

Innovation Hub for Rural Areas and People

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Abstract. Rural areas are under pressure. Over the past twenty-five years, rural regions have experienced a rapidly shrinking population as people, especially young adults, have migrated to cities. PoliRural is a research and innovation project designed to advance rural policy development in the age of disruptive data and technologies in order to deliver a trusted, scalable and transferable solution for policy co-creation. PoliRural project includes two main parts, rural part and technological part. In the second part are text mining solution or dynamic model tool. The technological part is covered by PoliRural Digital Innovation Hub (DiH). The DiH is the main ICT vehicle for interactive knowledge sharing and will host all results generated by the project. It will include 12 regional hubs (in accordance with 12 regional pilots) represented as living case studies. The DiH is a multi-actor ecosystem that supports communities in their digital transformation by providing a broad variety of services from a one-stop shop.

Keywords: Rural development; ICT; text mining; Digital Hub.

1 Introduction

Rural areas are under pressure. Despite being home to more than a quarter of Europe's population and providing more than one fifth of all EU jobs, the old-fashioned image of the rural idyll is seemingly no longer valid. Over the past twenty-five years, rural regions have experienced a rapidly shrinking population as people, especially young adults, have migrated to cities with the lure of better paid jobs, modern affordable homes and more exciting lifestyles (Westhoek, van den Berg and

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Bakkes, 2006; Wiebe et al., 2018). European Commission reports that only 5.6% of all European farms are run by people younger than 35 while more than 31% of all farmers are older than 65 (DG Agri, 2017).

Decision makers have the ability to steer change and in so doing reduce the negative impact thereof, however this requires advanced knowledge of how a particular action, or inaction, will affect people and places, at present and in the future. The use of text mining is only starting to gain traction in other domains while in rural policy making it is virtually non-existent (Kayser and Blind, 2017). The quantitative-qualitative nexus in futures exploration, despite some signs of strengthening in recent years, continues to be marked by a strong polarisation when it comes to methodological choices. In futures research, a long-standing divide remains in place between strictly quantitative and more qualitative approaches (Fontela, 2000).

PoliRural is a research and innovation project designed to advance rural policy development in the age of disruptive data and technologies in order to deliver a trusted, scalable and transferable solution for policy co-creation. It brings together decision makers, experts and rural inhabitants using advanced policy simulation tools to better understand and tackle regional challenges, ultimately making rural areas and professions more attractive and liveable for established populations and recent or potential newcomers (Ulman et al., 2020).

One part of the PoliRural project is Digital Innovation Hub (DiH). Digital hubs can be in different forms. Rural village hall to provide a resource for supporting digital inclusion, and to be a 'place' for the integration of digital skills and resources into the community (Willis, 2019). Building on and complementing existing experiences, the T20 platform is a digital hub for producing knowledge, informing policies and connecting potential partners to accelerate the jobs of the future, within the context of an increasing integrated global economy (Belize, Basco and de Azevedo, 2019). So, digital hub can be ICT platform for sharing of knowledge or tools (Kasim and Drus, 2018). In the emerging technological scenario world is becoming a text mining and digital hub where data is easily accessible on the internet (Kumar and Tripathi, 2015).

PoliRural Digital Innovation Hub is the main ICT vehicle for interactive knowledge sharing and will host all results generated by the project. It will include 12 regional hubs (in accordance with 12 regional pilots) represented as living case studies with discussion forums, interactive policy simulations, best practices, wikis, training courses, as well as links to national sites where information on specific policy measures can be found.

2 Materials and methods

The basic scientific method of analysis and synthesis was used to tackle the research problem. PoliRural will use different technologies to achieve the goals and objectives. These technologies mainly relate to either to the text mining solution or the Digital Innovation Hub where project results will be published. The main modelling work will initially be carried out using Stella, proprietary software to avoid lag times for the research, however a parallel track will take place throughout the project, focusing on

the innovative use of Open Source system dynamics software as a base for post-project sustainability.

The Innovation Hub objectives:

- Act as a gateway to PoliRural pilot activities, allowing users not only to check past achievements, ongoing developments and future events, but also get involved in building a better future for their region, for example by joining stakeholder panels, participating in online (forum) discussions
- Provide data that may not be readily available from other sources. This may include Earth Observation based maps showing land use (change) in each of the 12 participating regions. Such maps can be used for policy evaluation e.g. correlating changes in non-arable land with direct payments (CAP subsidies) for a given area
- Host the outputs of the PoliRural Semantic Explorer (text mining) and Policy Modeler (system dynamic modelling) for easy access by stakeholders in pilot locations and beyond
- Integrate an online learning course so that anyone with an interest in rural foresight could apply the PoliRural framework to deliver desired change in their region

Final components of the PoliRural Digital Innovation Hub are in the 9th level of Technology readiness levels (TRLs). A components' list and TRLs are in the table 1.

Table 1. Technology readiness levels (European Commission, 2014) for PoliRural Digital Innovation Hub components.

Component	Final TRL	Product
RDF Storage	9	Virtuoso
Geo Storage Library	9	PosGIS, Geoserver, Mapserver
Metadata catalogue	9	Micka, Ckan
Geovisualization library	9	HSlayers NG, WebGlayer, Leaflet
Framework	9	Liferay
MOOC	9	LMS Moodle

There are integrated internal and external data in the DiH as:

- Internal data:
 - The Smart Points of Interest dataset
 - Open Land Use
 - Open Transport Map
- External data:
 - Eurostat

The Digital Innovation Hub have four main components or spaces:

- 1) *Interaction space* is home to a Digital Science Shop as a communications platform, where users can look for researchers solving their problems and young researchers (bachelor, master and doctor studies) can look for topics

for their thesis. It will also comprise components for interaction Wikis, dialogue etc.

- 2) *Learning space* providing an environment and courses that permit training of partners, external stakeholders and early adopters.
- 3) *Experimentation space*, where users will have the chance to test new analysis techniques and model simulations and visualization with real data from their own pilot regions.
- 4) *Developer space*, with cloud hosting, shared components, tools, services, data and development environments for pilots wishing to run their own services.

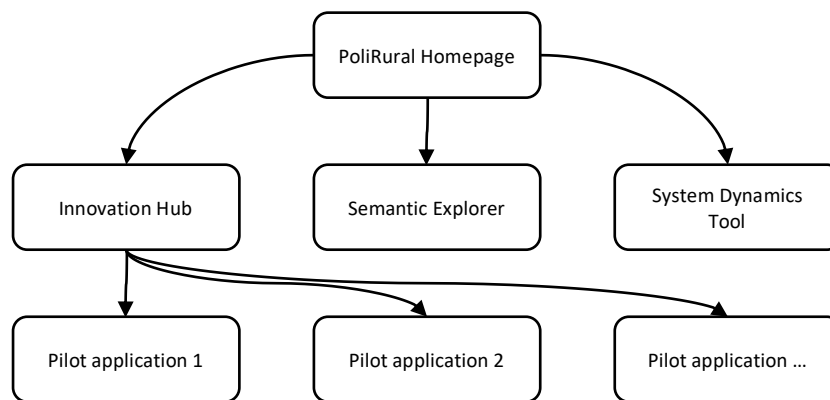


Fig. 1. The relationship between the Innovation Hub and other PoliRural systems.

3 Result and discussion

The technical platform of the innovation hub is described as a reference architecture that can be realized in three different ways:

- 1) As a central service provider, shared data and components node
- 2) As a centralized pilot node hosted in the PoliRural private cloud
- 3) As a decentralized pilot node hosted in a legacy environment

This approach permits the innovation hub architecture to be applicable to both new and legacy IT environments. We believe this approach is superior to a make-or-break monolithic system that must be identical in every way, shape and form.

- The box denoted is a placeholder for the cloud hosting sub-system that is described in greater detail in the following chapter.
- The components shown as boxes in the diagram above will be available for inclusion in centrally hosted and decentralized pilot instances of the Innovation Hub platform as Docker images.
- Boxes shown in grey colour are external to the innovation hub application system and will be dealt with as third-party integrations as required.

The frontend layout of the DiH portal is based on the wireframe for better UX usage and is implemented into the Liferay portal framework. Responsive design based on the Bootstrap framework is used for optimal viewing and navigation across a wide range of devices, including traditional PC, tablet and surface, smartphones, and all other mobile devices. Also, semantic code for better SEO and application of the SEO principles. Liferay Portal provides a robust platform to build a website on quickly and serve it to all clients - desktop, mobile, or anything in between. It provides all the standard applications which are needed. It also provides an easy to use development framework for new applications or customization.

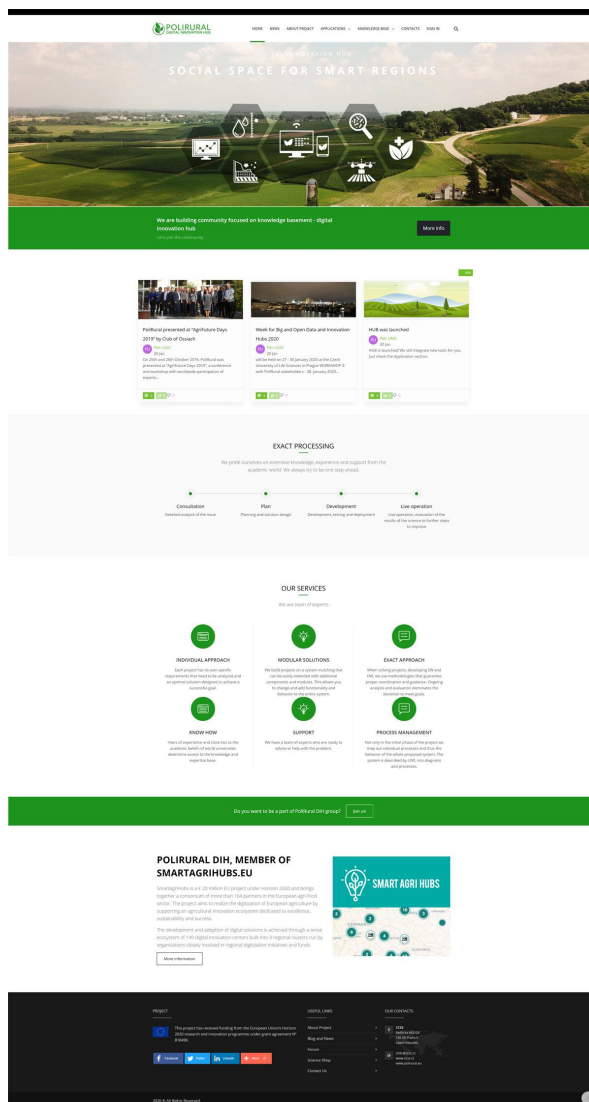


Fig. 2. Overall design.

The Map is one of the central functions of Hub. The Map client is based on HSLayers NG. Link to GitHub <https://github.com/hslayers/hslayers-ng>. HSLayers NG (<https://ng.hslayers.org/>) is a web mapping library written in JavaScript. It extends OpenLayers 4 functionality and takes basic ideas from the previous HSLayers library but uses modern JS frameworks instead of ExtJS 3 at the frontend and provides better adaptability. That's why the NG ("Next Generation") is added to its name. It is still under development and provided as open source. HSLayers is built in a modular way which enables the modules to be freely attached and removed as far as the dependencies for each of them are satisfied. The dependency checking is done automatically.

A platform to facilitate experimentation and data science-oriented tasks as well as publishing prototype applications is DiH Lab. It showcases system dynamics models and in future will also provide running it with different parameters. The main building blocks of the DiH are:

- Dashboard
- External apps (mainly maps)
- List of datasets with descriptions
- Workspaces
- Models (System dynamics)
- Maps for calculating and displaying of rural attractiveness and clusterization of regions.

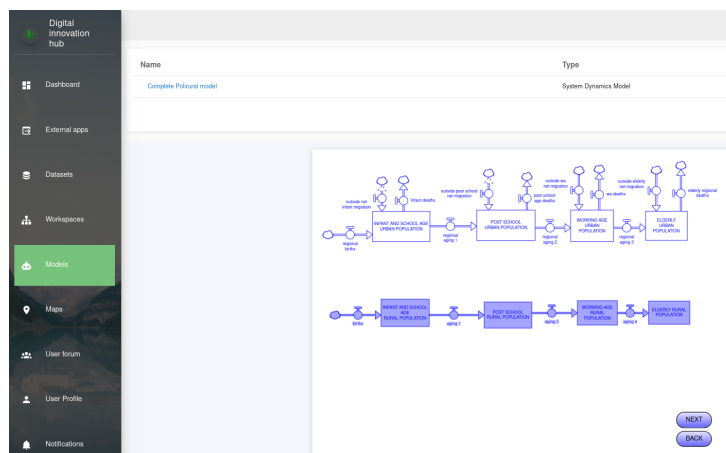


Fig. 3. Dynamic model integration.

The DiH Lab is a platform where users can have their own isolated docker based environment to perform data science related tasks involving data mining, processing and visualization. A visual modelling tool has been developed to make the process of chaining the building blocks of data-processing-pipeline easier. Linking datasets to

processing nodes, generates code in the Jupyter Notebook which is behind each processing node.

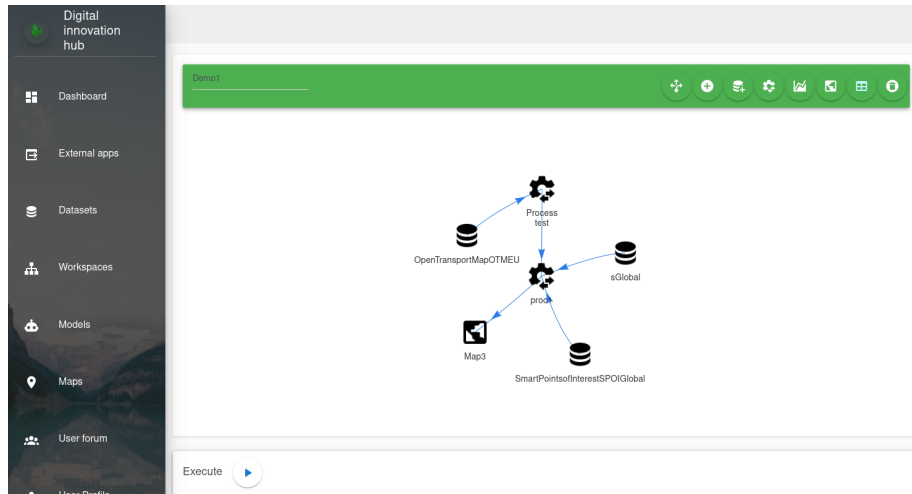


Fig. 4. Working with models using Jupyter Notebook.

The PoliRural DiH is a central real and virtual space, where all stakeholders (policymakers, public servant, regional development agencies, NGO, citizens, scientists, developers, data experts, planners) meet and share their needs and achievements to improve policy and decision making on local, regional and eventually national level. The core of the Innovation Hub is the DiH platform. This DiH also supports the sharing of information with other projects and initiatives. Similar tools are developed for other fields or can be integrated (Kasim and Drus, 2018; Blaud et al., 2002). Digital Hubs are also important as a base of place for knowledge and innovation (Pancholi, Yigitcanlar and Guaralda, 2015).

4 Conclusion

The DiH is a multi-actor ecosystem that supports communities in their digital transformation by providing a broad variety of services from a one-stop shop. The purpose of a DiH is to:

- provide a social space for community of practices;
- provide access to digital technologies and competencies;
- provide access to infrastructure and tests digital innovations (“test before invest”);
- provide development playground for map-based projects;
- offer training and skills development;
- offer support in finding finance for digital transformation;
- help in networking and connecting users and suppliers of digital innovations;

The main goal of this activity during the PoliRural project is to design and develop a prototype of a Digital Innovation Hub. This DiH should integrate technology, datasets and libraries in one infrastructure with a complex user-oriented portal in the Web environment. The user portal should provide general principles of the content management framework as well as principles of social space by providing a blog, forum, science shop, wiki pages etc. The DiH should be able to connect end users with developers or researchers to improve the impact of the demo applications or case studies by short-chain feedback from end-users. End users can join larger communities around the DiH to get advice, cooperation potential and access to modern technologies utilization.

The prototype of the DiH is based on a cloud solution where Liferay is providing user portal framework and background for front-end applications while OpenStack provides a back-end environment where many libraries for data analyses, data storage and data publishing are installed (PoliRural, 2020).

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