A Cloud-Based Platform to Support the Policymaking: The Case of the DECIDO Project.

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Abstract

Policy making is the process of creating and monitoring policies to solve societal challenges. In this respect, it is often conceptualized as a policy cycle [15], consisting of several different phases, such as agenda setting, policy formulation, policy implementation & monitor and policy evaluation. Citizens often have the perception that the policy decided by the public authorities doesn't meet their needs. They would like to be engaged to provide their contribution to the policy decision, supporting the decision takers in a bottom-up approach. Citizens are called to take an active role in public services definition and implementation through co-production and co-creation. In this paper we illustrate how DECIDO project can support the policy makers along with citizens, organisations, businesses, public authorities to create/improve better policies, exploiting the power of data through the use of the disruptive technologies. Evidence-based and data-drive approaches are strongly recommended to take informed design decisions affecting the policies. The solution proposed by DECIDO is a combination of a co-creation methodology to involve all the actors in the Policy Life Cycle, and an easy-to-use web portal to support the creation of the policy exploiting big data analysis and cloud services in each phase of the Policy Life Cycle.

Keywords

Cloud services, policymaking, co-creation, open data

1. Introduction

DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies) is an European project funded under the H2020 Programme (under the topic DT GOVERNANCE 12-2020). The project started the 1st March of 2021 and will end the 29th of February 2024.

The mission of DECIDO project is to demonstrate the ground-breaking impact of the adoption of innovative methodologies, tools and data, enabling the effective development of better evidence-based policies by public authorities. DECIDO will serve as an intermediary between the public sector, the citizen science world and the European Cloud Infrastructure (ECI) through the direct collaboration with European Open Science Cloud (EOSC) and will provide storage capacity and processing power through EGI infrastructure. The project will test the DECIDO solutions in 4 cities/regions across Europe:

1. Pilot on Forest fires in Kajaani, Finland: prevention and protection against forest fires; Procedures to mitigate damage to nature, infrastructure and life.
2. Pilot on Floods and on the Social Crises following a pandemic or the outbreak of a conflict, Italy: improve design of emergency policies related to floods and weather alerts in two areas of the City of Turin (Meisino Park and Murazzi), as well as to the social crises following a big pandemic event or the outbreak of a conflict in a neighbouring country.

3. Pilot on Power Outage in Greek Municipalities, Greece: power outage management of public infrastructure and cultural assets of Greek municipalities via emergency response mechanisms.
4. Pilot on Wildfires in the Aragon Region, Spain: improve the design of emergency policies related to wildfires.

The project has several objectives:

- Objective 1: Enable public authorities in adopting **data** and **cloud** technologies (from the PA and research sector) to support evidence-based policies
- Objective 2: Support emergent strategic management in order to ensure that data can contribute to **evidence-based policy making** processes aligned with political objectives and priorities
- Objective 3: Facilitate the active **involvement of local actors** in data generation, how it is analysed and used within the policy making life cycle
- Objective 4: Pursue sustained use of **data analytics** and cloud infrastructure in policy making

According to the aforementioned objectives, the main results the project is developing are:

- An **easy-to-use portal** to define, manage and evaluate PA policies in a collaborative manner leveraging services offered by EOSC cloud services, data made available by EOSC and by other data providers (e.g. data.europa.eu), including Public Administrations themselves.
- A **co-creation methodology** on how to improve the collaboration among all stakeholders involved in the policy life cycle (PLC), using the idea of Hackathons. This enables bottom-up and externally collaborative ideation of innovative policies.

The paper is structured as follows: Section 2 presents how the DECIDO project exploits data to achieve the decision making. Section 3 introduces how the disruptive technologies can facilitate the policy makers and Section 4 describes the case study in Aragon region on wildfires. Finally, Section 5 concludes and outlines future directions.

2. DECIDO Solution: From Data and Co-Creation to Decision Making

Democracy, a concept that originated in ancient Greece approximately 2400 years ago, has seen significant evolution over centuries. Until the 1960s, this evolution was primarily towards representative democracy, a system where citizens exercise control over the government by voting in open elections. However, post-1960s, new avenues emerged for citizens to influence their governments through stakeholder engagement, marking the rise of participatory democracy (1960s-1980s) [1].

From the 1980s to the 2010s, citizens were afforded the choice between free public or private service providers. This period saw citizens being viewed as customers with individual needs in the paradigm known as new public management [2].

Starting from 2010, a shift towards the co-creation paradigm was observed, where citizens are seen as knowledgeable contributors who participate in public governance discussions in (virtual) arenas [3]. This shift marked a significant paradigm change, wherein citizens transitioned from being regarded as customers [6] to being recognized as partners [7]. Co-creation fosters deliberative democracy [4] and is particularly pertinent in local and regional government settings, where decision-makers interact with citizens and stakeholders on a daily basis [1]. This interaction can significantly influence the creation of public value.

DECIDO harnesses co-creation in public policies, involving all stakeholders in the policy life cycle. The project's main outcome is a co-creation methodology to optimize tasks across the policy life cycle phases. This methodology is backed by digital tools such as a data catalog, dashboards, survey tools, and a co-creation tool, all unified in one accessible platform - the DECIDO Portal.

To create a new policy, policy actors (which include decision makers, stakeholders, organizations, citizens, etc.) should leverage data to develop evidence-based policies. Additionally, these policies should take into account information derived from co-creation activities. The emphasis on evidence-based policy-making, a movement that has gained significant traction in recent years, is intended to make the public policy-making process more efficient and effective [5].

2.1. Policymaking Co-Creation Methodology

Assessments of the utility and effectiveness of co-creation in policy-making have yielded varying and sometimes contradictory findings. Certain studies have illustrated the added value in policy construction through e-participation [8][9], capitalizing on the rise of digital media platforms in e-governance. However, there are also studies that highlight instances of failure in such initiatives [11][12]. For instance, Estonia's Osale.ee saw a decline in user participation when efforts to promote the e-participation system and engage citizens were discontinued, leading to the termination of the experiment [10]. Main impediments encountered during these co-creation trials encompass technological progression and data management, along with inexperience regarding the topics under discussion, data scarcity, and the absence of a guiding figure. These factors often result in a lack of impact on the decision-making process [13].

Considering the previous weakness of the co-creation approach, we created a guide for the implementation of co-creation activities to be followed during the development of DECIDO project. Co-creation can be defined as "a *process through which two or more public and private actors attempt to solve a shared problem, challenge, or task through a constructive exchange of different kinds of knowledge, resources, competences, and ideas that enhance the production of public value in terms of visions, plans, policies, strategies, regulatory frameworks, or services, either through a continuous improvement of outputs or outcomes or through innovative step-changes that transform the understanding of the problem or task at hand and lead to new ways of solving it*" [14]. This means that co-creation takes place when citizens take an active role in public services.

The DECIDO co-creation activities will take place at the four steps of the policy development cycle: Agenda setting, Policy formulation, Policy implementation and simulation, Policy evaluation. Considering the previous four steps and the stakeholders involved in each step, the co-creation process in DECIDO can be structured in the following way:

1. **Step 1 - Agenda setting**: it is made up of the following sub-steps:
   a. Understanding the problem: analysis of available information (data) on the emergency situation.
   b. Resource planning: planning of personal, material (tools, equipment).
2. **Step 2 - Policy formulation**: consists of the following sub-steps:
   a. Formulation of the challenge: based on the complete problem definition
   b. Generation of ideas: gathering ideas from various sources to meet the challenge.
   c. Selection and prioritization of ideas based on the criteria.
   d. Conceptualisation: means envisaging some solutions to the challenge.
   e. Prototyping: means making a decision on which concept will be implemented and prototyped for validation.
3. **Step 3 - Implementation and simulation**: it is made up of the following sub-steps:
   a. Implementation: means implementing the solution that has been tested.
   b. Launching: the solution is implemented, and now it is delivered to the stakeholders.
4. **Step 4 - Evaluation**: involves monitoring the functioning of the solution and the interaction of the different stakeholders with it.

The DECIDO co-creation methodology provides a comprehensive description of each stage, detailing the activities required during all sub-stages, the stakeholders involved, and the supporting methods, techniques, and tools. This concept established the criteria for developing the DECIDO toolkit, ultimately leading to the construction of the DECIDO Portal solution (refer to Section 3 for further details).

2.2. DECIDO Methodology: From Data & Co-Creation to Decision Making

The DECIDO methodology was designed to transform user needs into valuable information that facilitates improved decision-making. This process integrates co-creation sessions with the use of

digital services for data collection. The raw data collected is then analyzed, and the derived information bolsters the decision-making process (as depicted in Figure 1).

Each pilot identified their needs and challenges, outlining how DECIDO's tools could improve their policies. Alongside the technical team, they evaluated and selected services from the European Open Science Cloud (EOSC) based on their needs and DECIDO's requirements, promoting awareness of cloud services in public administration. Next, they shifted focus to data discovery and collection, selecting data for policy discussion from open data portals or public administrations' (closed) data.
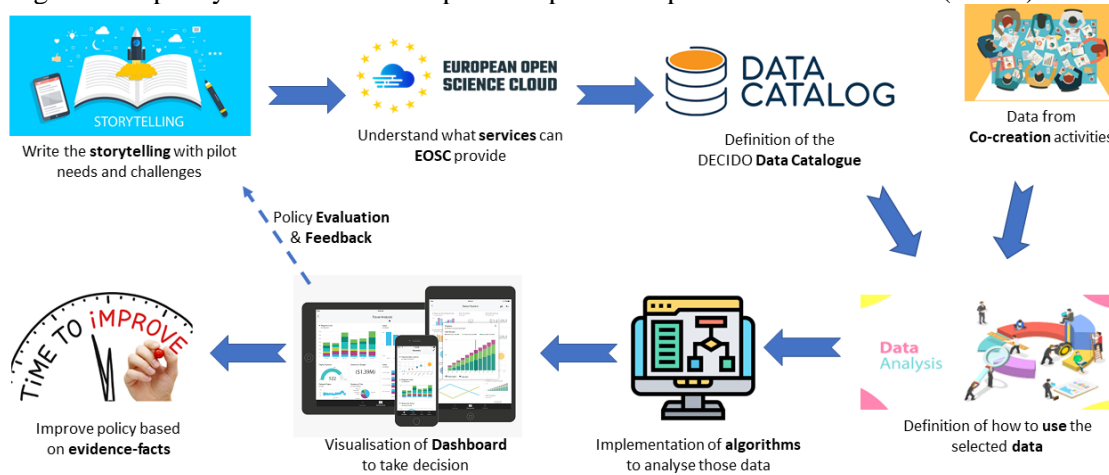

Figure 1 - DECIDO methodology

The DECIDO Data Catalogue, our first initiative, compiles data for policy creation. Besides this, co-creation sessions yielded implicit knowledge, converted into data via participant surveys, co-creation documents, etc. Upon data collection completion, stakeholders determined its usage for data-driven policy. Algorithms transformed data into information, visualized on interactive dashboards. The information enabled evidence-based policy creation. Finally, policy participants evaluate the policy, providing feedback for future improvements..

3. The Use of Technologies to Support the Policy Making

There are several technological requirements that can facilitate the DECIDO policy-making process. The following examples could be directly derived from the DECIDO policy life cycle methodology and its corresponding set of user roles:

- Workflow support: A workflow should guide and support all collaborating stakeholders throughout the different phases of the DECIDO policy-making process, documenting the main results of each phase.
- Access to information: Policy and decision makers as well as a broader public need access to information about the creative process, participants, methods, data and evidence, conclusions, solutions, and finally proposals for new policies or policy alterations.
- Cloud-based approach: A cloud-based solution can provide scalability, accessibility, cost-effectiveness, security, collaboration, and flexibility, enabling other creative "policy labs" to engage and make use of the solution.
- Collaborative tools: Collaborative tools such as shared workspaces, Wiki-like solutions, and instant messaging platforms can enhance communication, coordination, and cooperation among policymakers.
- Data management and visualization: A policy-making process requires robust data management systems that can collect, store, process, analyse, and share data in a secure and timely manner. Visualization tools such as graphs, charts, and maps can help policy-makers to communicate complex information in a clear and understandable manner.

An integrated and user-friendly platform meeting these technological requirements can help boost policy making initiatives, engage more stakeholders and consequently help policymakers to make informed decisions based on accurate data, collaborate effectively with stakeholders, and communicate their findings to the wider public.

3.1. Re-Use of Existing Infrastructure

A key objective of the DECIDO project is to leverage the pre-existing infrastructure within the European Open Science Cloud (EOSC). The EOSC has the potential to be a platform that supports policy-making by offering access to data and scientific resources. Services based on the EOSC can provide crucial functionality to bolster policy-making in several ways:

- Identity and Access Management: The IAM services within the EOSC, which include user authentication, authorization, and access control, are designed to be compatible with other IAM systems employed in research and academic institutions.
- Data Sharing: The EOSC can facilitate the exchange of data between different organizations, easing access to and analysis of data pertinent to policy-making.
- Collaborative Research: The EOSC can foster collaborative research efforts that tackle policy questions, forming interdisciplinary research teams capable of addressing complex policy problems.
- Policy-Relevant Research Services: The EOSC can offer services relevant to policy research, such as simulation models, data visualization tools, and predictive analytics.
- Standards and Interoperability: The EOSC can encourage the use of open standards and interoperability between various data sources and tools, making it simpler for policy makers to access and utilize data from diverse sources.

In summary, the EOSC can provide foundational functionality for supporting evidence-based policy-making. However, to expand the range of available tools and services specifically supporting the DECIDO policy approach, the DECIDO project partially developed and integrated complementary services within the EOSC ecosystem.

3.1.1. The DECIDO Portal Solution

The DECIDO Portal solution is a user-friendly web application designed to enable collaborative definition, management, and evaluation of public administration policies. Leveraging the services provided by the European Open Science Cloud (EOSC) and external tools/services, as well as data from the EOSC and other providers like *data.europa.eu*, the portal integrates a range of components that can help public authorities harness the power of big data and cloud technologies while placing the citizen at the centre of the policy life cycle.

Figure 2 below provides a comprehensive overview of the DECIDO functional architecture and its different layers. This suite of tools aims to aid all stakeholders engaged in the policy life cycle in adopting the DECIDO co-creation methodology. It achieves this by offering a complete set of digital services designed to simplify and streamline each phase of the methodology.

Built on the cloud services available through the EOSC, the DECIDO Portal integrates a range of services and tools, including EGI "Check-in"[2] for single sign-on authentication and authorization activities, "Jupyter Notebook"[3] for data analysis algorithm development, EGI "Data Hub"[4] for persistent data storage and sharing, and "Amnesia"[5] for anonymizing personal data, all provided in a Software-as-a-Service (SaaS) model. The data management layer is furthermore supported by robust

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[2] https://www.egi.eu/service/check-in/
[3] https://jupyter.org/
[4] https://www.egi.eu/service/datahub/
[5] https://amnesia.openaire.eu/

components for data-flow management based on "Apache Nifi"[6] and a data catalogue based on the Fraunhofer "piveau"[7] platform.
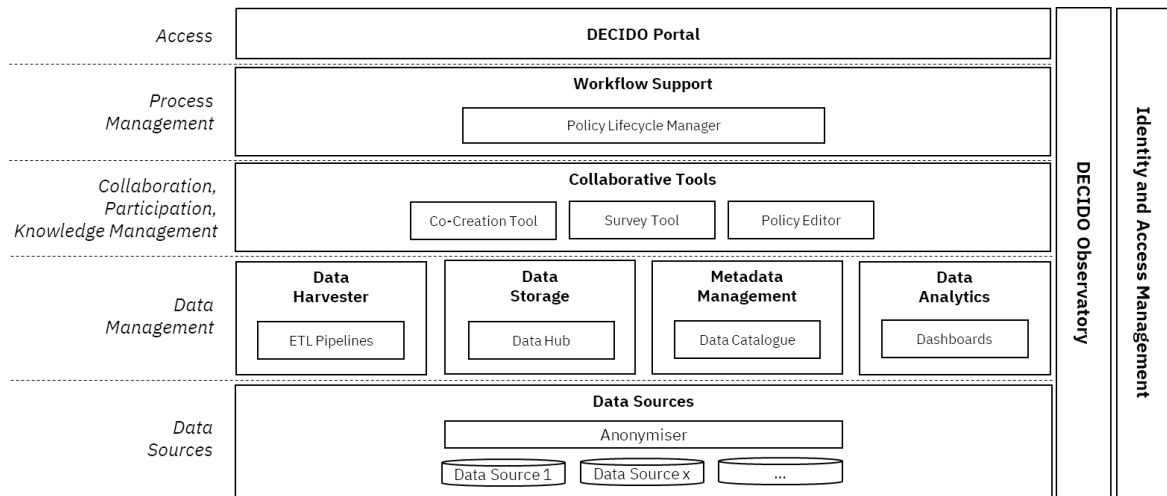

Figure 2 - DECIDO Architecture

Additionally, the functionality has been upgraded integrating a survey tool ("LimeSurvey"[8]) to collect feedback, and a wiki ("XWiki"[9]) that can be used for collaborative documentation. Both tools can facilitate discussion forums to enhance stakeholder collaboration.

The EOSC Cloud Infrastructure is also utilized to provide additional processing and storage capacity. The main function of the portal is to manage policy creation throughout its entire value chain, from data collection to analysis and visualization, through co-creative processes and stakeholder collaboration on policy related challenges.

4. The Real Case of Aragon Wildfire

Data sourced from the Aragon government reveals that between 2005 and 2021, over half of the fires (53.3%) were ignited accidentally or through negligence. In light of this, the paper presents a novel methodology. This approach is designed to contribute to resolving this problem by establishing a more efficient policy-making system. Specifically, the system would focus on the management and surveillance of alert scenarios resulting from wildfires.

This real-world case study and pilot of the DECIDO project utilizes a citizen science approach. This method is an effective means of collecting and analyzing large volumes of data, leveraging the resources and knowledge of the public. General citizens can contribute by issuing alerts of potential fire sightings and providing valuable information about factors that may affect fire progression, such as the presence of combustible material in the area.

Our methodology champions co-creation and stakeholder engagement, acknowledging their crucial role in the design phase. To ensure the output is relevant to the target groups, their input is essential. To achieve this, we will conduct co-creation workshops where we will gather information and requirements from all stakeholders. The project has identified the following target groups:
- Affected citizens: Citizen living in risks zones in Aragon
- Fire-fighters, to use the data for a better management of fire extinction.
- Policy Makers and local authorities, to use the information provided by the pilot
- General public, to be aware if they are near a risk zone and/or a fire

In the Aragon region pilot, three significant events were conducted. These included a technical hackathon focused on space applications, a datathon where relevant datasets were identified, and a

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policy co-creation process based on a "data alliance" concept. Each of these events will be elaborated further in the subsequent sections.

First co-creation event: Space apps

On October 1st, 2022, over 60 individuals convened at Etopia, a center for art and technology in Zaragoza, to partake in the ninth installment of the NASA SpaceAppsChallenge hackathon, reputedly the largest such event globally. The premise of this event was to utilize data sources provided by NASA, as well as any other information deemed necessary by participants, to address a series of problems and challenges proposed by NASA itself ahead of the competition. This event was sponsored by Ibercivis and H2020-DECIDO, who supported the local Zaragoza event by mentoring participants tackling the challenge titled "Earth Data Analysis, Developers Wanted." The event resulted in 14 work teams developing 14 unique solutions to the challenges presented, all of which were aligned with the objectives of the DECIDO project.

Second co-creation event: Datathon identifying datasets

On November 25th, Aragon Open Data hosted a datathon titled "The Future of Data", coinciding with the tenth anniversary of this open data portal established by the Government of Aragon. Teams participating in this event were tasked with creating new services beneficial to society, drawing on the open data provided via the Aragon Open Data platform. The challenges proposed to the teams spanned a wide range of topics. These included fostering a connection with nature, promoting vibrant neighborhoods, generating employment opportunities, enhancing university life, promoting awareness of Aragon, focusing on renewable energies, and understanding and mitigating the issue of forest fires.

Third co-creation event: The data alliance

On February 17th, middle and high school students from Aragon participated in a test of the data-informed public policy creation and evaluation process. This decision-making cycle includes data analysis, policy proposal design, implementation, and effectiveness measurement.

Students simulated the first two stages, focusing on Aragon's forest fires, specifically from the past year, as part of the DECIDO pilot. The DECIDO platform was used during these co-creation sessions to visualize forest fire data, enabling rapid understanding of the problem.

5. Conclusion

The role of evidence-based policy making is increasingly recognized in contemporary governance. This approach, bolstered by the use of co-creation, can streamline the policy-making process. The inclusion of various stakeholders allows the process to draw from a rich diversity of perspectives and knowledge, enhancing the quality and relevance of policy decisions. Co-creation sessions have proven to foster inclusivity, transparency, and accountability, leading to more effective and sustainable policies. Furthermore, these sessions can stimulate collaboration and partnerships between government entities and civil society organizations, strengthening and making the policy-making process more responsive.

The DECIDO project showcases the potential of utilizing co-creation to enhance evidence-based policy-making, a notion that could be of great interest to the CAiSE community. By involving stakeholders in policy-making, it ensures a more comprehensive approach to the development and implementation of information systems. This approach aligns the systems more closely with user needs and encourages transparency, fostering mutual understanding and cooperation among diverse stakeholders. These stakeholders include researchers, practitioners, and policymakers, which is essential when addressing complex issues in Information Systems Engineering.

The project's progress thus far has resulted in numerous contributions to the policy-making community. This includes participation in the Data for Policy conference, the formation of the Data Driven Policy Cluster, which encompasses all projects funded under the same H2020 topic, and a paper detailing the DECIDO experience with a focus on the Italian pilot [16].

In this framework, DECIDO introduces a new method for policy creation. This method combines cloud-based technologies with the insights of actors involved in the policy life cycle, offering a fresh and effective approach to policy-making.

6. Acknowledgements

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