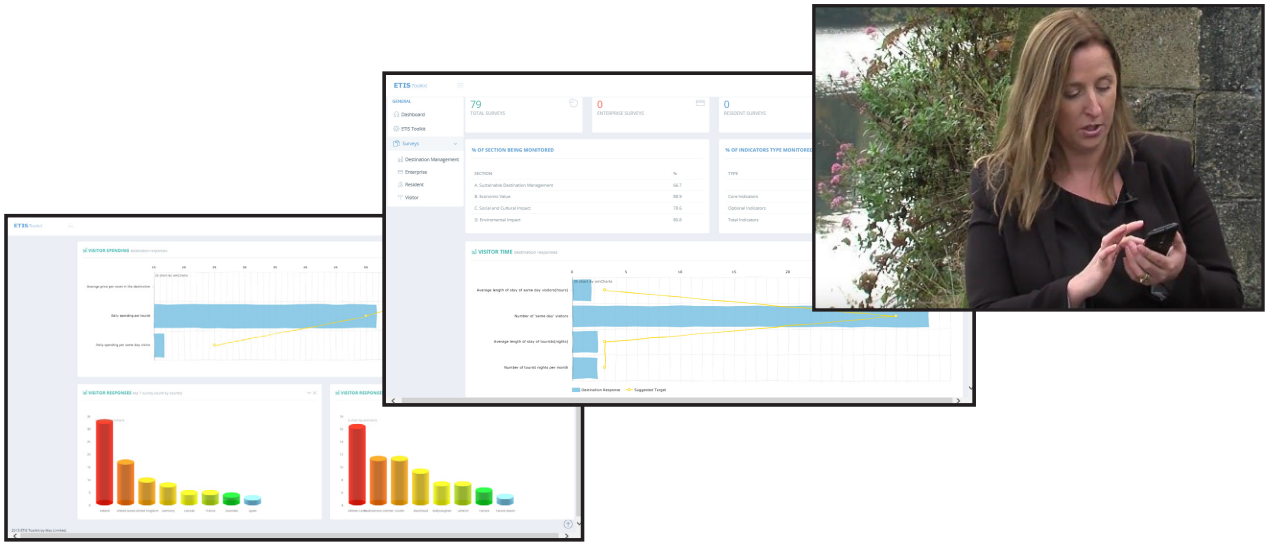


Mobile apps to support tourism for conservation (ETIS Service)

SDI4Apps enables an European Tourism Indicators System (ETIS) web service and apps for the Burren and European GeoParks Network. ETIS is a new EU standard, that is a local community led process for monitoring, managing, and enhancing the sustainability of a tourism destination (http://ec.europa.eu/growth/sectors/tourism/offer/sustainable/indicators).

SDI4Apps enables streamlining and enhancing the current manual system by transforming the system to linked open geospatial data. SDI4Apps enables the provision of a web service and multiple easy-access/voluntary geographic information apps for the various stakeholders involved.

The following images show the ETIS management dashboard from app data showing how the destination is performing.

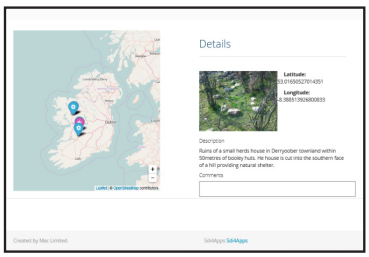


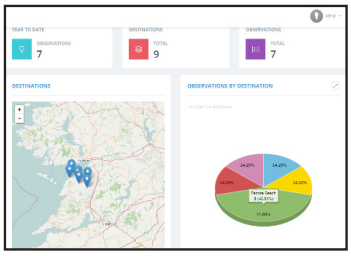
The ETIS services will now be sustainably continued and extended for the agencies involved, and particularly targeting GeoParks globally.

Ground-truth tourism sites services and user apps

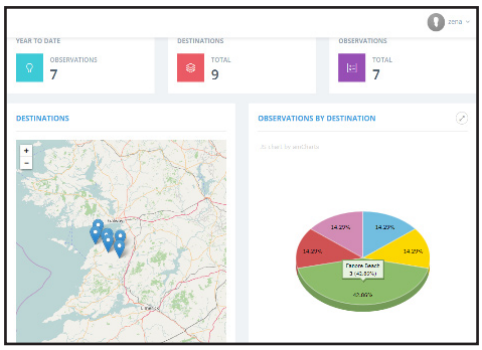
SDI4Apps has enabled the following user-requested services to groundtruth and sustainably manage tourism sites:

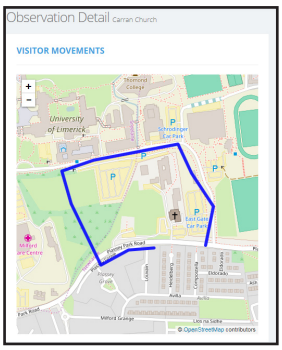
1. HERITAGE SITES REPORTING
   - For field officers, visitors and people interested in their local heritage, to seek out and ground truth protected monument sites.

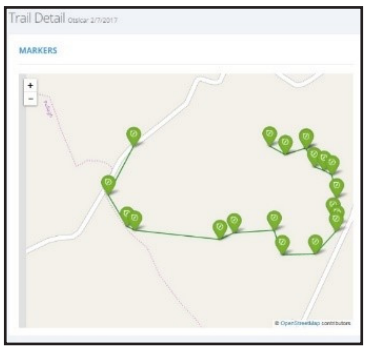




2. GEOPARK MANAGEMENT PORTAL, providing:
   - Site monitoring - reporting the site status for the Burren GeoPark management team
   - Visitor observation - reporting on visitors to a site for the GeoPark management team.
   - Walking trail monitoring - reporting on several points along a walking trail between sites







For both of these services ground truthing is the crowdsourcing process of gathering data in the field, to either complement or dispute remotely collected data.

The groundtruthing services will now continue and be extended, initially targeting GeoParks globally, and other applications subsequently. Their market potential is extensive.

5.2 Tourist Apps Based on SPOI

The following applications are based on the Smart Points of Interest (SPOI) dataset and aim at providing tourist information in different ways. The SPOI dataset is briefly described in Section 4.2. In this section, the details about the data model and other features of the SPOI dataset are presented.

The SPOI dataset was designed mainly for the purposes of tourism, as a background data for tourist map or promotion of services or places of interest. Data are published as 5-star linked open data. This means that the data are:

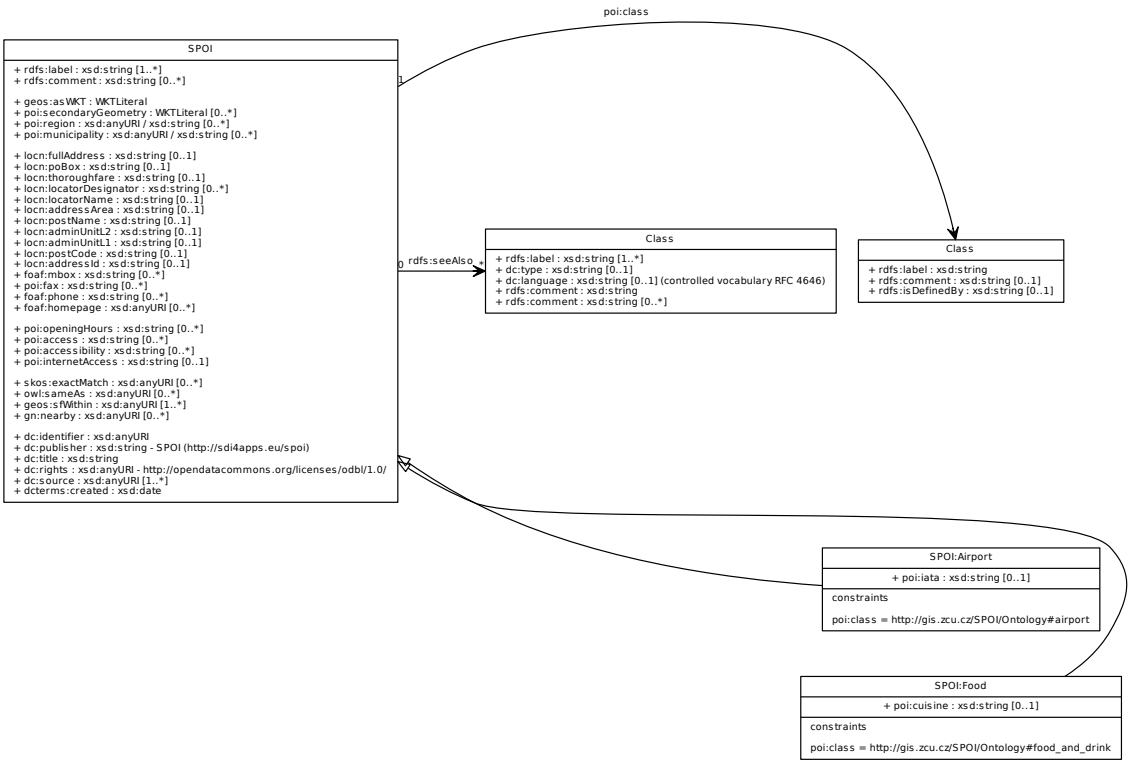
- ***** on the web
- ****** machine readable
- ******* stored in an non-proprietary data format (Resource Description Framework)
- ******** accessible through many respected and standardised vocabularies (for example FOAF, RDFS, Dublin Core, GeoSPARQL) to add more semantics to data
- ********* linked, i.e. contain relations to other features in the SPOI dataset or external databases (for example DBpedia or GeoNames.org).

SPOI contains metadata, including feature metadata, and links to other non-structured data (photos, web pages, Wikipedia articles, maps etc.). Data are available to view via a map client with editing functions or to download through the SPARQL endpoint.

The current version of data (April 2017) includes more than 28 million points of interest from the entire world. The data originate from various open resources of global datasets (OpenStreetMap, GeoNames.org, Natural Earth; DBpedia and Wikidata are planned to be processed in the near future) and local datasets from Pošumaví (Czech Republic), Sicily (Italy), Antwerpen (Belgium), Zemgale (Latvia) or Belluno (Italy).

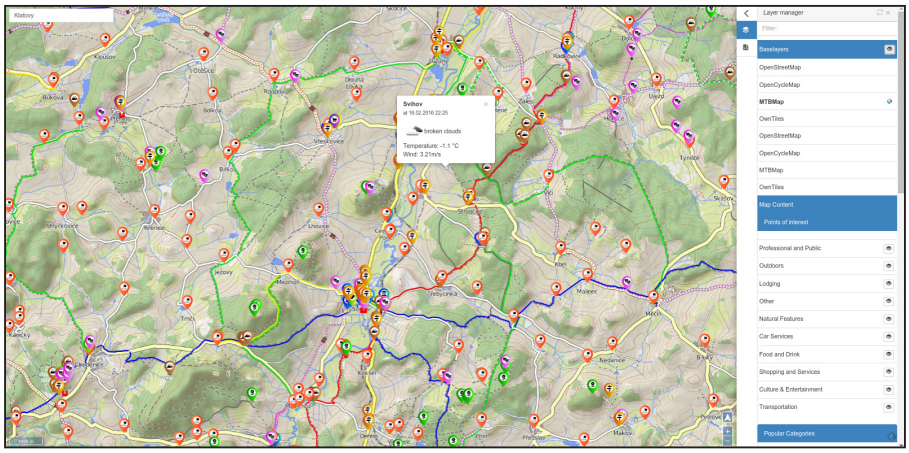
The harmonisation of local data was realised in cooperation with other EU projects including Foodie, OpenTransportNet, Peregrinus and Citadel on the Move. The data harmonisation consists in many interconnected steps inclduing coordinate transformation, implementation of the SPOI ontology for points of interest classification, filtering and format conversion.

The SPOI data model is depicted in the following figure.



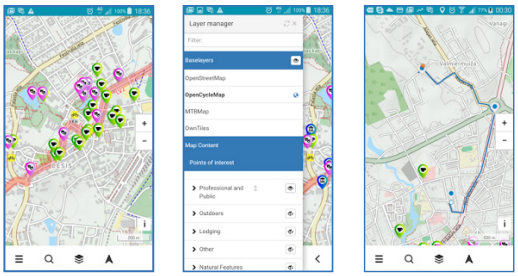
SPOI map app

This is a preview of the SPOI map application for browsing and editing points interest. This app is available at http://sdi4apps.eu/spoi.



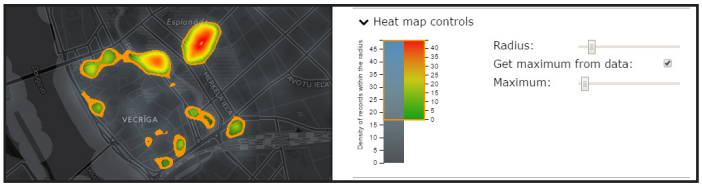
SPOI mobile map app

A mobile version of the SPOI map app available on Google Play: https://play.google.com/store/apps/details?id=com.sdi4apps.spoi



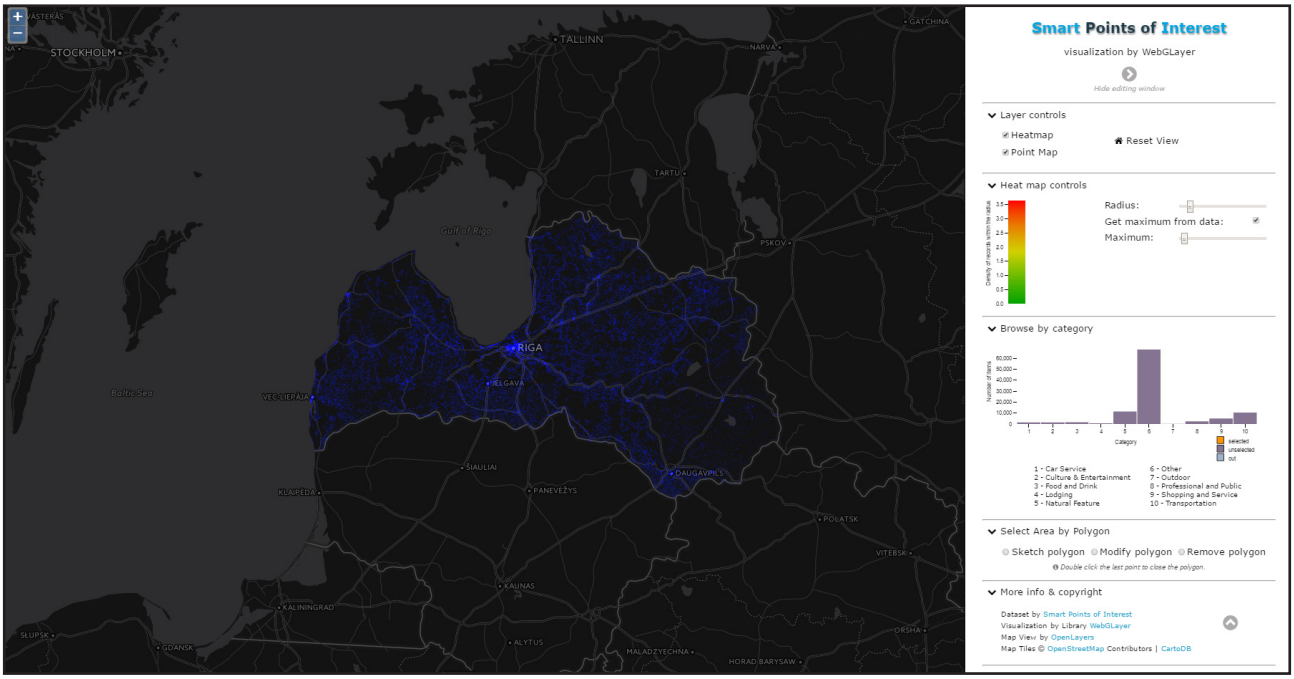
Analysing points of interest

This is a web-based interactive application allowing the user to explore the Smart Points of Interest dataset in the forms of a dot symbol map showing all the records, and a heat map, which represents the density of records by colour scheme based on a red-green colour gradient.



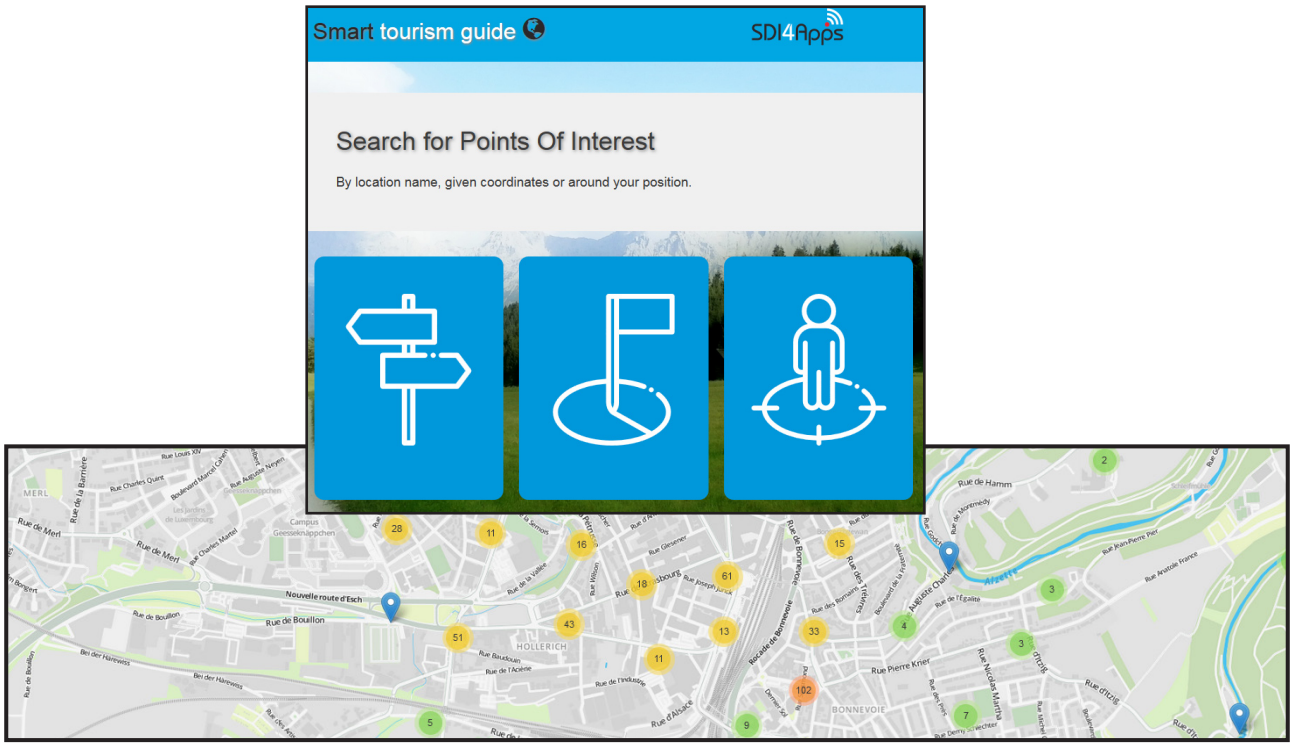
The visualisation of data is based on the WebGLayer library, an open-source JavaScript tool for coordinated multiple views of spatial data. This library offers immediate data filtering and response rendering due to the utilisation of WebGL. By leveraging the graphical processing unit (GPU), the library is able to visualise and filter up to hundreds of thousands features with several attributes with a minimal delay. Histograms are rendered by D3.js (Data Driven Document) and the map view is displayed via OpenLayers.

The SPOI analysing app for Latvia is available at: http://portal.sdi4apps.eu/spoi-webglayer/ and is depicted in the following image.



Smart tourist guide

The final tourist application allows the user to browse points of interest in a certain area of interest by providing the location name, inserting coordinates or using positioning system of your smartphone. The app is available at http://portal.sdi4apps.eu/guide/.

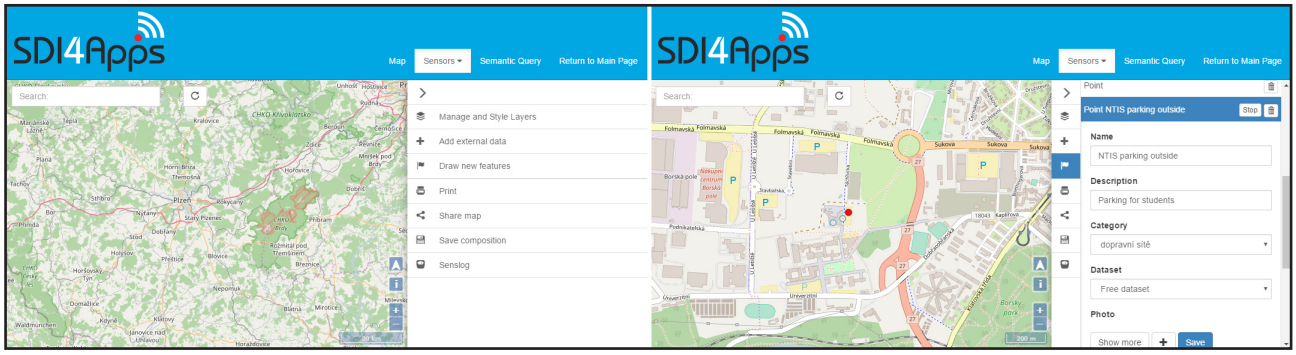


5.3 Sensor Network Based Apps

The following apps are focused on open sensor networks including data collection by humans (crowdsourcing), combining sensor data from different sources and their management via the open sensors network platform, which is a part of the SDI4Apps portal.

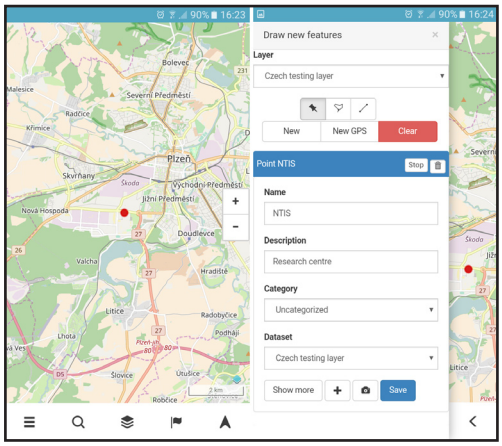
Voluntary geographic information (VGI) monitoring app

VGI monitoring is a web based application providing a client interface for visualising, collecting and updating VGI. The VGI Monitoring application is based on HSLayers NG and uses the VGI module of SensLog. SensLog is a data management component that provides an API for receiving data from sensor networks as well as from standalone mobile devices.



Mobile VGI monitoring app

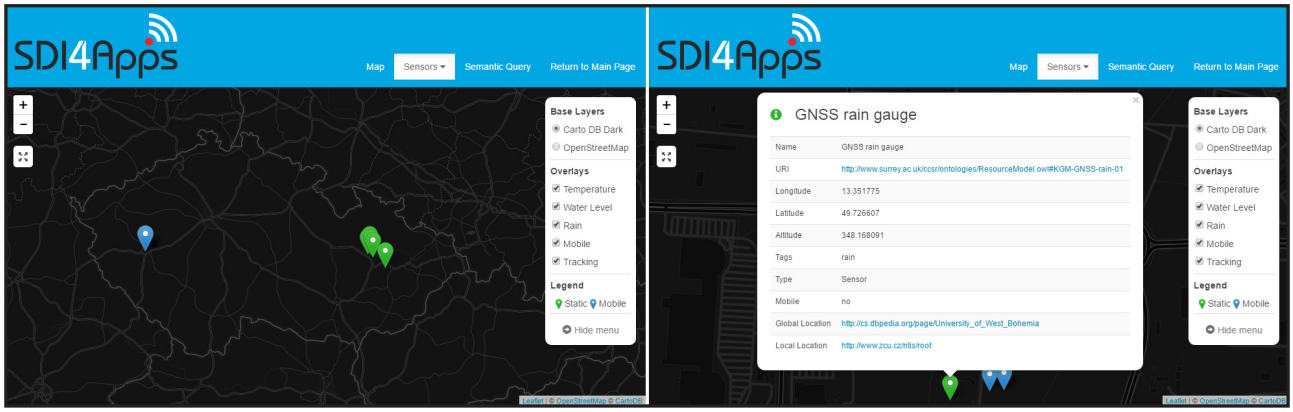
This is a mobile version of the VGI monitoring app, a client app running on smartphones (Android or iOS based). The advantage of the mobile version is that it can use the current position of the smartphone from the GNSS chip.



Internet of things (IoT) discovery app

The IoT discovery app allows the user to find particular IoT resources by location and/or by specified attributes of the resource. The IoT discovery app can be considered as a graphical catalogue of all available resources/sensors.

The user can get full semantic description of the resource in the RDF format as well as the endpoint that provides direct access to the resource data.

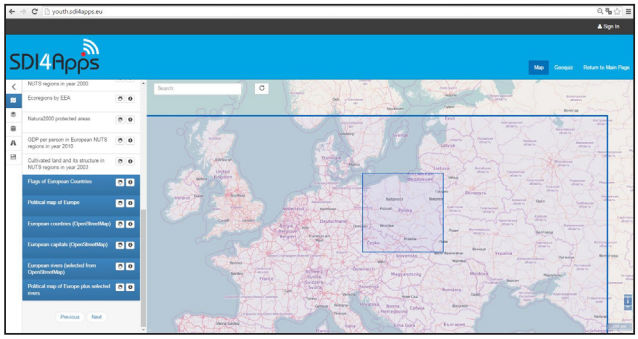


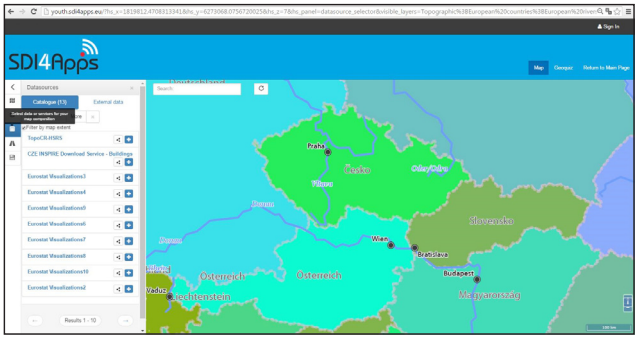
5.4 Educational Apps

The following apps were developed for educational purposes. They provide means for creating thematic maps, viewing spatial datasets and answering quiz on geographical topics.

Map composer

The map composer is a web application built on top of HSLayers NG that provides functionality for creating thematic maps. In the context of the project the map composer plays a very important role as it allows thematic map creation. The application users can overlay data from different sources and visually explore patterns in data and relationships between different data layers. The application is intuitive enough even for users that don't have strong background in GIS.

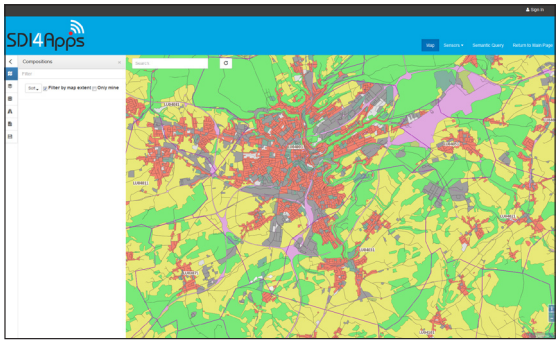




Thematic map viewer

The thematic map viewer is a web application tied to the map composer. While the map composer allows the user to create maps, the thematic map viewer allows the user to explore thematic maps of others.

The compositions can be shared on social network sites using shortened URL. If the composition utilises vector sources, the user can also adjust the layer visualisation and layer transparency. This makes it easy to explore the relationship of various spatial data layers.

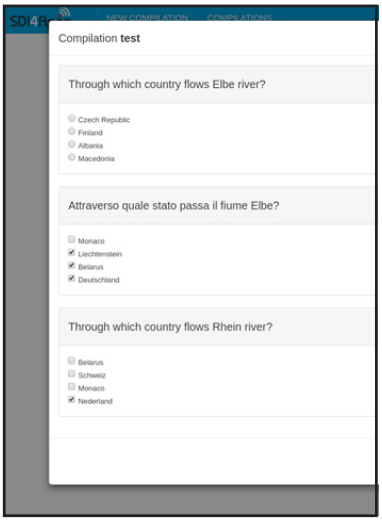


Quiz

The app provides an educational multilingual tool about regions through dynamic definition of question/answer game on environmental and cultural heritage knowledge.

The app allows to:

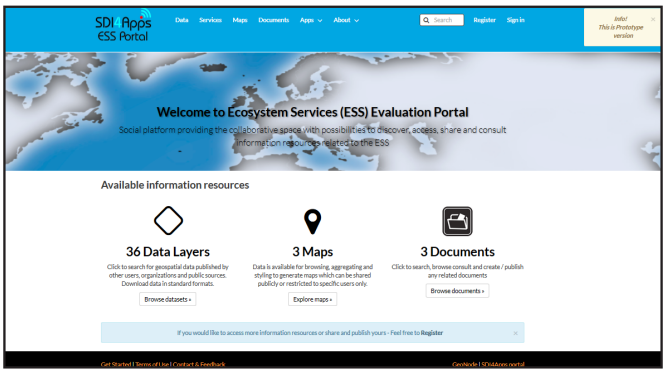
- define questionnaires based on SDI4Apps RDF and spatial data,
- answer questionnaires and providing user with feedback on correct/wrong answers.



5.5 Ecosystem Services Evaluation Apps

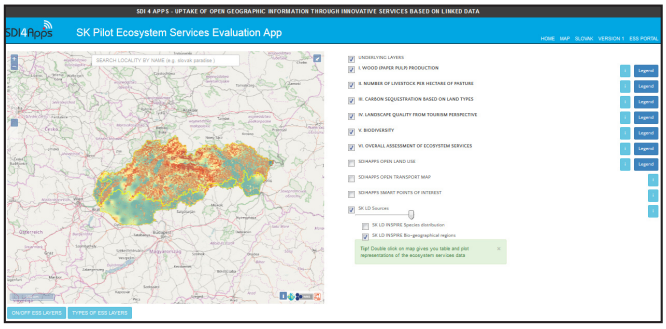
These applications focus on the EcoSystem Services (ESS) Evaluation domain representing the direct and indirect contributions of ecosystems to the human well-being. The main aim of the apps is to provide, in connection with the Mapping and Assessment of Ecosystems and their Service (MAES) activities, a common interface facilitating the access and exchange of knowledge and resources related to the ESS topic. This includes a possibility to visualise the ecosystem services values for a location of interest on national level with the potential for reuse in other countries and or the EU level. Within the SDI4Apps project, potential stakeholders from Slovakia were identified. The stakeholders are mainly from the public and R&D sectors, with involvement of the private, non-governmental authorities as well as citizens.

In order to support the members of the MAES SK Working Group involved in the activity of the ecosystem assessment process in Slovakia aiming to contribute to the fulfilment of the Action 5 of the EU Biodiversity Strategy to 2020, three main applications were developed via a set of iterations during the 3 years life span of the project.



The first app is the ESS evaluation portal that provides a collaborative platform for discovery, access, sharing and consulting ESS information resources.

The second app is the ESS evaluation app focused on a combination of various external and SDI4Apps geospatial web services and advanced visualisations of ESS related information.



In order to stimulate further reuse of the datasets developed and integrated during the SDI4Apps project implementation, the ESS API, as a machine readable application programming interface, was made available. The API provides an access to the web services related to the ESS applications. These services are made available via GeoServer API . The users may select preferred formats of published view (WMS) and download (WFS) services.

For the development of the above mentioned applications, a set of the SDI4Apps datasets and platform components were reused. Where relevant, additional open data and software components were included utilising the results of various projects and initiatives.

In addition to the main user group requirements, significant contribution to the app development was gathered during the project hackathons - BalticHack, MedHack and DanubeHack I and II. In order to ensure further sustainability of these outcomes, a close connection with the main target users will be kept, whilst investigating further business opportunities to utilise the knowledge and experience gained during the SDI4Apps project implementation.

6 DISSEMINATION ACTIVITIES

6.1 Publications

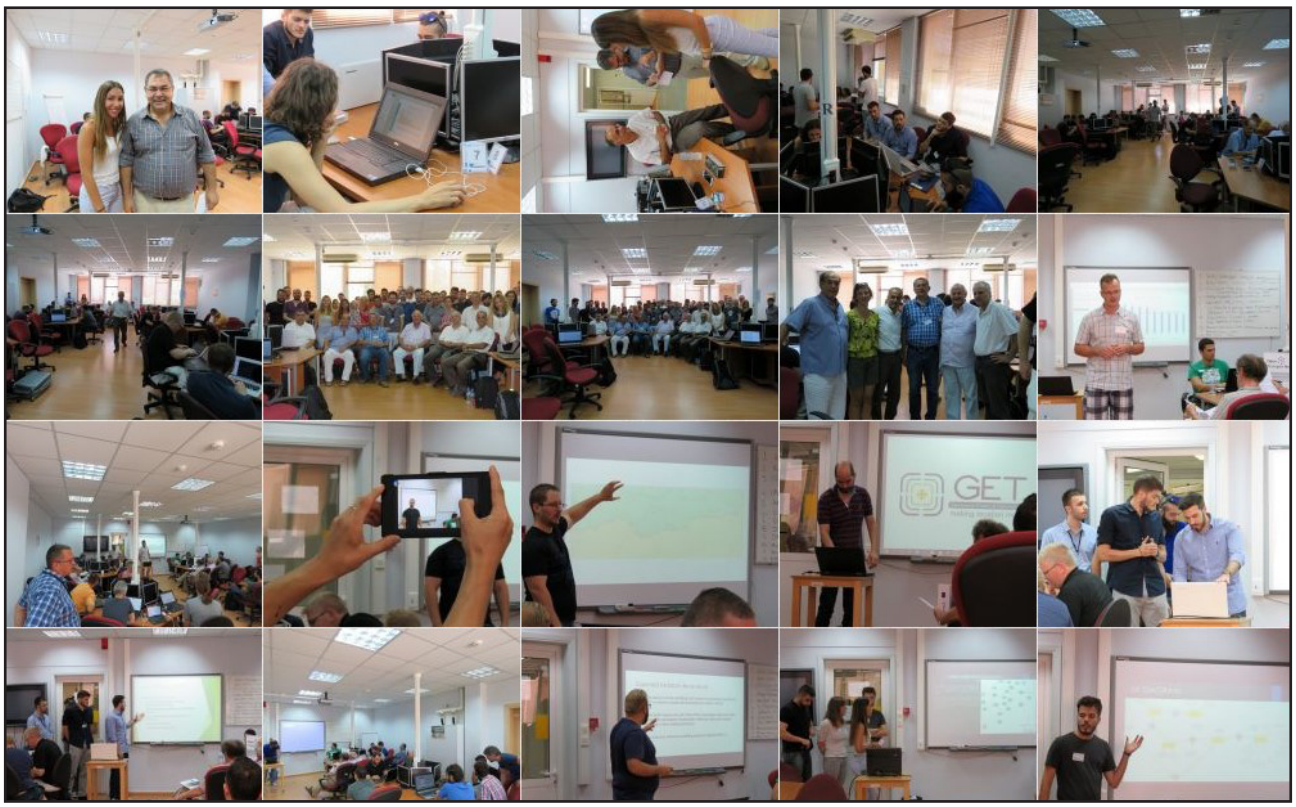
- Mildorf, T. & Charvát, K., 2013. Inovativní služby založené na propojených datech – projekt SDI4Apps (Innovative services based on linked data - the SDI4Apps project). Geobusiness. Available at: http://www.geobusiness.cz/2013/11/inovativni-sluzby-zalozene-na-propojenych-datech-projekt-sdi4apps/ [Accessed May 31, 2014].
- Charvát, K. et al., 2014. SDI4Apps. In P. Cunningham & M. Cunningham, eds. IST-Africa 2014 Conference Proceedings. IST-Africa 2014. IIMC International Information Management Corporation.
- Cerba, O., Prezentace z projektu SDI4apps (Presentation from the SDI4Apps project). http://prostudenty.blogspot.cz. Available at: http://prostudenty.blogspot.cz/2014/04/prezentace-z-projektu-sdi4apps.html [Accessed August 25, 2014].
- Vohnout, P., Cerba, O., Kafka, S., Fryml, J., Krivanek, Z., & Holy, S. (2014, May). SmartTouristData approach for connecting local and global tourist information systems. In IST-Africa Conference Proceedings, 2014 (pp. 1-6). IEEE.
- Mildorf, T. et al., 2014. Open Data Platform for Data Integration, Visualisation and Map Design. In T. Bandrova, M. Konecny, & S. Zlatanova, eds. Thematic Cartography for the Society. Lecture Notes in Geoinformation and Cartography. Springer International Publishing, pp. 3–11. Available at: http://link.springer.com/chapter/10.1007/978-3-319-08180-9_1 [Accessed July 11, 2014].
- Mildorf, T. et al., 2014. Open Land Use Map. Agris on-line Papers of Economics and Informatics, 6(4), pp.81–88.
- M. Tuchyna, T. Kliment, P. Pastorek, B. Krsak, Z. Okanikova, 2015. 15th International Multidisciplinary Scientific GeoConference SGEM 2015, www.sgem.org, SGEM2015 Conference Proceedings, ISBN 978-619-7105-34-6 / ISSN 1314-2704, June 18-24, 2015, Book2 Vol. 1, 525-532 pp
- Čerba, O., Mildorf, T. & Berzins, R., 2015. Designing SDI4Apps POI Base. In Joint Proceedings of SSN-TC and OrdRing 2015. 14th International Semantic Web Conference. Bethlehem, Pennsylvania, United States: Sun SITE Central Europe, pp. 43–56. Available at: http://ceur-ws.org/Vol-1488/paper-05.pdf [Accessed December 14, 2015].
- O'Flaherty, J. „Community Co-design of a Geospatial Linked Open Data Platform for Environmental Management." AGRIS On-line Papers in Economics and Informatics 7.2 (2015): 55.
- Čerba, O. et al., 2015. Integration and Visualization of Tourism Data. In 27th International Cartographic Conference. Rio de Janeiro, Brasil: International Cartographic Association. Available at: http://icaci.org/files/documents/ICC_proceedings/ICC2015/papers/4/436.html [Accessed December 14, 2015].
- Matyska, Ludek. „The Czech e-Infrastructure and the European Grid Infrastructure Perspective." International Symposium on Environmental Software Systems. Springer International Publishing, 2015.
- KRŠÁK, Branislav - SIDOR, Csaba - ŠTRBA, Ľubomír - MITTERPÁK, Marek: Usage of linked open data for the measurement of mining tourism POIs' impact on the competitiveness of a destination: Research notes part 1 / Branislav Kršák ... [et al.] - 2016. In: Acta Montanistica Slovaca. Roč. 21, č. 2 (2016), s. 162-169. - ISSN 1335-1788 Available at: http://actamont.tuke.sk/pdf/2016/n2/10krsak.pdf
- Čerba, Otakar, et al. „SDI4Apps Points of Interest Knowledge Base." Progress in Cartography. Springer International Publishing, 2016. 229-237.
- Tuchyňa, Martin, et al. „Cloud based geospatial support for ecosystem services evaluation in Slovakia-A study case of SDI4APPS project." Conference: SGEM Multidisciplinary Scientific Conference.[online] Available at. 2016.
- Charvat, K., Cerba, O., Kozuch, D., & Splichal, M. (2017). Geospatial Data Based Environment in INSPIRE4Youth. Procedia Computer Science, 104, 183-189.
- Fotopoulou, E., Zafeiropoulos, A., Papaspyros, D., Hasapis, P., Tsiolis, G., Bouras, T., ... & Zanetti, N. (2016). Linked data analytics in interdisciplinary studies: The health impact of air pollution in urban areas. IEEE Access, 4, 149-164

6.2 Events

This is a list of selected dissemination and validation events of the SDI4Apps project:

- INSPIRE Implementation in the Danube Region, Zagreb, 29-30 April 2014
- IST Africa, Mauritius, 6 - 9 May 2014
- AgriFuture Days 2014, Villach, 16 - 18 June 2014
- 8th INSPIRE Conference, Aalborg, 16 - 20 June 2014
- Open and Linked Open Data for Agriculture, Forestry, Environment, Transport and Rural Development, Jelgava, 16 - 17 Sept 2014
- 19th International Conference on Information Systems for Agriculture and Forestry, Jelgava, 16 - 17 Sept 2014
- IRLOGI GIS Ireland 2014, Dublin, 16 Oct 2014
- GEO-XI Plenary, Geneva, 12 Nov 2014
- 9th GEO European Projects Workshop, Denmark, 15 - 16 June 2015
- INSPIRE Conference 2015 & Geospatial World Forum, Lisbon, 25 - 29 June 2015
- Geomatics in projects 2015, Plzen, 07 - 08 Oct 2015
- IRLOGI GIS Ireland 2015, Dublin, 15 - 16 October 2015
- Danube Open (Geo) Data Hackathon - Developers' Workshop, Bratislava, 16 - 17 Oct 2015
- ICT-2015, Lisbon, 20 Oct 2015
- GEO-XII-GEOSS AIP-8 Mexico City, 09 - 10 Nov 2015
- Eurocarto, Vienna, 10 -12 Oct 2015
- Wherecamp Navigation Conference 2015, Berlin, 26 - 27 Nov 2015
- Roadshow, Prague, 18 January 2016
- Latvian Workshops, 26 - 27 January 2016
- Roadshow, Klatovy, 17 February 2016
- EC DG JRC: Data management and Value-added Applications Workshop, Ispra, 23 Feb 2016
- Czech Copernicus User Forum, Prague, 10 May 2016
- XXIII ISPRS Congress 2016, Prague, 12 -19 July 2016
- INSPIRE Conference 2016, Barcelona, 26 - 30 Sept 2016
- JRC Ispra MIG-T Meeting, 26 Oct 2016
- SDI4Apps Stakeholder Conference, Vidzeme, 8 Dec 2016
- Roadshow, Prague, 23 Jan 2017
- Conference-Open Technologies for Growth, Riga, 2 Feb 2017
- Stakeholder Workshop, Latvia, 8, 13 and 22 March 2017
- Stakeholder meeting, Jelgava, 22 March 2017

6.3 Hackathons



Jelgava Hackathon 16 - 17 Sept 2014

The Open Data Hackathon was co-organised by the SDI4Apps project within the frame of the ISAF conference (http://isaf2014.info/)

Open Data Hackathon Dresden 14 - 16 Sep 2015

SDI4Apps co-organised an open data hackathon in the frame of the 19th International Conference on Information Systems for Agriculture and Forestry

Danube Open (Geo) Data Hackathon - Developers' Workshop Bratislava 16 - 17 Oct 2015

SDI4Apps was co-organising a Danube Open (Geo) Data Hackathon - Developers' Workshop

Baltic Open Data Hackathon in Latvia 16 - 18 March 2016

The Hackathon organised by SDI4Apps was focused on

- Tourism routes for e-vehicles.
- Heritage tourism routes.
- Land use: investment attraction for brownfield areas, mapping of brownfield connectedness to major communications and TEN-T networks, models of using OLU as a map for investment attractiveness

Conference and MedHackathon Patras 13 - 15 July 2016

Events organised by SDI4Apps in cooperation with University Patras, FOODIE, OTN and Capsela project

Hackathon on INSPIRE Conference Barcelona 26 - 30 Sept 2016

SDI4Apps co organise this event together with projects from Citizens observatories, DG JRC, DG Envi and DG RTD.

Hackathon Conference Pilsen 3 - 6 Oct 2016

The Open Data Hackathon was a part of a Joint conference focused on geo-sciences applications. The best hackathon projects was presented and awarded during the conference.

Hackathon Kosice 26-27 Nov 2016

SDI4Apps project contributed to the event with the dedicated workshop, presenting the main outcomes of the project to the T-systems Hackathon 2016 participants and providing the mentoring support during the event.

DanubeHack 12 - 13 Dec 2016

DanubeHack was focused on

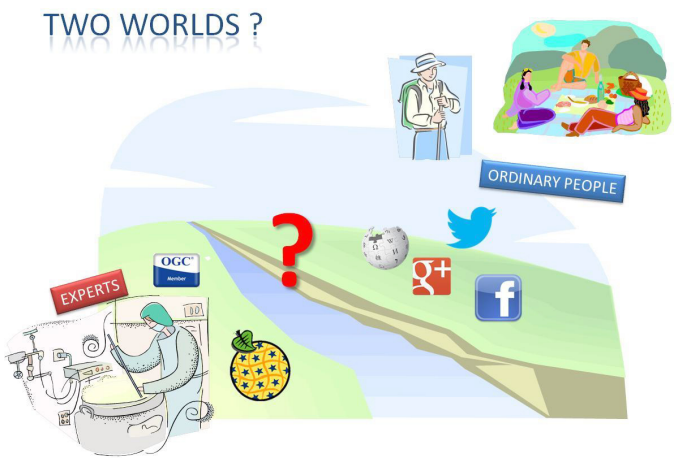
- collection of the evidence about the possible added value generated on top of open (geo) data , related application programming interfaces (APIs) and software tools, identified within the Danube region,
- explore the potential of citizen science and participation in creating and using value added services and applications,
- and test the requirements and benefits of INSPIRE, creating and re-using related data and services, including apps demonstrating the possibilities of INSPIRE infrastructure and where possible with use of open Data.

7 IMPACTS AND SUSTAINABILITY

7.1 Socio-Economic Impacts and the SDI4Apps Sustainability

SDI4Apps makes open data reuse easier for both data providers and consumers, by providing an open cloud platform of services and enablers that combine geospatial and non-spatial open data without requiring expert knowledge of the data providers nor the IT technologies running in the background. Thus the major socio-economic impact of SDI4Apps is to provide an open bridge between the two worlds of:

1. The top-down managed world of INSPIRE, GMES, GEOSS and similar initiatives represented by SDI experts, and
2. The bottom-up mobile world of smartphones, tablets, world of citizens and also world of thousands micro-SMEs developing applications.



Key to this socio-economic impact of the project is the sustainable operation of the SDI4Apps Framework after the project ends, to ensure the long-term sustainability of the SDI4Apps data models and network services, and exploitation of project results by guaranteeing added-value and return-on-investment to the different stakeholders involved.
This is being achieved by the SDI4Apps platform and its code-base being taken over by the Plan4All association (http://www.plan4all.eu/), to ensure its systemic sustainability through 3 main elements:

1. The adoption and spread of the SDI4Apps data harmonisation tools, metadata models and network services, their maintenance and further development.
2. The sustainability of the stakeholder partnerships that participated in the validation pilots and therefore constitute the foundations of SDI4Apps scenarios, and the growth of similar partnerships across Europe.
3. The growth and continued vivacity of the SDI4Apps communities as spaces for the socialisation of innovation and promotion processes.

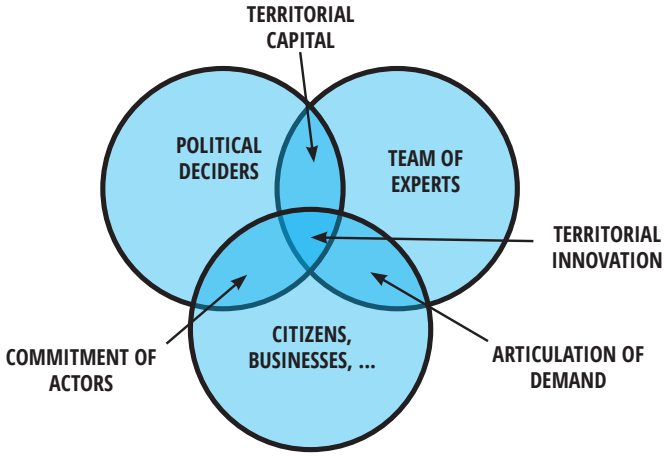
For the first element concerning interoperability and harmonisation processes, the user-driven methodology adopted throughout the project is the best guarantee of ensuring long-term viability of the SDI4Apps platform by Plan4All, and that the scope and nature of the validation pilots constitute the ideal mix for sparking of its viral adoption.

The second element touches on an important innovation in SDI4Apps, namely the service delivery model for the setting up and delivery of the validation pilot services. This model broadens the PPP (Public-Private-Partnership) and "triple helix" (PPP plus University) approaches to the kind of multi-stakeholder local partnership that characterises the Living Lab and Social Spaces for Research and

Innovation (SSRI) approaches. The social validation activities in SDI4Apps were intended to enhance the pilot evaluation approaches with a better understanding of these partnerships and their dynamics as a means of ensuring that the roles of different stakeholders and the perceived benefits are sufficient to guarantee the long-term viability of the partnership and the services it delivers.

The third element is therefore strongly linked to this ecosystem concept, since the SDI4Apps social network is where this ecosystem lives and has been made manifest. The criteria for long-term viability here are just not economic or institutional, but rather the continued social vitality generating a return on participation for each members of the communities involved.

The broader socio-economic context of the long-term viability of SDI4Apps can be viewed using a Territorial Innovation model which was developed to underpin the notion of a Territorial Living Lab*. In this model, the typologies of actors involved are the same as in the traditional concertation and participation processes in spatial and strategic planning, and correspond roughly to the participants and communities that took part in the SDI4Apps pilots. These are classified according to political decision-makers, technical experts in the various fields concerned (not only ICT) and the citizens and businesses that make up the socio-economic fabric of the territory, and their interactions as shown in the diagram on the right.



Territorial Innovation occurs in the overlap, where the roles of all three of the actor groups come together, and also where all three of the interaction processes – the formation of Territorial Capital, the political commitment of actors, and the articulation of the innovation demand – overlap.

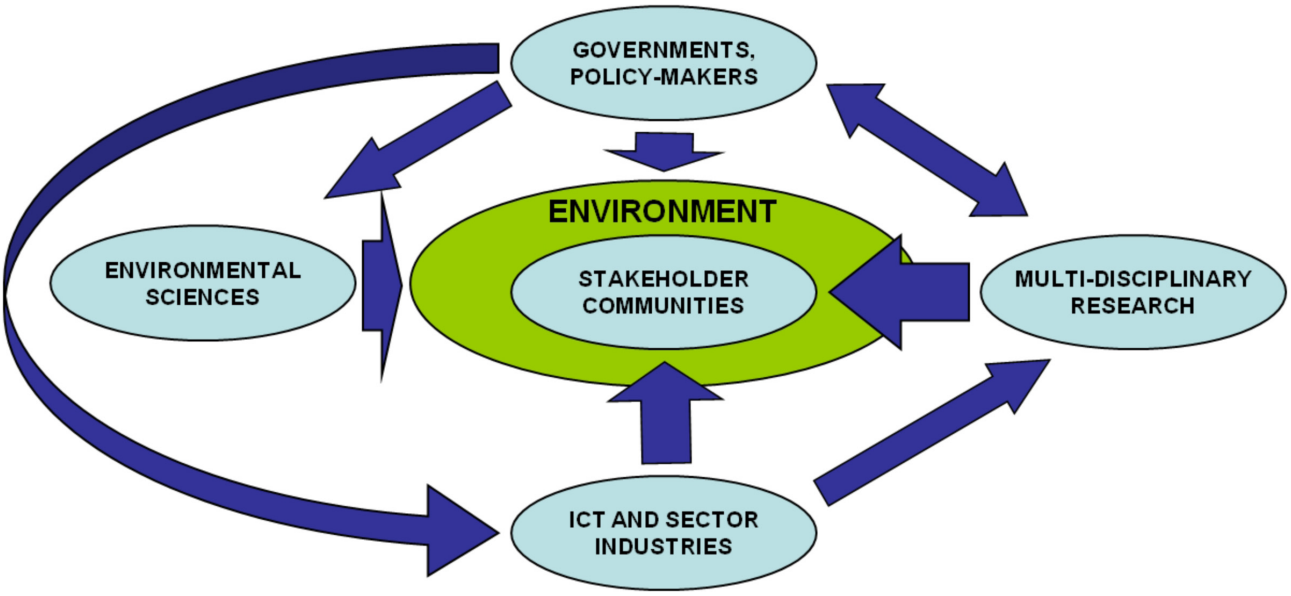
As each of the 6 SDI4Apps validation pilots evolved they relied on trans-regional and trans-European data sharing between pilot settings, within networks of interest present in the project and with collaborating members of their user communities. The robust stakeholder involvement central to SDI4Apps has not only generated sustainable economic returns through the interface between the business and the scientific community, but also now guarantees a solid contribution to a knowledge-driven economy. European competitiveness and the Digital Single Market (DSM) increasingly rely on distributed/networked SMEs or other local businesses under a well-anchored government umbrella framework. While community-based businesses foster trust, commitment, high-quality of tools and services, accountability, social-environmental responsibility, business ethics, and "contagious commitment".

SDI4Apps has stimulated networking of organisations dealing with SDI for environment (regions, NGO, universities, high schools, long life education). Implementing the project at European level allowed the consortium to have the necessary breadth to cover the complete chain and allowed know-how, experience, methodologies, and general practice to disseminate throughout Europe. The networking capacity of SDI4Apps was increased as many of the project partners are members of international bodies, and they are able to use this network to extend the impact of the project. In addition, both the awareness and training activities of the project (such as the hackathons and local workshops) as well as the exploitation and sustainability activities (such as the transfer to the Plan4All Association) have promoted the uptake of results from interested stakeholders, and invited interested organisations to join the project by joining the SDI4Apps communities, and now become members of the Plan4All association.

* Marsh, J.2008: Living Labs and Territorial Innovation. In: Collaboration and the Knowledge Economy: Issues, Applications, Case Studies, IOS Press, Amsterdam (NL), 2008

7.2 Impacted Stakeholders

It was found that the stakeholders impacted by SDI4Apps can be described and mapped as follows, based on institutional, operational, and economic standpoints related to the environment (using ICT-ENSURE's analysis of the environmental research problem space)*:



Governments and policy-makers	mainly as funders of environmental research, the initiators of top-down actions such as SISE, SEIS, ENHIS, etc., and generally institutionally mandated for the implementation of INSPIRE. In SDI4Apps, different levels of government are represented in all of the pilot communities.
Environmental Sciences	experts in the field of the environment (generally Universities or government bodies) applying INSPIRE to improve their capacity to monitor and predict; these actors generally assume an observational stance with respect to the environment, and are also present in the SDI4Apps pilots
ICT and sector industries	including in the broadest sense industrial activities with an effect on the environment, i.e. agro-food multinationals, the construction industry, etc.; these stakeholders are present in several of the SDI4Apps pilots. This category also includes the ICT industry and its potential interest (low so far, and of particular interest to SDI4Apps) in adopting INSPIRE or building its services on top of INSPIRE services.
Multi-disciplinary Research	this groups socio-economic and ICT researchers into a multi-disciplinary perspective on the SDI4Apps problem space as a question of sustainable development including both the environment and human communities within it; this group drove some of the SDI4Apps pilots,
Stakeholder Communities	these are the associations, local NGOs, etc. who represent those directly affected by environmental change; they are involved primarily in information management, dissemination and awareness activities; these actors can be said to be "inside" the environment rather than observing it and are often the "champions" within SDI4Apps pilot communities.

* http://ict-ensure.tugraz.at/en/index.html