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Towards an Open Data Research Ecosystem in Croatia

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Abstract: Open data initiatives have resulted in greater availability of data, thereby realising ambitions such as improved efficiency and effectiveness of public services, increased transparency, accountability and citizen participation, and economic and social value creation. Open data research is a crucial component in creating and accelerating sustainable and innovative open data ecosystems. However, not all countries equally progress with regard to implementing open data policies and some countries are falling behind. The project Twinning Open Data Operational (TODO) examines which strategy can boost the open data ecosystem of countries that are just beginning to develop open data policies. We are developing and implementing an interdisciplinary multi-domain open data research approach to increase the maturity of the concept and impact of the open data ecosystem in Croatia and beyond. This paper lays down the strategy to arrive at a sustainable open data research ecosystem in open data beginners countries.

Keywords: Open data, open data research ecosystem, strategy beginners, open data beginners, Croatia

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1. Introduction

In the past ten years, open data initiatives have resulted in a greater availability of data, thereby realizing ambitions such as improved efficiency and effectiveness of public services (e.g., Huijboom and Van den Broek 2011), increased transparency, accountability and citizen participation (Jetzek 2013), and economic and social value creation and job creation (e.g., Omidyar Network 2014, Global

Partnership for Sustainable Development Data 2017). Moreover, open data are essential for achieving the United Nations' Sustainable Development Goals (see The Open Working Group 2015). It has been claimed that the economic value of billions of Euros will be created by the reuse of open government data (Dekkers et al. 2006, Pira International et al. 2000, Vickery 2011). Open data are data that can be used and reused without any (financial, legal, intellectual and technical) barriers. Open data can be framed as data that is free of charge, licence free, machine readable and provided in open format (Welle Donker and Van Loenen 2016, see also Sunlight Foundation 2010). To realize the benefits of open data to the full, traditional "one-way street" open data practices and initiatives should be replaced by an open data ecosystem, i.e. a concept related to open data, which focuses not only on data accessibility, but also on the larger environment for open data use – its "ecosystem" (Pollock 2011, World Bank Group 2015). Pollock (2011) argued that we should transform our one way open data streets towards an ecosystem where data is cycled and recycled among producers and users with a prominent role for info-mediaries. The ecosystem builds on the open data infrastructure and is "made up of a series of interrelated tools and services that rely on one or more elements of the infrastructure either directly, or through intermediary tools and services, for their sustained operation" (Davies 2010 cited in Van Loenen et al. 2018). The added value of the ecosystem perspective on open data is its focus on the relationships and interdependencies between the social (publishers and users of open data) and technological (data linking, big data analysis, storing, visualising) factors that affect the performance of open data activities (Dawes et al. 2016, Zuiderwijk et al. 2014).

Ongoing open data research is characterised by single disciplinary approaches (Zuiderwijk et al. 2014). In recent years, the concept of open data has been discussed and investigated from a technological perspective (Pollock 2011), a business perspective (Heimstadt et al. 2014), a socio-technical perspective (Ubaldi 2013), an operational perspective (Zuiderwijk et al. 2014) and a process perspective (Janssen and Zuiderwijk 2014). However, some perspectives remain under-studied (for instance, the legal and governance perspective), and ecosystems are still largely described and studied by their individual elements (see Charalabidis et al. 2018). Moreover, international open data research on open data practices are often addressing lessons learned in specific domains (e.g., agriculture, geomatics, statistics, health, big data, research) without identifying challenges that users of data across different domains are being confronted with (Verhulst and Lammerhirt 2016). Provided the many interdependencies in the open data ecosystem, it should be studied holistically, by investigating and developing all elements not only individually, but especially in relation to each other (Verhulst and Lammerhirt 2016). An interdisciplinary multi-domain research approach will provide the required new insights delivering answers and solutions that are far beyond those obtained within single disciplinary, single domain approaches.

Croatia is one such country that is just at the beginning and where the impact of open data is still in its infancy . The Global Open Data Index (Open Knowledge Network 2017) ranks Croatia as 23rd out of 30 European countries. Similar scores were provided by the Open Data Barometer (Web Foundation 2017) (31st out of 40 European countries). While other European Union (EU) member states started to implement their open data strategies in 2005 with the adoption and implementation of the 2003 PSI Directive (Directive 2003/98/EC on the reuse of public sector information), Croatia lagged behind with implementing the Directive, which just started in 2013. As a result, open data

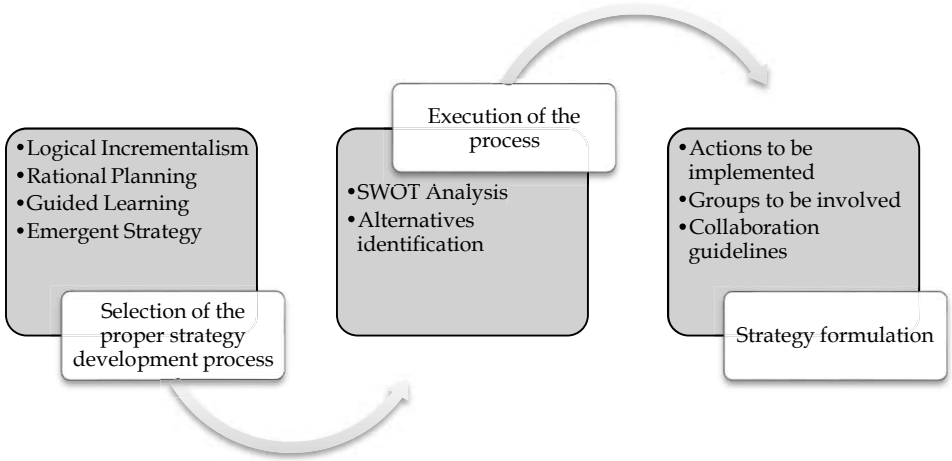
benefits such as increased transparency, innovation and economic growth or a more efficient public sector, have only modestly been realized in Croatia (Information Commissioner Croatia 2017).

An important component in creating and accelerating sustainable and innovative open data ecosystems is a strong academic open data community and an active involvement of research in the development and implementation of the national open data agenda (see Harrison et al. 2012). While open data research in Croatia is advancing and promising, it is not sufficiently mature to support or to steer the open data agenda and to realize the full economic and societal potential of open data. By establishing a sustainable open data research environment capable of addressing key challenges in open data research through the development and application of an interdisciplinary and multi-domain research approach on open data, we explore how we can change the current situation, and establish a sustainable open data research ecosystem at the University of Zagreb (UNIZG). This paper aims to present our ongoing research to create a research environment that explores novel approaches towards researching societal and scientific open data challenges.

2. Methodological Approach

The TODO project is aiming at implementing an interdisciplinary open data research approach in a dynamic setting of 7 faculties of the University of Zagreb and two international universities. Therefore we combined a literature study into performing interdisciplinary research strategies with action research theory (Stringer 2014). Idenburg (1993) explains the four styles of strategy development. The methodological approach follows the procedure described below and depicted in figure 1. The first step is to identify the proper style of strategy development process; then to execute this process and finally to formulate the final strategy fitting our scope. The selection of the proper style of strategy development is decided based on the analysis of the situation in two axes: (a) Goals orientation (what) and (b) Process orientation (how). Rational Planning seems to fit better to our scope since we have strong Goals orientation and weak Process orientation. After a careful SWOT analysis and based on the opinions of external (in the domain of open data) and internal (in the situation in the country/institution under study) experts, the alternatives have been drafted. The final step of the methodology proceeds to the formulation of the actual strategy presented in Section 4.

Figure 5: Methodological Approach for Strategy Development



3. Current and Envisioned Situation

3.1. Current Situation at the University of Zagreb

Open data research in UNIZG is performed in at least six different faculties: the Faculty of Geodesy, the Faculty of Electrical Engineering and Computing, the Faculty of Organization and Informatics, the Faculty of Law, the Faculty of Transport and Traffic Sciences, and the Faculty of Agriculture. We reviewed the current open data research ecosystem within UNIZG through a SWOT analysis. The results of the SWOT analysis of open data research at UNIZG are presented in Table 1.

Table 1: SWOT Analysis Open Data Research at UNIZG

Strengths	•Involvement of researchers from many different disciplines related to open data agenda: law, organization studies, geomatics, ICT, transport, etcetera •Long tradition and international recognition in many scientific and artistic fields •Significant experience of national and international scientific projects •Large number of researchers in scientific and teaching positions •Existence of international recognized researchers and research groups •Researchers cover all scientific and art fields •Well-developed ICT infrastructure in most of the faculties
Weak-Nesses	•Large number of relatively small and fragmented research units •Limited international collaboration with and connection to international open data research community •Different levels of achievements and excellence at faculties regarding open data •Low level of cooperation between faculties regarding open data •Low number of publications on open data in international peer reviewed journals •Limited awareness of the value of open research data •Departure of young and prospective researchers to international institutions, limiting possibility to open new research topics
Oppor-tunities	•Implementation of open data agenda in Croatia requires support from research •Strong desire for education among open data professionals •New generations of researchers and practitioners require updated training and education curricula •National, regional and international universities interested in cooperation with open data projects •Enterprises interested in cooperation with university on technological projects •Raising attention in academic community to open data developments in the Balkan (and similar countries and regions).
Threats	•Lack of national research funding in Croatia •Scientific open data community builds on established research institutions and networks •Low attractiveness of research positions compared to enterprise and international institutions participating in open data agenda •Rather low interest among enterprises to collaborate on open data projects

3.2. Envisioned Situation at the University of Zagreb

In the envisioned situation a sustainable open data research environment is established covering multiple disciplines (ICT, engineering, public administration, law, humanities and social sciences, organisation and informatics) and domains (geospatial, transport, agriculture, law, research and education). This should be strengthened by the close cooperation with two leading international partners (Delft University of Technology and University of the Aegean) and with support from key organizations in the Croatian open data ecosystem. Ultimately this may result in an internationally recognized and competitive centre of excellence in open data research.

4. Strategy Towards Open Data Research Ecosystem

Central to the strategy is the development of an interdisciplinary open data research approach. Interdisciplinary research does not occur automatically by bringing together several disciplines in a research project (Tait et al. 2007). Extra effort is needed to promote formation of a cohesive research

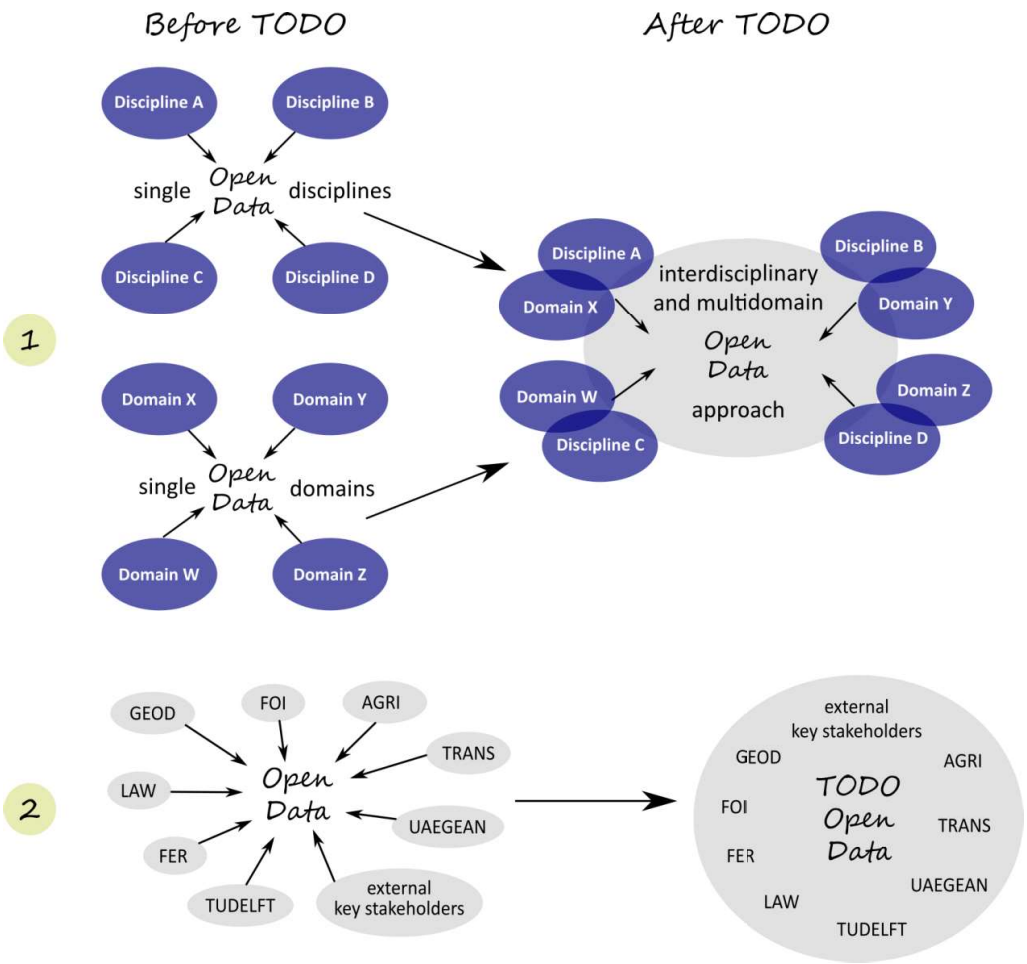
team involving researchers from different disciplines, to combine expertise from several knowledge domains and to overcome communication problems among researchers from different disciplines (Tait et al. 2007). Establishing unambiguous communication between researchers from different disciplines is key to performing interdisciplinary research (Klein 2008, Tait et al. 2007). It is essential that all project participants share a common knowledge base on open data and use the same open data vocabulary (Pollock 2018; Daily and Ehrlich 1999; Wear 1999). In addition, Klein (2008) argues that researchers have to collaborate to develop a common understanding of a phenomenon. An iterative and transparent process should be implemented to arrive at a common stakeholding. External stakeholders can also play an important role in interdisciplinary research, focusing attention on the need for relevance to real world problems and encouraging the uptake of research results by industry or other end-users (Tait et al. 2007).

Provided the interdisciplinary research prerequisites, and the SWOT analysis of open data research at UNIZG, the strategy for stepping up and stimulating scientific excellence and innovation capacity in open data research in UNIZG was designed to encompass five phases:

1) Establishing a new research environment;
2) Building open data capacity;
3) Collaborating and knowledge sharing;
4) Outreach and dissemination; and
5) Creating a sustainable open data research environment.

The strategy should enhance the capacity for open data research at UNIZG by connecting fragmented research groups and researchers across the different research areas and disciplines, in order to arrive at a situation where the UNIZG partners will function as one research unit within UNIZG (see figure 2).

Figure 2: The open data research ecosystem before and after the strategy; from a (1) single discipline and single domain to interdisciplinary multi-domain research approach; and (2) from fragmented groups to a coherent open data research environment.



4.1. Establishing a New Research Environment

We aim to remove barriers and to establish connections between research groups and environments and promoting cooperation in open data research between several research groups at different faculties at UNIZG by providing all open data researchers with a research environment (Open Data Labs) at the level of each partner institution to perform interdisciplinary multi-domain open data research, and to establish good practices to be followed by other faculties and research groups. This is followed by the establishment of a central open data centre of excellence in the UNZIG, strengthened by additional involvement of key open data stakeholders in Croatia and abroad.

The research environment is supported by an online collaborative research environment that will facilitate the communication among the researchers of the different faculties and those of the international partners, including the sharing of information and knowledge (online training material, open data wiki, platform for the webinars, a MOOC, dissemination material, news, and research data).

4.2. Building Capacity

A second component of the strategy is to build open data capacity in UNIZG. This capacity building is aiming to upgrade the general open data knowledge based of UNIZG scientific staff through an online training program, a summer school and site visits to best practices in open data.

The online training program will develop a framework under which a common open data language will be developed and innovative interdisciplinary research conducted. It will further provide all open data researchers at the UNIZG with in-depth knowledge and understanding of the main concepts, theories on and approaches to open data research from different disciplines. To enhance know-how of concepts, approaches and theories related to the different phases of the open data life cycle and different domains of open data through a summer school. Finally, to increase the knowledge on and understanding of real-world open data policies, technologies and initiatives in different domains through site visits at best practices in open data in Europe. Visiting selected institutions and external experts will also foster the exchange of knowledge and scientific collaboration between international open data researchers, practitioners and decision makers.

4.3. Collaborating and Knowledge Sharing

The third component of the strategy is to develop and apply an interdisciplinary multi-domain research approach for open data. This will be performed by the UNIZG staff together with the international counterparts. The collaboration of researchers and research teams within and across disciplines will be stimulated through staff exchanges, seminars, joint publications and presentations, and the supported by the open science collaboration platform. This platform should provide the staff members with effective and innovative means of collaboratively collecting, manipulating and managing research data, as well as collaborative knowledge sharing and creation. In addition to knowledge sharing, partners will also exchange established (inter)national networks among each other. To address jointly and innovatively research challenges that require an interdisciplinary multi-domain approach on open data through the organization of two research seminars dedicated to defining research topics for Early Stage Researchers in the UNIZG research groups.

4.4. Dissemination and Outreach

The fourth step in the strategy aims at increasing the visibility and reputation of UNIZG among the national and international research community, industry, policy-makers and the general public. Outcomes will be communicated to different target groups via a variety of different communication channels, but also participation and knowledge exchange is sought with external researchers by open participation to the national open data conference in Croatia, and scientific workshop, that will be organised. Open data starters will be addressed through the creation of an open data wiki in Croatian, and the development of a Massive Open Online Course (MOOC) on best practices for open data in Croatia.

To implement the knowledge gained in open data education through the review, revision and updating of study programs and courses on open data, as well as pioneering with guidelines for using open data in high school education.

To strengthen UNIZG's international profile and reputation in open data education and research through the organization of an international Open Data conference for open data researchers.

4.5. Creating a Sustainable Open Data Research Environment

The final step of the strategy is to ensure the post-project continuation of the international collaboration and its impact on open data research and practice through the establishment of a cooperative structure. A joint research agenda will be developed and submission of joint project proposals prepared.

5. Conclusion

An important component in creating and accelerating sustainable and innovative open data ecosystems is a strong academic open data community and an active involvement of research in the development and implementation of the national open data agenda. While open data research in Croatia is advancing and promising, it is not sufficiently mature to support or to steer the open data agenda. This paper presented a strategy for establishing such a desired open data research ecosystem in the University of Zagreb, Croatia.

Central to the strategy is the development of an interdisciplinary open data research approach. Stepping up and stimulating scientific excellence and innovation capacity in open data research in the University of Zagreb encompasses five phases: (1) establishing a new research environment, (2) building open data capacity, (3) collaborating and knowledge sharing with international partners, (4) outreach and dissemination, and (5) creating a sustainable open data research environment.

This should lead to an envisioned situation of a sustainable open data research environment covering multiple disciplines and domains, strengthened by the close cooperation with two leading international partners and with the continuous support from key organizations in the Croatian open data ecosystem: the sustainable open data research ecosystem.

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