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A Paradigm in policy making: the Horizon 2020 - 101004605 DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies) project

edited by
Vanni Resta

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"Learn, discuss
and then decide"

from "Useless Sermons"
of Luigi Einaudi, President
of the Republic of Italy
(1948 – 1955)

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Foreword

Vanni Resta

DECIDO is a Horizon 2020 project started in March 2021 lasting for three years. This book is the very final part of the project and is has been written, more or less five months before its end. In fact, this volume forms one of the last initiatives of the Consortium which will be briefly presented in the following pages.

All the authors of the following Chapters are members of the DECIDO team. They are an expression of very different backgrounds, and so do their Chapters took often same themes but with different perspectives. The works herein all evidence of policy making and therefore they allow us to understand the multifarious aspects its threats.

Coming back to the DECIDO project, it is the case to start giving evidence of its origin mentioning its framework and the Horizon 2020 coordinates in term of "call for proposal" and "topic" which originates this exercise. DECIDO born, as a proposal, in the late winter of 2020 (a real terrible time!) written to "reply" to the call: "DT-GOVERNANCE-12-2020" expiring on 19th March and belonging to the Horizon 2020 pillar dedicated to "Societal Challenges". In details, the reference programme within the framework Horizon Framework was "Europe in a changing world – Inclusive, innovative and reflective societies" and the related topic was "Pilot on using the European cloud infrastructure for public administrations". This project is a so called "Innovation Action", the Consortium is composed of fourteen Partners across eight European Countries with a vast geographic coverage (from Malta to Finland).

The author of the foreword is a non-expert in the variety of competencies around the world of policy making. For certain situations this is a disadvantage even though it enables us to consider the matter from a

different angle. From this position, this book aims to give evidence of the various technologies and methodologies enhanced by years of research and experiments on the field to create and co-create emergencies policies. A massive effort is dedicated in DECIDO in citizen's engagement which is crucial for the success of any use case within the project. A further difficulty faced is the lack of a proper way to measure resilience both in qualitative and quantitative terms. Empirical evidence demonstrates the non-uniformity in defining all the processes and measures adopted from a pilot site to achieve this purpose. This consideration encourages the need of the creation of a proper "policy creation certification" like is happening in other emerging sectors. As per the mentioned certification its potential of innovation lies in the principles from which it draws inspiration, that is the sharing of responsibility in the management of an emergency, the control of activities generating impacts and the use of market mechanisms that seek in policy co-creation a source of competitive advantage which can used by all the categories of involved subjects starting from Public Administration, control bodies, other Institutions, citizens all pillars on which the DECIDO project is based on.

However, there are other vast obstacles before thinking about a possible resilience certification. These relate to the fact that every site and every emergency treated in each site has its own peculiarities.

Chapter 1 is an introduction to the importance of policymaking in disaster risk management, highlighting the challenges policymakers are facing when ti comes to applying policies for disaster risk reduction, as well as the opportunities and positive impact these policies can have to wider society, not only in terms of public safety but also in terms of managing global emergencies and crises. Chapter 1 will briefly present the overall context of this book, and it will present the DECIDO project, its objectives and goals, and a brief landscape analysis based not only on the existing relevant projects and initiatives but also on the contributions of the DECIDO project in identifying the needs and challenges in European Public administrations and European Open Science Cloud to widen the use of the European Cloud Infrastructure services and data to Public Authorities.

Chapter 2 examines the role of Data Storytelling in aiding decision makers in their decision-making processes. The chapter delves into the DECIDO Approach, which emphasizes the data value chain and the effective construction of policies using informed facts. Additionally,

the chapter offers a brief overview of the European organization responsible for handling data.

Chapter 3 contains two elements: 1. the description of the DECIDO co-creation methodology and the elements that have been taken as a reference to design it. We present the hackathon concept and its meaning in the context of the co-creation methodology implementation and finish with some lessons learned and recommendations for implementing this methodology from the experience gained in the DECIDO pilots. 2. the description of the European Open Science Cloud (EOSC), the value and potential of the use of the services offered by this platform by public authorities. The section concludes with a description of the Competence Centre concept developed in DECIDO to foster the bilateral collaboration between representatives from the Public Sector with EOSC experts and consultants.

Chapter 4 delves into the radical necessity of incorporating citizen science throughout the policy lifecycle: from agenda setting to policy evaluation. By juxtaposing traditional policy-making with the current demands of informed and engaged citizens, we underscore the pivotal role of citizen-led participation in shaping policy agendas, formulating evidence-based proposals, ensuring transparent implementation, and evaluating policy impacts. Furthermore, the chapter emphasises the importance of fostering a science mindset - comprising a wide range of rigorous types of knowledge - among citizens, promoting critical thinking and evidence-based decision-making, even under conditions of uncertainty. Within this context, the DECIDO project emerges as a lighthouse, exemplifying the successful implementation of this necessary approach to policy-making. While acknowledging potential challenges, such as data reliability and representation concerns, the chapter posits a future where citizens and scientists collaboratively influence the trajectory of their communities, with the DECIDO project contributing to the essential integration of citizen science in the policy-making process.

Chapter 5 describes the four pilot cases that trailed the DECIDO approach during the project. The pilots covered forest fires in Finland, refugees, floods and food distribution in Italy, wildfires in Spain, and power outages in Greece. Together with local stakeholders and civil organizations, the pilots worked on two trial iterations to improve existing policies. The chapter provides descriptions of the problem, how the DECIDO approach was used, and the challenges and achievements of the pilot.

Chapter 6 is a collection of different aspects internal and exogen to DECIDO project. The first paragraph is considered a sort of pride for the DECIDO project: the presentation of a summary of the university master's degree thesis of a Sapienza university of Rome student, Cristian Bonfili who decided to prepare his final dissertation over the DECIDO project. Subsequently, a paragraph is dedicated to what was learned by the project in term of Social Life Cycle Assessment Oriented Behaviour Change Games. The third paragraph give evidence of the training strategy adopted in the project mainly in the piloting phase. Finally, the fourth part is related to the impact driven by the project in the European stakeholder mentioning some relevant policy initiatives.

Finally, Chapter 7 presents an analysis of DECIDO exploitation results and the impacts that the project may bring in the future at the social, behavioural, cultural and environmental levels.

Moreover, it describes how DECIDO's methodological approach, through social awareness raising, may contribute to environmental risk mitigation by supporting Policy Making process.

The volume is ending with a sort of "epilogue" in which there is a "recipe" on how to proceed in producing co-created policies for managing emergencies. This represents a unique opportunity given by the Europe Union in its role to create a European citizenship and a sense of belonging to a big community of a little bit less than four hundred and forty-eight millions of human beings.

1. Introduction to policy Making and disaster risk management

Martha Papadopoulou, Charalampos Chatzimallis, Francesco Mureddu, Alessandro Paciaroni, Charlotte van Ooijen

1.1. The intersection of policymaking and disaster risk management in the policy cycle

Martha Papadopoulou, Charalampos Chatzimallis, Francesco Mureddu, Charlotte van Ooijen

Policymaking procedures are critically important in risk management for several reasons, from the allocation of resources by defining priorities and setting aside budgets for risk reduction to the adaptation of legal frameworks and risk reduction strategies, by specifying standards, guidelines, and requirements that organisations and individuals must adhere to, promoting consistency and accountability. One of the main goals of policies in disaster risk management is to achieve community resilience by promoting awareness, education, and preparedness among the public. To do so, policymakers apply risk assessments, to understand evolving risks and adapt appropriate strategies accordingly.

Policies related to risk management are also designed to ensure public safety, but also to manage global crises and risks at a wider scale (climate change, pandemics, cyber threats etc.). Thus, policies set the ground for emergency response, and other measures that directly impact public safety during disasters, as well as facilitating cooperation among nations to address cross-border challenges. Certainly, this is a long-term process that can result in potential foresight scenarios and preventive measures for a variety of topics and domains, from technological advancements to ethics on data management and the role of AI. That is the reason why policymaking is crucial in risk management as it provides the framework, methods, practices, and guid-

ance to identify, assess, and effectively respond to risks and disasters, aiming to safeguard communities and foster resilience.

Recent scholarship underlines the importance of addressing the various challenges posed by disasters, risks and threats. Birkmann et al. (2019) focus on the integration of disaster risk reduction into national policies and the challenges of mainstreaming resilience considerations. Moreover, Kuhlicke et al. (2020) explore how stakeholder engagement can be encouraged through participatory approaches in shaping disaster policies, emphasizing the importance of community engagement in policy and decision-making. What is more, recent research illustrates the ongoing evolution of policymaking in the context of disaster risk management, highlighting the increasing recognition of the interconnection of disaster risk reduction and the effectiveness of the Sustainable Development Goals (SDGs) (UNDRR, 2015). Consequently, the dynamic interplay between policymaking and disaster risk management remains a critical field, with a need for innovative approaches and a commitment to resilience within the policy cycle.

This book will present DECIDO project's objectives, goals, outputs and results, contributing to the groundbreaking impact of the adoption of innovative methodologies, tools and data enabling the effective development of better evidence-based policies by public authorities. In detail, this book will present: a) the landscape analysis of the DECIDO project and challenges that need to be addressed (Chapter 1), b) the ways evidence-based fact can improve the policymaking process (Chapter 2), c) the DECIDO Co-creation methodology (Chapter 3), d) contributions to Citizen's science contexts (Chapter 4), e) a detailed description of the 4 project's pilots implementation (Chapter 5), f) a presentation of achieved results and lessons learnt (Chapter 6), g) expectations after DECIDO project ends (Chapter 7).

The DECIDO project serves as an intermediary between the public sector, the contexts related to citizen science, and the European Cloud Infrastructure (ECI), with direct collaboration with EOSC, providing storage capacity and processing power through EGI infrastructure. DECIDO aims to create a bridge between Public Authorities and EOSC to widen the use of the ECI services and data to Public Authorities and to enable and encourage Public Authorities to use appropriate infrastructures, services, data and methodologies to apply a more evidenced informed approach to policies.

DECIDO will be tested in 3 different domains of disaster risk management. The pilots have been carefully chosen in different domains and countries having diverse economic, social and cultural backgrounds and with different preparedness for the use of evidence-based and co-creation approaches.

To bridge the gap between Public Authorities and European Open Science Cloud, DECIDO has worked on the definition of a Competence Centre to establish a bilateral collaboration between the project pilot operators and their teams of experts, and the EOSC supply side.

DECIDO was also presented in several conferences, among others: the CCGRID2022 in Taormina (IT), the INDEED Research Forum in Brussels (BE), the EGI Conference 2022 in September in Prague (CZ), the Open Access Week 2022 (remotely), the EOSC Symposium 2022 in Prague (CZ), the Data For Policy in Brussels (BE), and the EIRD 12th Annual Conference in December in Tbilisi (GE).

From a technical point of view, the core developed technologies of the project are the following:

a) *DECIDO Portal:* The DECIDO Portal is the unique point of access to the DECIDO solution. It integrates all the functionalities that could support the actors involved in four phases of the Policy Life Cycle.
b) *DECIDO Back-End:* The DECIDO Back-End is a collection of the orchestrated services and tools integrated and offered via the DECIDO Portal to support evidence-based policymaking in public administrations.
c) *DECIDO Storage and Processing Power*: The Storage and Computing resources provided by EGI can be used to store, process, and host the DECIDO Portal and provide the necessary federated authorisation mechanism.

DECIDO's implementation phase consists of two phases of experimentation to test the DECIDO proposed solutions in 4 pilots around Europe:

Pilot 1: Pilot on Forest fires in Kajaani, Finland: prevention and protection against forest fires; Procedures to mitigate damage to nature, infrastructure and life.
Pilot 2: Pilot on Floods, on Response to the Pandemic and on Psychological Protection of Youth, Italy: improve design of emergency policies related to floods and weather alerts in two areas of the City of Turin (Meisino Park and Murazzi), to the social crisis following a big pandemic event, to the psychological problems of young people.

Pilot 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.
Pilot 4: Pilot on Wildfires in the Aragon Region, Spain: improve the design of emergency policies related to wildfires and management of controlled fires.
The results coming from the pilots' experimentation phase allow to verify and reach the initial objectives of the project:
Objective 1: Enable public authorities to adopt data and cloud technologies (from the PA and research sector) to support evidence-based policies.
Objective 2: Support emergent strategic management to ensure that data can contribute to evidence-based policymaking processes aligned with political objectives and priorities.
Objective 3: Facilitate the active involvement of local actors in data generation, and how it is analysed and used within the policymaking life cycle.
Objective 4: Assess the transformative impacts, benefits and risks (including ethical) of the deployment of big data tools and methodologies and the use of cloud infrastructure in the following disaster risk management domains: floods, forest fires, power outage.
Objective 5: Pursue sustained use of data analytics and cloud infrastructure in policy making.

1.2. Landscaping and challenges

The process of shaping the future through policy impact analysis and prediction presents policymakers with a range of challenges. These challenges were also identified during the Interactive Evidence-Based Policymaking in Europe Summit and are common across various application areas. There are two main aspects of these challenges based on enhancing the capabilities of public administrations and ensuring active engagement of societal stakeholders.

There are three key areas of challenges, when it comes to public authorities adopting data and cloud technologies: a) Day-to-Day Operations Management: Policymakers must grapple with issues related to the daily management of government functions while integrating data-driven approaches into their operations, b) Workforce Development: Preparing the government workforce to effectively harness data for policy prediction is a significant challenge. This involves training

and cultivating a skillset that can navigate the data landscape, c) Budgetary Considerations: Policymakers must also find ways to balance budgets while investing in the necessary technology and expertise for evidence-based policymaking.

Furthermore, building trust emerges as a crucial challenge, particularly when it comes to involving societal stakeholders in the policymaking process.

In the course of shaping policies for risk and disaster management, there are several challenges to be addressed as well. Recent research emphasizes the complex and interconnected nature of disaster risks (IPCC, 2021). This complexity makes it difficult for policymakers to address all potential effects, requiring a holistic approach. Moreover, increasing uncertainty, driven by climate change (UNDRR, 2021), poses a significant challenge to disaster risk reduction policies. Policymakers struggle to develop adaptive strategies when facing evolving risk patterns, such as more frequent and severe extreme weather events, leading to crises at a global scale. Adequate and comprehensive data and information are crucial for effective risk management (Lauta et al., 2020). Policymakers often face gaps in data availability, quality, transparency, and accessibility, delaying evidence-based decision-making. Moreover, balancing short-term political cycles with the need for long-term disaster risk reduction is a significant challenge (Kelman et al., 2015), as policymakers need to prioritize immediate concerns over comprehensive risk reduction strategies.

Other challenges rely on limited resources and competing policy priorities that can lead to risk reduction efforts (Pelling et al., 2010), as policymakers have to allocate resources to address disaster risks effectively. Other challenges might be related to engaging communities in the policymaking process for disaster resilience, the political will to enact and enforce risk reduction policies, the enhancement of international cooperation, especially in regions prone to transboundary risks, and the emerging technologies, such as artificial intelligence and data analytics.

For the identification of the needs and the challenges in European Public administrations, DECIDO followed a stepwise approach, by studying the results of the previous related projects and initiatives, their needs in terms of the public sector. Then the project's research team conducted desk research and concluded the needs and challenges identification. To maintain a common format for the collection pro-

cess and facilitate comparison, a taxonomy was created using elements from the BigPolicyCanvas classification and adapted to the DECIDO project.

Therefore, each need that was identified and included in the DECIDO list of needs was questioned with respect to the following features:

- Type of the need, among the following five options: *Information, Legal, Organisational, Strategical, Technical.* The same need types were also used in BigPolicyCanvas and are adopted by DECIDO for alignment purposes.
- Scope of the need, among the following four options: *Local, Regional, National, EU*. The same need types were also used in BigPolicyCanvas and were adopted by DECIDO for alignment purposes.
- Big Data Exploitation, with *Yes* or *No* options, to showcase whether big data technologies are being used for the addressing of the specific need.
- Cloud Services Exploitation, with *Yes* or *No* options to showcase whether cloud services are being used for the addressing of the specific need.
- Policy Domains, with options among 12 categories, to map the need with specific policy domains to which it is mostly related.
- Priority level, with *High, Medium* and *Low* options.

For the challenges identification, the identified challenges were classified based on their type, from the following options: *Organisational, Societal, Ethical, Legal, Information and Strategical.* They are closely related to the needs type classification.

1.3. Conclusions

In conclusion, the relationship between policymaking and disaster risk management is undeniably essential in our ever-changing world. This is not just crucial but multifaceted, addressing resource allocation, legal frameworks, public safety, and global cooperation.

There is a significant need to confront these challenges, emphasizing the integration of risk reduction into national policies, the power of stakeholder engagement, and the alignment of disaster risk reduction with global sustainability goals. With innovative approaches and a dedication to safeguarding communities, policymakers can ensure a

safer and more secure future amidst an ever-shifting landscape of risks and disasters.

When it comes to policy impact analysis and prediction, policymakers have to face a multifaceted landscape of challenges. These challenges are based on two core dimensions: enhancing the capacities of public administrations and fostering active engagement of societal stakeholders.

There is a need to build trust, particularly when involving societal stakeholders in the policymaking process. Moreover, the escalating uncertainty driven by climate change and other global challenges and emergencies requires adaptive strategies for evolving risk patterns. Adequate and comprehensive data and information have become an ongoing challenge, as well as the perpetual tension between short-term political cycles and long-term disaster risk reduction remains a significant policy challenge.

To address those challenges, policymaking processes need to contribute to engaging communities, increasing political will, fostering international cooperation, and adapting to emerging technologies like artificial intelligence and data analytics.

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2. Data Storytelling: how the evidence-based fact can improve the policy making process

Antonio Filograna, Roberto Di Bernardo

The act of transforming data analyses into relatable language with the aim of influencing business decisions or actions is defined as data storytelling. The primary goal of data analysis is to produce meaningful insights from data that provide additional information and comprehension to a targeted audience. The raw data could be not an added-value. What is important is the information coming from the raw data, that can bring the policymakers to take decision based on evidence facts.

The new way to see the policymaking process not be able to leave the data-drive approach out of consideration. In this chapter, we will demonstrate how the data storytelling can support the decision makers and all the actors involved in the policymaking process to create better policies, exploiting the information.

In the year 1856, Florence Nightingale came back home from Crimea war, after nursing soldiers being the responsible of a wide network of different UK infirmaries in the camps. She understood from this experience that the causes of the mortality in the ranks of the army were due not only to the bullets but also to the healthcare conditions in which the soldiers lived. She collected a lot of data, analysed them with the support of statisticians and scientists.

The results of her analysis demonstrated that one of the most important factors of the death causes among the hospitalised patients was the overcrowding of the hospitals. Starting from these results, the Nightingale team proposed some solutions to improve the quality of life of the soldiers, notably a huge healthcare reform based on the sewerage network reclamation, clean air in the rooms and reduction of the overcrowding.

She might present this data to the politicians, Members of Parliament, and doctors. But her real objective was the chief of the British Army, the Queen Victoria. To catch the attention of these policy makers, Florence could not present the raw data, as they were. She adopted a fascinating approach to introduce the information coming from the data analysis. Nightingale chose to use hand-drawn diagrams, never seen before, going beyond the visualization of the graphs themselves and getting a real Data Storytelling.

The Parliament adopted what she proposed, and the results confirmed what Florence demonstrated with her information. These reforms were included in the British Public Act in the 1875, having a huge impact also for the citizen healthcare conditions.

This was one of the first examples where the Data Storytelling had a huge impact on the policy decisions. The raw data were transformed in information accessible by the humans and this allowed improving the quality of the life of the citizens in the future.

DECIDO project was inspired by the story of Florence Nightingale and aims at analysing a wide range of data, coming from different data sources, to provide the decision makers with the right information to create better policies. One of the main innovations of DECIDO was involving citizens and stakeholders in collecting knowledge and co-creating the policies. For doing this, you need to have two main pillars 1) a methodology (the DECIDO policy life cycle Methodology) to describe each step to create a policy, and 2) some digital services (the DECIDO Portal) that can support all the steps in the methodology. The first pillar defines how to create a policy following the policy life cycle (PLC). 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, consisting of several different phases, such as agenda setting, policy formulation, policy implementation & monitor and policy evaluation. The second pillar enables to create analytical tools that enable public administrations to reuse common infrastructures and datasets for the development of better targeted and more effective evidence-based policies. From a technical perspective, the digital services are provided through a web portal, relied on the services provided by the European Open Science Cloud (EOSC). The DECIDO Portal integrates several already existing tools (e.g. Big Data analysis, Cloud services and infrastructures, Co-creation) to become the unique access point for the policy creation.

2.1. DECIDO Approach

Antonio Filograna

The two main pillars are exploited to enable the DECIDO approach that follows a specific pathway to achieve its main objective: from data to the decision making, using the data storytelling. As W. Edwards Deming said, "Without data, you're just another person with an opinion", we need to base our decisions on data.

The first step is to collect the needs of all PLC stakeholders and the challenges they want to address. Nowadays, citizens are called to take an active role in public services definition (the policy creation is one of them) and implementation through co-production and co-creation. From the beginning of the process, the citizens a requested to participate and their knowledge, suggestions and feedback are collected during most of the activities in the PLC. Taking into account the results of the first step, the second one is related to figure out what kind of digital services can be exploited to include in the web portal and make them available for the user. The third step is the (raw) data collection. On the one hand, stakeholders (e.g. citizens, businesses, decision makers, organisations, etc.) collect datasets belonging to different data sources allowing the building of the so called DECIDO Data Catalogue. This catalogue is a set of open data, publicly available to foster their re-use, that can be analysed to extract useful information to create the policy. On the other hand, social hackathons must be organised to gather the wisdom of the crowd. A social hackathon is a session of co-creation involving in a round table or in several activities the stakeholders belonging to the PLC. In a co-creation session, the problems affecting the policy to be created are studied, discussed, and analysed. The knowledge coming from those sessions must be "saved" and it will be part of the raw data to be analysed among other data coming from other data sources.

Once we have data, we need to decide how to use them and for what purpose (forth step). Some of the collected data will be used by humans to improve their knowledge, some other will be processed by AI-based algorithms to give evidence-based information (fifth step). In the sixth step, the data will be visualised in user-friendly dashboards. Through those dashboards, we can tell the story narrated by the data, that now became information having a business value. As last step, the policy will be written down and the stakeholder can give feedback on how the new policy works.

All these steps define the DECIDO Data Storytelling and how evidence&data-based approach is strongly recommended to take informed design decisions that can affect the creation of new policies or the improvement of the already existing one.

We experimented this approach directly in real cases in the field. The challenges, the achievements, and the lesson learnt will be described in the Chapter 5 and 6.

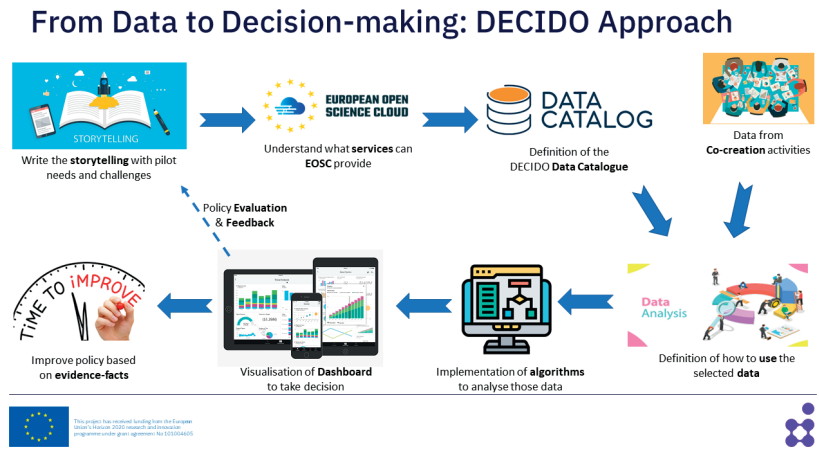

Fig. 1. DECIDO Approach

2.2. Organisations across EU dealing with Data

Roberto Di Bernardo

Clive Humby, a British mathematician, stated in 2006 that "data is the new oil". As the oil needs to be treated to become petrol, useful for the cars, the raw data needs to be manipulated to become information. Nowadays, a lot of organisations in Europe are working to define a common strategy on how to organise the data coming from different domains and how to handle it.

The Big Data Value Association (BDVA - https://www.bdva.eu/) is a proactive organization driven by industry objectives. Its primary mission revolves around fostering an innovative ecosystem that facilitates the data-driven digital transformation of both the European economy and society.

BDVA boasts a substantial membership base of over 230 members scattered across Europe, offering a well-balanced mix of large, small,

and medium-sized industries, as well as research and user organizations. Its core areas of focus include the advancement of big data technologies and services, the development of data platforms and data spaces, Industrial AI, the creation of value through data-driven approaches, standardization efforts, and the cultivation of essential skills. On of the focus of BDVA is the definition of Data Spaces, dedicated to ensuring secure data sharing and realizing the practical potential of European data spaces, which are fundamental to the Digital Europe Strategy. With regard to the implementation of data space strategy, the International Data Space Association (IDSA - https://internationaldataspaces.org/) plays a pivotal role. IDSA seeks to pave the way for a data economy in which every individual and organization maintains full control over their data assets. IDSA is actively establishing the necessary standards for data spaces to ensure data sovereignty for all participants, allowing data sharing without dependence on a single dominant player. Their primary mission revolves around advancing the IDS standard, driving innovation, increasing awareness, and fostering global adoption of data spaces to guarantee data sovereignty. Data Spaces, in this context, serve as environments that facilitate trust-based relationships between partners, governed by the IDSA standard, ensuring secure and sovereign data exchange, certification, and governance, not just within Europe but also beyond.

Like IDSA, Gaia-X (https://gaia-x.eu/) is focused on establishing an ecosystem where data can be shared and accessed with confidence. In the context of Gaia-X, the ultimate goal is to create a federated system that connects numerous cloud service providers and users within a transparent environment, driving the future of the European data economy. Within the association, responsibilities encompass defining the architecture, policy and rules, labeling, and compliance requirements. Over 350 members actively participate in these efforts, each undertaking specific tasks and promoting international cooperation. Software artifact wise, FIWARE Foundation (https://www.fiware.org/) drives the definition and the open source implementation of key open standards that enable the development of portable and interoperable smart solutions in a faster, easier and affordable way, avoiding vendor lock-in scenarios, whilst also nurturing FIWARE as a sustainable and innovation-driven business ecosystem. FIWARE leads, supports and integrates multiple innovative upstream projects on the one side, and fosters open source community platforms on the other side. FIWARE

Open Source technology is used for developing Smart Solutions, Digital Twins and Data Spaces in a wide variety of domains of digital transformation, one of them is Smart Cities. FIWARE serves as the foundational framework for the technical implementation of a comprehensive reference architecture for Smart Cities. Embracing a 'system of systems' approach, it proposes an approach based on shared Digital Twin representation of the city; each system contributes data to enhance specific aspects of the Digital Twin representation, and simultaneously, each system accesses the necessary data from the Digital Twin representation of the city. This enables systems to derive value from the information provided by others while remaining independent.

Recognizing the need for overall sustainability in the data economy, BDVA, IDSA, Gaia-X, and FIWARE Foundation have joined forces to establish the Data Space Business Alliance (DSBA) at https://data-spaces-business-alliance.eu/. DSBA represents the first-of-its-kind initiative, bringing together industry players with a shared vision of realizing a data-driven future where organizations and individuals can unlock the full potential of their data. Data spaces are considered a crucial step towards the data economy of the future, and the Alliance seeks to amalgamate Europe's best skills, assets, and experiences into a unified platform for data spaces.

2.3. Evidence-based facts to improve the policy making process

Antonio Filograna

The Data Storytelling can be enabled by adopting digital services, as those ones provided by DECIDO. The technology is only an enabler to lead the changing that the DECIDO approach wants to generate. The DECIDO portal gives a unique access point to the management of the policy. The digital tools, part of DECIDO portal, allow users to collect data from different data sources, to administer survey to figure out what the feeling of the users involved in the policy life cycle is, to co-create all the ideas on how you would like to create a new policy following the social innovation approach, to analyse and visualise the information coming from the raw data collected.

The use of digital technologies in public administration empowers policymakers to imagine various possibilities and their potential consequences, making it easier to create well-informed and efficient

policies. Whether it is planning cities or preserving the environment, these tools serve as virtual laboratories that enable policymakers to test different strategies and predict outcomes. Furthermore, they introduce a new era of transparency and public participation. Citizens also have the ability to access and engage with data, promoting a more collaborative approach to policy development. This openness not only strengthens confidence in the government but also guarantees that policies are based on the community's needs and desires.

The main goal of using the evidence-based facts to improve the policy making process is to demonstrate how this comprehensive approach and the digital tools can drive innovation and create significant value. By using digital tools to support policy and decision-making, cities are transforming the way they envision their future. Policy makers, citizens, organisations, municipalities, and their public administrations are the architects of a more sustainable, accessible, and prosperous city, where policies are not static but continuously adapted based on real-time information and input from who lives the city. This digital transformation is not just an evolution, but a revolution in governance that will fundamentally change the way of thinking the relationships in the city, among citizens and decision makers, going towards a more collaborative way to tackle whatever situation and problem that involves everybody.

In conclusion, data storytelling acts as a powerful instrument that overcomes the sector of data analysis and allows us to effectively disseminate insights and make data-driven decisions. Through the creative combination of data, narrative, and visualization, it is possible to transform raw data into information and fascinating stories that engage and illuminate audiences. By exploiting the potential of data storytelling, we can bridge the gap between complex data and human understanding, leading us closer to a world where data is not just numbers and graphs, but a means to inspire change and drive innovation.

3. Co-creation methodology and the bridge between Public Authorities and EOSC (European Open Science Cloud)

Andrea Cristofori, Fotis Karayannis, Jabier Martinez, Xavier Salazar Forn, Xabier Uriarte, Gergely Sipos

Digital technologies offer public authorities new ways to conceive, plan, implement and evaluate policies. Harnessing data through analytical and processing techniques provides Public Authorities with tools for policy making.

Moreover, enabling citizen participation in policy making through co-creation activities contributes to better targeted policies, increases their legitimacy and decreases citizens' distrust of government.

In addition, the European Open Science Cloud (EOSC) is progressively expanding its user base to include Public Authorities in Europe so that, through EOSC, they can have easy and open access to state-of-the-art data and computing resources together with data analysis tools and research infrastructures of pan-European relevance that can be used by the public sector for their evidence-based policy-making activities.

In this context, this chapter describes two of the pillars of evidence-based policy design that we developed at DECIDO:

- The co-creation methodology designed at DECIDO to involve citizens and other stakeholders in the process of designing new evidence-based policies.
- The EOSC platform and activities developed at DECIDO to establish an EOSC Competence Center for Public Authorities that provides a sustainable way to foster bilateral collaboration between Public Sector representatives and EOSC experts and consultants.

3.1. The co-creation methodology in DECIDO

Jabier Martinez, Xabier Uriarte

DECIDO deals with co-creation because in the process of development of better targeted and more effective policies, the active involvement

of citizens and communities (that is, civil society) is considered to contribute in enhancing trust and boosting the perceived legitimacy of authorities and designed policies.

Among all the definitions of co-creation that we have found when carrying out the literature review of co-creation documentation, the one that appears to us to be the most complete and that best represents what we want to do in DECIDO is the following:

"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" (Torfing, Sørensen, & Røiseland, 2016).

Since DECIDO has been designed, implemented and tested in the domain of disaster risk management, its methodological approach for co-creation has involved the following typologies of stakeholders:

- Political actors, mainly policy makers responsible for making decisions affecting emergency response policies, but also organisations that would finance DECIDO-like initiatives in the future.
- Intervention actors are those bodies involved in direct intervention in emergency situations. This is a heterogeneous group that depends on the intervention structure put in place to address the emergency situations. This group includes e.g. police, rescue department, civil protection authorities, fire department, emergency medical services, social welfare authorities, volunteers, etc.
- Social actors include individuals, groups or communities affected by the emergency situations or interested in addressing them such as citizens, civil society organisations, religious associations, press, etc.
- Information, advice, knowledge and expertise providers. This typology of stakeholder contributes with their knowledge, expertise, advice and ideas to improve the emergency protocols in place. This group includes consultants, researchers and technology providers.

Co-creation methodology in DECIDO is structured according to the phases of a policy making lifecycle:

1. The **agenda setting** phase that is aimed at understanding in as much detail as possible what the current situation is in relation to

the emergency situation to be targeted and whether there is already a policy in place to address it. This phase involves planning human, economic and material resources needed to address the challenges of designing a new emergency policy or updating an existing one.

2. The **policy formulation** phase is the creative stage of the policy life cycle: once the problem(s) to be solved has been adequately analysed and understood, the specific challenge(s) to be addressed can be formulated. The phase continues with the collaborative generation of ideas to respond to the challenge(s) posed and the selection and prioritisation of ideas. The phase ends with the production and validation of one or more prototypes corresponding to those ideas that the working team considers to address the challenge(s) in the best possible way.
3. The **implementation and maintenance** phase consists of putting in place the prototype(s) modelled and validated in the policy formulation phase. Just as the previous phase was the creative stage, this phase is the stage where policy is put into action.
4. The **evaluation** phase in which the newly implemented policy is put under the scrutiny of those who have to apply it or are affected by its implementation.

The following figure shows the phases of the policy making lifecycle with the relationship between them.

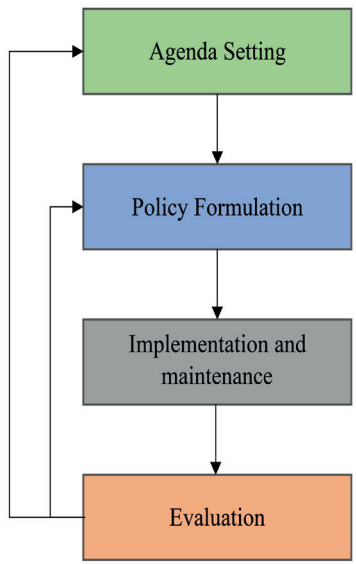

Fig. 2. Relationship between the phases of the policy making lifecycle in DECIDO

As the figure shows, if the policy does not overcome the Evaluation phase, this may lead to a reformulation of the policy with the same data and starting conditions as initially considered, or it may lead to a rethinking of the whole process from the Agenda Setting phase because it is required to rethink either the initial data or the necessary resources (agents involved, time, financing, etc) of the policy design process.

In addition to the four phases of the policy making lifecycle described before, DECIDO's co-creation methodology is inspired by the co-creation methodology designed in the H2020 CITADEL project "Empowering Citizens to Transform European Public Adminis-

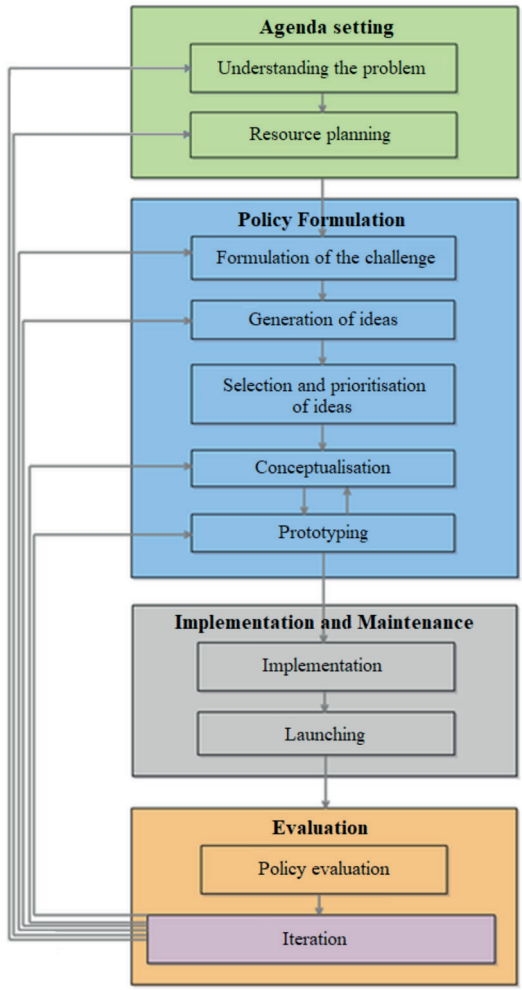

Fig. 3. Graphical representation of DECIDO's co-creation methodology

tration". CITADEL was focused on transforming the public sector to make more efficient, inclusive and citizen-centric public services that identified new or unsatisfied needs more quickly, satisfied them more effectively and in an inclusive way, providing also guidelines and features to support new processes. Co-creation in CITADEL consisted of four phases:

1. Ideation and research, to understand the real needs of citizens.
2. Concept and design to work on the previously detected needs.
3. Development and implementation to prototype the solution, validate it through users and implement it.
4. Production and maintenance to launch the service and evaluate it.

Based on the above references, the detailed co-creation methodology designed for DECIDO is shown in the picture Fig.3 at the previous page:

The description of the steps of this methodology is as follows:

1. Agenda Setting phase. It consists of two steps:
   a) Understanding the problem: this step is designed to understand in as much detail as possible the current situation in relation to the policy to be addressed. This involves the analysis of available information, needs, difficulties, challenges, etc., from different perspectives.
   b) Resource planning: consists of planning the human and material resources that will be involved in the co-creation process.

2. Policy Formulation phase. It is made up of five steps:
   a) The first one is the formulation of the challenge from all the information gathered in the previous phase. The formulation of the challenge is one of the most important steps because the design of possible solutions is based on the challenge. The characteristics of the challenge formulated should be as follows:
      i. It should be clear and concise and cover all aspects of the problem analysed.
      ii. It should be concrete and addressable.
      iii. It should be stated in a simple language, understandable to all parties involved in addressing it.
      iv. It should include the criteria that will be used for assessing possible solutions.
   b) Generation of ideas: this is the brainstorming step to generate ideas to address the challenge. It is a divergent step, in which the

quantity of ideas, the freedom to contribute ideas and the suspension of any judgement on the appropriateness of ideas matter.

c) Selection and prioritisation of ideas: based on the criteria established when formulating the challenge, the ideas from the previous step are assessed and prioritised. After this step, a ranking of ideas will be available, which can be worked on in subsequent steps.
d) Conceptualisation: in this step the most promising ideas are concretised and solutions are envisaged making their future features more tangible through visual representations or concepts.
e) Next comes the step of prototyping: a decision is made on which concept of concepts will be further worked on and then they are implemented and prototyped for validation by stakeholders. Prototyping means translating concepts into tangible artifacts.

3. Implementation and Maintenance phase. It consists of two steps:
   a) The implementation that consists of developing and putting into action the solution tested and validated in the prototyping sub-step. Here, we make sure that the solution is technically sound, has a strong value proposition, fits the needs of the different stakeholders and contributes to addressing the different aspects of the initially posed challenge.
   b) The launching step means delivering the implemented solution to its users by means of a good communication of all aspects of the solution and opening channels to receive feedback from users and stakeholders.

4. Evaluation phase. It consists of one step:
   a) The policy evaluation step involves monitoring the performance of the solution launched and the interaction of users and stakeholders with it. As the policy's lifespan is expected to be in the medium to long term this step might lead to policy improvements or even to its cancellation.

3.1.1. Co-creation methodology and hackathons.

When the first activities involved in the co-creation methodology began to be implemented in some pilots in the DECIDO project, the term hackathon emerged and started to be used by pilots.
But, what is the relationship between hackathons and the co-creation methodology at DECIDO?

The term hackathon, as defined in the Wikipedia, integrates the concepts of marathon and hacker, referring to a collective experience that pursues the common goal of developing applications collaboratively in a short period of time. The term is believed to have been created in 1999 independently by the OpenBSD developers and the Sun Microsystems marketing team.

But since 2000, the term hackathon has also started to be used for all kinds of time-limited events where solutions to a business or social problem or challenge are sought in a collaborative way. This is precisely the spirit of the co-creation process in DECIDO, the collaborative exploration of solutions to address the challenges posed by different emergency situations.

The elements that typically make up hackathons are as follows:

- An introduction where the schedule and activities are presented, the background is explained and the theme of the event is detailed.
- Conferences, talks, group workshops to provide interested parties with fair and accurate information.
- Pitches in which participants can suggest suitable project ideas on which they would like to work with others.
- Teamwork in teams designed on a project-by-project basis and as heterogeneous as possible.
- Development work to develop the initial idea and brainstorm strategies and solutions to put them into practice.
- Awards ceremony to end the event choosing some winners and giving them prizes.

Taking on the one hand the described components of a hackathon and on the other hand the steps of the co-creation methodology, we can say that a hackathon in DECIDO includes at least the following steps of the Policy formulation phase:

- Formulation of the challenge.
- Generation of ideas.
- Selection and prioritisation of ideas.
- Conceptualisation.
- Optionally, prototyping, depending on the level of technical competence involved and the time available.

Other co-creation activities prior to the development of the hackathons (such as the Agenda setting) or after the hackathons (such as the Implementation, Maintenance and Evaluation) should not be considered hackathons.

3.1.2. Some tips on implementing the co-creation methodology

There are some lessons we have learned when implementing the co-creation methodology in the DECIDO pilots, which are shown below:

- Challenges should be formulated as concretely as possible. The more concrete the challenges formulated are, the more concrete the solutions will be.
- Experience has shown that there are three approaches to address the challenges in the co-creation process:
  - What could be called the *standard* approach: establishing the stakeholder team and addressing the challenge in a linear way, following the steps specified in the methodology.
  - Another approach would be the *parallel* one: this would mean addressing the same challenge in parallel Policy formulation phases with different stakeholders.
  - The third approach would be the *serial* one: there is an initial challenge to be addressed but subsequent co-creation activities implementation shows that the challenge has to be extended or reformulated. The extended or reformulated challenge has to be addressed in subsequent Policy formulation phases with the participation of the same stakeholders or the addition of new ones.
- It is important for stakeholders to get involved in the co-creation process. One way to achieve this is to keep them well informed about the whole co-creation process so that they receive information before, during and after co-creation activities. Some stakeholder communication initiatives include the following:
  - Share with stakeholders brief summaries of the topics to be addressed in the co-creation sessions in advance of the sessions (one week).
  - Especially at the beginning of the process, hold preparatory meetings with stakeholders to explain how the whole process will work.
  - Each co-creation session should include an initial part to provide basic information: objectives of the session, topics to be addressed and activities to be carried out.
  - A digital platform such as the DECIDO digital platform helps to keep all stakeholders involved in the co-creation process, not only informed but also connected.

- In relation to the planning of co-creation activities, it is important to maintain an adequate pace of activities that allows stakeholders to participate in them but does not cause them to lose interest because of long periods of inactivity.
  - A good strategy for planning co-creation activities is to take advantage of and collaborate with other events organised by initiatives with similar objectives to those of the co-creation process.
- The relevance of the type of language used. The format and content of the language used for communication with stakeholders should be such as to ensure that it can be understood by all stakeholders and should be expressed in a clear and understandable format. In relation to language and how to stimulate the participation of stakeholders (especially citizens) in the co-creation process, the H2020 SOCKETS project in its Guidebook towards Responsible Tech Innovation using Societal Engagement suggests the following issues:
  - Describe the event in a way that stimulates people's curiosity and triggers their interest to participate. A challenge may affect stakeholders directly, but it is important that it is expressed in a way that helps to stimulate their participation in its resolution.
  - Explain clearly why people should participate and what they can gain from it.
  - Use normal language rather than technical jargon.
  - Introduce activities with stimulating questions and an active vocabulary.
  - Explain which tangible outcomes can be expected and, if possible, how they will be acted upon.

3.2. Creating a bridge between Public Authorities and European Open Science Cloud

Xavier Salazar Forn, Fotis Karayannis, Andrea Cristofori, Gergely Sipos

3.2.1. Introduction to EOSC

The European Open Science Cloud (EOSC) is an environment that enables European researchers, innovators, companies, Public Authorities, and citizens to share, find, and reuse resources in the form of data, publications, services, tools, software, methods, workflows etc. for research, innovation, education and beyond. This open en-

vironment federates the resources across thematic communities and national boundaries, using a set of rules, standard processes, and interfaces. EOSC builds upon existing infrastructures and services supported by the European Commission, Member States and research communities. The overall approach is to build a federated 'system of systems', with added value services, aggregated content, and interoperable services that enable being used jointly. EOSC is expected to operate under well-defined conditions to ensure trust and safeguard the public interest. Overarching concepts of EOSC are enabling science to be *as open as possible, as closed as necessary* and the FAIR principles (Findability, Accessibility, Interoperability and Reusability) of data, software and any science related output. Seamless access and reliable reuse of the resources are essential. Based on the above, EOSC encompasses two main concepts: Open Science, including the FAIR principles, and the EOSC Commons, including the EOSC Portal/Marketplace. In terms of architecture, EOSC is composed of two main components, the EOSC Core, i.e. core services to support the operation of EOSC, and the EOSC Exchange, i.e., a set of services including a portal/marketplace to enable the use of the services by the users. Examples of EOSC Core services include, among others, authentication and authorisation, monitoring, accounting, order handling, and helpdesk.

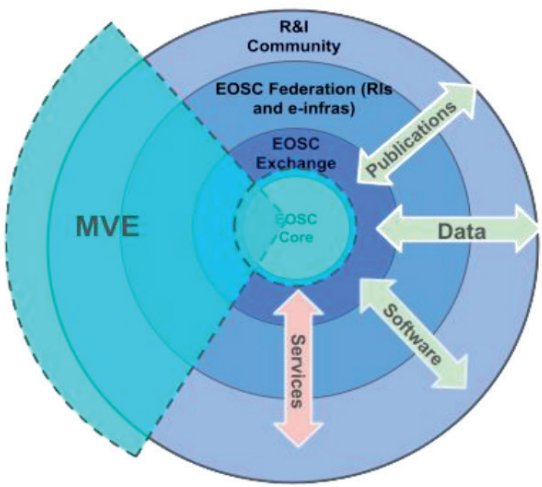

Fig. 4. High-level diagram of EOSC

Besides the EOSC Core and Exchange, EOSC is expected to be composed by related thematic (domain-specific) Research Infrastructures (RIs) and generic (domain agnostic) e-Infrastructures, through which the Research and Innovation (R&I) communities will be able to use it. Finally, the Minimum Viable EOSC (MVE) is a subset of all the data/services and the federated communities that acts as a so-called *minimum viable product* or a proof of concept.

Regarding its governance, during the Horizon Europe programme timeframe, EOSC has been agreed as a 'co-programmed European Partnership' and its current governance is a tripartite one, composed of i) the European Commission, ii) the Member States and the Associated Countries represented via the EOSC Steering Board (EOSC SB) and iii) the EOSC Association (EOSC-A) representing the community. The EOSC Partnership is funded with almost €500 million from the EC and of at least another €500 millions of in-kind contributions by the Member States and Associated Countries. With the above EC contributions, a series of EOSC-related projects have been funded, creating the required core infrastructure, but also covering the federation of thematic communities and generic e-Infrastructures in EOSC. EOSC is expected to move away from the current phase that is based on a set of projects to a next operational phase based on procurement. Tender specifications on three main areas (lots) have been issued early 2023 and the results of the procurement were announced in the last quarter of 2023. The operational phase of EOSC is expected to start in 2024, creating the so-called 'EU node' coming out of the procurement, while a set of diverse EOSC national/regional and thematic nodes will constitute the new EOSC ecosystem.

The ambition of EOSC is to develop a *Web of FAIR Data and Services* in Europe, for science and beyond (including the Public Sector), offering a wide range of added-value services. These will range from finding, synthesising, visualising, and analysing data within and across disciplines, to long-term data preservation, or the monitoring of the uptake of open science practices and other policies.

3.2.2. EOSC and the Public Sector

Since its inception, EOSC has been primarily built focusing on the research sector, yet as part of its Strategic and Innovation Agenda and Multi Annual Roadmaps (which are key elements of European part-

nerships), it is expected to widen the scope and progressively expand its user base to the private and Public Sectors.

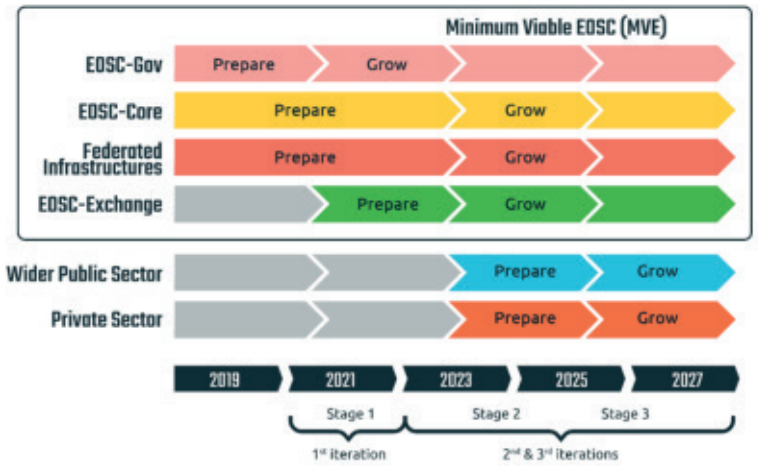

Fig. 5. The EOSC SRIA: Engagement with the Public Sector

As part of this staged development approach, EOSC was expected to expand to include the wider Public Sector and the private sector in stage 2 (2023-2024; prepare) and stage 3 (2024-2025; grow). However, this time frame has shifted slightly and the expansion to the public and private sectors is expected to start sometime in 2024, most probably after the EOSC EU node has become operational (~mid 2024). Furthermore, for most part, the MVE can be considered a list of services, and as there is limited expert support to assist the uptake of services - especially beyond research-the uptake of these services by Public Authorities might not be high. This is not trivial, as this user group may not have all the required knowledge in terms of adoption of high-technology paradigms. Moreover, EOSC requires further data management services for sensitive data that are critical to this user group. The MVE will therefore need to be expanded with not just tailored services, but also with dedicated consultancy, tuned to the needs and requirements from the Public Sector, who is not involved in research activities but may want to exploit open access to EOSC data and services.

In order to successfully extend the EOSC knowledge ecosystem beyond the core research community, EOSC must demonstrate value and impact that is relevant and meaningful to the diverse groups be-

longing to broader Public Sectors. To deliver this value, EOSC must better understand the wants, needs and requirements of this specific user segment. On the other hand, there is also the need to understand what value the Public Sector user base brings to the table for EOSC in order to understand the impact.

To bridge this gap, the DECIDO project consortium (eviDEnce and Cloud for more InformeD and effective pOlicies) has brought together innovative public administrations, leading European ICT service providers, and research institutions. As part of this action, a dedicated task entitled 'Big Data and European Cloud Infrastructure Governance case studies and viability strategies' has aimed to foster this cross-fertilisation between EOSC and the Public Sector. A key scenario in this cross-fertilisation is that the Public Authorities that do not have dedicated infrastructure (computing/storage/access) and other required services/capacities, will use the EOSC ones. This will open a new market for EOSC, with an appropriate fee and related support services.

3.2.3. EOSC Exchange Services Used in DECIDO

Through the EOSC Marketplace, EOSC allows access, at the time of writing, to 3 million of research and innovation tools and services, thousands of datasets from a wide scale of research domains from renowned European service providers. Among all the offers, which range from software, services, publications, data, etc. the following services have been identified and are being used as integral part of the development and deployment of the DECIDO project:

- **EGI Check-In**: Check-in is a proxy service that allows scientific communities to securely access and control access to resources in the EGI Federated infrastructure. It operates as a central hub that connects federated Identity Providers (IdPs) with EGI service providers. Users can authenticate with their preferred IdP (e.g., an eduGAIN account, institutional account, social media account, etc.) to access and use EGI services in a uniform and easy way. This service has allowed DECIDO to integrate its features and management of the groups on the different components allowing the login and access to the different components seamlessly.
- **EGI Notebooks**: Notebooks is an environment based on the Jupyter technology and offers a browser-based tool for interactive data analysis. This environment provides users with notebooks where

they can combine text, mathematics, computations and rich media output. EGI Notebooks is a multi-user service that can scale on demand, being powered by the compute services of EGI. The DECIDO project has a dedicated instance of Notebooks cluster which has been connected with a dedicated space on the EGI DataHub where data from the different pilots has been stored.

- **EGI DataHub**: DataHub is a high-performance data management solution that offers unified data access across globally distributed environments and multiple types of underlying storage. It allows researchers to share, collaborate and perform computations on the stored data easily. The access and operation are granted based on the DECIDO dedicated Virtual Organisation (VO) in Check-In and some additional permission that have been set in DataHub. The access can be through the web interface or the API and during this phase of the project both have been exploited to access and upload the data. Furthermore, work has been performed to automate the creation of additional spaces, one for each pilot of the project.
- **EGI Cloud Compute**: are available to automate the creation and management of cloud and Kubernetes clusters, however, we have opted to use the standard OpenStack interface offered by the EGI provider selected to support the DECIDO project. As this required only the creation of the desired VMs, it has been achieved with the use of the standard OpenStack interface. The access to the OpenStack Horizon web dashboard has been configured to grant access to the DECIDO VO members on the EGI Check-In.
- **Amnesia**: Amnesia is a tool that allows end users to anonymize sensitive data to share them with a broad audience. The service enables the user to guide the anonymization process and decide on a flexible trade-off between privacy guarantee and data utility. The service is offered through a web interface that allows users to explore the anonymized data visually and also offers a Rest API. It is part of the EOSC offering and it has been used in the anonymisation of datasets in the DECIDO project which was highly requested by Public Authorities.
- **Zenodo**: Zenodo is the general-purpose repository that enables researchers, scientists, projects and institutions to share, preserve and showcase multidisciplinary research results (data, software and publications) that are not part of the existing institutional or subject-based repositories of the research communities. It is founded

by CERN data centre and is used by more than 50K researchers and 3K communities all over the world. In DECIDO it has been used to create a community as placeholder to share all produced publications, newsletters and other dissemination material.

3.2.4. Feedback from EOSC Exchange Services

All these services have been used in different project settings for data collection, pre-processing, analysis, and storage. They have been integrated into the backbone of the DECIDO platform and tested through the pilot use cases. One of the main objectives of DECIDO is the assessment - through the use cases - whether EOSC related services and infrastructure are suitable for the uptake of services delivered by Public Authorities. Feedback related to user experience and programming perspectives show a positive appreciation, even if some elements are seen to be complex, and hence some customisation would be needed to increase overall user experience. Here below further details for EGI Cloud, EGI Check-in, DataHub and the Amnesia desktop application are summarised:

- **EGI Check-in:** The flexibility of the AAI system is appreciated, allowing authentication from multiple sources, and ensuring a diverse and accessible user experience. The authentication process itself is user-friendly; however, more customization and options to personalise the integration within specific services would be beneficial - e.g., to adapt the look and feel to the target platform.
- **EGI Cloud Enrolment:** The Enrolment process uses a straightforward wizard for data collection of the user; however, the process is perceived to be complicated for non-technical users due to the number of steps involved and the time-consuming steps required from filling in the data to waiting for the admin approval. From a developer perspective the documentation is praised for readability and detailed user information. Nonetheless, it is recommended to streamline the information displayed and avoid details that are not crucial for maintainers, such as information about other groups or departments whenever they are not used.
- **DataHub:** DataHub serves as the centralised portal for data storage and offers the convenience of single sign-in through integration with Check-in. However, users find certain elements within DataHub to be complex.

- **Documentation:** Developers commend the clarity and conciseness of our documentation, facilitating straightforward integration. However, suggestions have been made to enrich it further with detailed examples, step-by-step tutorials, and code snippets to improve the understanding in different usage scenarios.
- **Amnesia:** While Amnesia serves its purpose as a desktop application prioritising privacy, user feedback indicates a need for improvements in user-friendliness to enhance the overall user experience.

3.2.5. Overall Recommendations

While there have been many efforts to enrich EOSC with services, data, and information, it is still difficult to navigate and find and use the right services for non-research communities. There is still a lack of understanding the difference between EOSC Core and EOSC Exchange and its implications in terms of uptake. A lot of mentoring and support is still needed to accompany external users - to understand how to access and use the different services. In many cases, the EOSC Exchange Service information is often incomplete in terms of purposes and how it can be accessed and under which conditions and makes it difficult to be used by non-research communities. EOSC needs to move to its operational phase, preparing related Service Level Agreements (SLAs), and marketing and consultancy services.

3.2.6. Incubation for a EOSC Competence Centre for Public Authorities concept in DECIDO

DECIDO has been working on the EOSC Competence Centre for Public Authorities concept to provide a sustainable path to foster the bilateral collaboration between representatives from the Public Sector with EOSC experts and consultants, so that the two communities can interact and profit from each other in a win-win situation. DECIDO has been acting as an incubator bringing together project pilot representatives and their teams of technical and policy experts, and the EOSC infrastructure and service supply side. This collaboration focuses on creating a channel for the exchange of support and technical expertise, that helps finding the right services for the needs of use cases, and to provide a channel to facilitate exploitation and outreach. The Competence Centre has been triggered by DECIDO, and it is open to

be extended to the rest of Public Policy Cluster Projects and any further interested parties. Main stakeholders include Public Authorities and their Technical IT Providers on the User Side and EOSC service and technical providers on the supply side. Main Value proposition for each of them is:

- **For DECIDO and other cluster projects** the EOSC CC for Public Authorities creates an additional avenue to facilitate the onboarding of developed services and results to the EOSC marketplace providing a channel for exploitation
- **Public Authorities and Technical Partners** are provided with fine-tuned consultancy, support and training to facilitate the access to EOSC ecosystem related computing infrastructure, data and services.
- **For EOSC Core** the concept provides a headway into a previously untapped market segment, thanks to the regular input and feedback on their specific needs, requirements, validation and testing, and overall endorsement and reassurance for other consumers in EOSC.
- **EOSC Exchange** providers is an opportunity for expansion of their user base and overall adoption of their services, data and technologies among Public Authorities

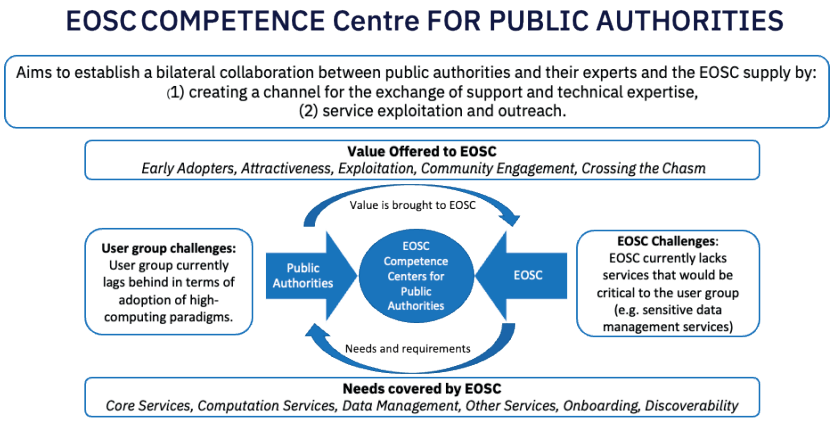

Fig. 6. Key Aspects of EOSC Competence Center for Public Authorities concept developed at DECIDO

What the Competence Centre offers to the EOSC:

- **Early Adopters:** Public Authorities part of the Competence Centre act as early adopters of EOSC related services accelerating its uptake in this user segment.

- **Enhanced Services:** Early success stories gathered from the use cases provide valuable insights for piloting and delivering new innovative services, data and resources for wider use and further increase the adoption by providing examples to follow from the same user segment.
- **Exploitation:** The Competence Centre provides an additional exploitation path for onboarding of newly developed services and increased users for existing services in the EOSC marketplace.
- **Community Engagement:** A well-established community of Public Authorities that will enable EOSC related entities to meaningfully engage with this user group for gathering needs and requirements and also for testing. This will be crucial for meeting the Strategic Objective 8 and Operational Objective 1 of the EOSC.
- **Suppliers:** Services developed by the Public Authorities and Data used and generated can effectively become part of the EOSC Ecosystem ready to be used and reused by broader EOSC community and hence increasing collaboration opportunities between Public Sector and research community.
- **Pathway to Impact:** Public Authorities use cases addressing real life problems for European citizen aiming to benefit peoples' wellbeing, economic wealth, or to find measures to prevent against hazardous events. Hence it represents an outstanding opportunity for EOSC to increase significantly its societal impact.

What the Competence Centre needs from EOSC:

- **Core Services:** Strong core services as part of EOSC. For example, a common way of identifying, authenticating and authorising users (AAI), helpdesk to support the users, training, etc.
- **Computation Services and Infrastructure:** Computational resources, including secure, federated cloud computing environments that offer secure access.
- **Data and Data Management:** Services for transferring, data discovery, accessing, analysing, sharing and archiving sensitive data.
- **Thematic Services:** Easy and seamless access along with possible customisation to other thematic services from EOSC Exchange.
- **Support for Service Onboarding:** Easy and clear onboarding procedures in order to make available policy development related services and solutions

- **Discoverability:** Increase the discoverability of policy development services. Extend and expand their use by making them accessible through the EOSC portal.

Main activities include matchmaking and brokering between user-needs and EOSC exchange services. Also support for finding suitable project funding and overall consultancy for both helping Public Authorities find the right EOSC services and data to develop own use cases and services. Learnings and best practices from the Competence Centre will not only be crucial for all stakeholders, they will also help EOSC "crossing the chasm" between early adopters and the early majority for the Public Authorities.

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4. Citizen science in the Policy Lifecycle: An Overview

Francisco Sanz, Lucía Moreno, Maite Pelacho, Olga Varela, Judith Bielsa

4.1. Introduction

Citizen science is defined in the White Paper for Citizen Science in Europe as the engagement of the general public in scientific research activities, where citizens actively contribute their intellectual effort, surrounding knowledge, tools, and resources to science (Serrano-Sanz et al., 2014). In line with this definition, DECIDO is pioneering the integration of this participatory approach into the realm of policy-making. We are leveraging citizen science not only as a means to gather diverse insights and data, but more importantly as a fundamental set of methods to support policy co-creation. In this innovative paradigm, citizens are not mere bystanders but active participants, contributing to the formulation of policies that are rooted, on the one hand, in the diverse perceptions and experiences of citizens, and on the other hand, in their contributions of data an analysis with high scientific, political and social value. Through DECIDO, policy making is embedded in a synergistic process that combines data evidence with the lived experiences and collective intelligence of the community, enhancing a more participatory, inclusive, and evidence-based governance.

Much citizen science seeks to respond to scientific, technological, environmental and social challenges –many of them intertwined– that require more and better knowledge, highlighting the limitations of institutional research (see e.g. Funtowicz & Ravetz, 1997). Public or citizen participation is similarly needed in policy making and has been a constant claim for some five decades [see e.g. (Joss, 1999)], in particular in the management of risk and uncertainty (Giddens, 1999) and in modes of governance in science (Nowotny, 2003; Jasanoff, 2003). Over

time, the very notion of citizen participation in policy-making has evolved significantly, in particular, towards models that go beyond participation as legitimising instruments of policies (De Marchi, 2003). Some lessons learned include aspects such as seriously acknowledging the knowledge of citizens beyond institutions (Wynne et al., 2007) who should not be considered ignorant or irrational when they express doubts or disagreements, for example in the areas of health and the environment (Irwin, 1995).

Importantly, while the contributions of citizen science to data collection and analysis are increasingly recognized, both by policymakers (see e.g.: McGlade, 2009; European Commission, 2023) and professional scientists (see e.g.: Nov et al., 2014; Kosmala et al., 2016; Wong et al., 2018) its transformative potential extends to the entire scientific process. Simultaneously, the synergies between citizen science and open science (Wagenknecht et al. 2021) are increasingly understood and analysed both by interests associated with advancing knowledge generation and accessibility, and sustaining research systems (Pelacho et al., 2021). As one of its core dimensions, citizen science represents a deep shift towards more, transparent, and participatory evidence-based policy-making.

One of the most significant ways citizen science promotes a bottom-up approach to policy-making is by empowering communities to identify and address their own concerns (see e.g.: Irwin 1995; Soleri et al., 2016; Dickinson et al., 2012). Instead of policies being designed and developed solely by top-down governmental or institutional directives, citizen science allows communities to highlight issues that matter to them, ensuring that policies are relevant and responsive to actual needs.

Citizen involvement in the scientific process promotes informed and engaged stakeholders, leading to a sense of ownership and grassroots advocacy for policy change. When citizens are both researchers and advocates, policies better reflect community will and are more effective. Empirical studies on this approach date back to the 1960s, exemplified by the research of Ostrom & Ostrom (1977) in urban conflict reduction. Shifting from top-down to bottom-up collaboration, emphasising *self-government* and *polycentric governance,* has gained traction, especially in resource conservation (Ostrom, 1990).

Moreover, the integration of local knowledge, often overlooked in traditional policy-making –despite of decades of claims, efforts, and re-

search (see e.g.: Fischer, 2000; Failing et al., 2007; Wynne et al., 2007)–, ensures that policies are tailored to the specific contexts and nuances of local communities. This bottom-up and collaborative approach, valuing local expertise –which is increasingly measured and promoted (see e.g. Failing et al., 2007)– enhances policy effectiveness and relevance.

Citizen evidence-based policy provides a nexus that brings citizens and policy-makers closer together so that both sides can understand each other, collaborate and co-produce more effective norms (Ostrom & Ostrom, 1977). Rooting policies in solid evidence helps to overcome individual biases and political manoeuvring, facilitating open dialogue and policy co-design by citizens and their representatives. This collaborative approach instils the necessary sense of collective ownership and accountability. By intentionally blurring these boundaries, the policy-making process not only becomes more democratised but also gains in transparency and trustworthiness, even more the case when policymakers themselves are also implied in the citizen science projects (Schade et al., 2021). In addition, this cooperative framework makes it easier to achieve risk management policy objectives by improving the allocation of resources and preparing citizens for better risk management, as Papadopoulou et al. (this book, chapter 1) explain in detail.

As we explore the transformative potential of citizen science in shaping evidence-based policies with active community involvement, it becomes imperative to understand its role throughout the entire policy lifecycle. From the initial identification of issues to the evaluation of implemented policies, citizen science plays a crucial role at every stage (Turbé et al., 2019). This holistic involvement fosters that policies are not only grounded in robust data but are also continually refined based on community feedback and evolving evidence.

The chapter is organised as follows: Section 4.2, on "Citizen Science in the Policy Life cycle," lays the groundwork, offering insights into the integration and influence of citizen science at various stages of policy development. Section 4.3 on "The Need for a Scientific and Integrative Mindset" elaborates on the need for citizen participation in both scientific rigour and an integrative approach. Section 4.4 on "The DECIDO Project: A Guiding Lighthouse" highlights DECIDO's critical role as a guide in the complexity of integrating citizen science and policy-making. Section 4.5, on "Challenges to Integrating Citizen Science into Policy," expands on the previous discussion to explore main ob-

stacles and challenges. Section 4.6, on "The Future of Policy Making: A Prospective," delves into the future landscape of policy making, painting a dynamic picture of a society in which citizen science is not an adjunct, but a core component of policy formulation, implementation, and evaluation, with policy to be adaptive, inclusive, and dynamic. Finally, section 4.7 summarises the key issues, ideas and proposals detailed in the previous sections.

4.2. Citizen Science in the Policy Lifecycle

The policy lifecycle, as a systematic framework, is used in public policy analysis to understand the various stages involved in policy formulation, development, implementation and evaluation (Jann & Wegrich, 2017) reflected in figure 1.

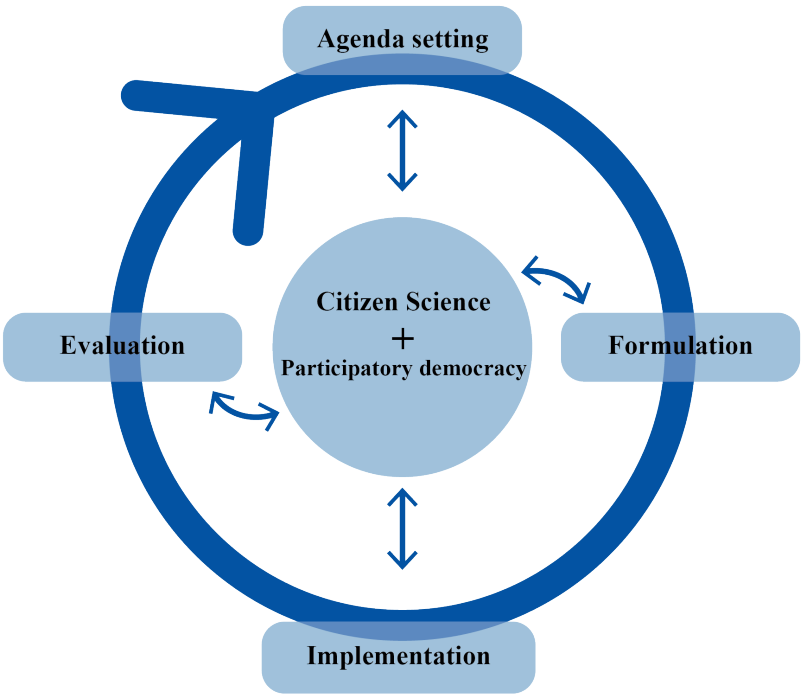

Fig. 7. Citizen Science in the Policy Lifecycle

In the model of representative democracy, it is common to find that the central actors involved in the political cycle are framed around tra-

ditional parties, businessmen and, in some cases, experts. As participation is delegated to specific sectors, the voice of citizens is derived from their representatives.

However, with the rise of the *participatory turn* (Jasanoff, 2023), collaborative work methodologies have multiplied, through which citizens themselves either take the initiative regarding their local concerns or get involved in projects implemented by others, including academic or governmental institutions. It is in this context that diverse citizen science methodologies become relevant: the collection and analysis of data, the monitoring, the problem definition, and the integration of different forms of knowledge are the main contributions of citizen science to policy-making.

An evidence-based approach, coupled with a real involvement of citizens in the policy cycle - democratising and non-instrumentalist - remains a challenge. In the following subsections, we will discuss how to address the necessary participation in the various stages of the policy cycle through citizen science.

4.2.1. Agenda Setting with Citizenship

The agenda setting largely determines the relevant issues to be discussed and addressed throughout the political cycle. In today's democracies, this process can be - to a greater or lesser extent and depending on the different administrative levels - top-down or bottom-up. In both cases, citizen participation is essential. However, it is well known that "participatory governance is enormously difficult: it requires a change of mindset, extensive changes in professional and institutional practices, and the design and implementation of new instruments and procedures" (DeMarchi, 2003).

Drawing from empirical cases, at local, multinational and global scales (Shanley et al. 2019), the great potential of citizen science has been discovered on the policy side, specifically in agenda setting, transforming this process from something often confined to centralised governmental power to a real democratised process, reflecting the diverse voices of society, and which we might call with Ostrom and Ostrom (1977) polycentric governance. By harnessing the collective intelligence and contributions of citizens (Gonzalo et al. 2023), the agenda-setting process is infused with a granularity and diversity of perspectives often absent in traditional approaches.

The multifaceted nature of citizen science allows for a more comprehensive and nuanced identification of issues. In a number of areas, emblematically environmental and health (Irwin 1995, Wynne 2007), citizens - as diverse as fishermen, farmers, forest rangers, people at risk from natural disasters or environmental or health problems, and a very long etc.- are frequently the first to witness and experience emerging problems. Their insights, when aggregated and analysed, can unveil patterns and trends that might remain hidden in a top-down approach. From environmental issues documented through community monitoring projects to health concerns expressed via digital platforms, citizen-collected data serves many times as an early warning system that demand policy attention (Turbé et al. 2019).

Moreover, citizen science has the potential of fostering a dynamic dialogical environment. It is not only about data collection but also about conversation, debate, and deliberation. In this ecosystem, issues are not uniquely identified but also defined, articulated, and prioritised through collective engagement, even in big online projects (Nov et al., 2013).

The participatory nature of citizen science amplifies public awareness and engagement. It does not just identify issues but also mobilises public sentiment and opinion around them. In an era where public opinion significantly influences policy priorities, citizen science serves as a conduit that translates societal voices into quantifiable data and actionable insights.

Furthermore, the integration of collaborative platforms in citizen science - alongside an open science approach (Wagenknecht et al. 2021) - enhances its various impacts. These platforms facilitate real-time engagement, data sharing, and collaborative problem identification. They make the agenda-setting process agile, adaptive, and responsive to emerging and evolving societal challenges. The role of citizens is active, not only highlighting issues but also participating in their definition, contextualization, and prioritisation.

In this landscape, agenda-setting is not a linear, one-dimensional process but a multi-dimensional, interactive ecosystem. Citizen science fosters that the policies crafted in subsequent stages of the policy life cycle are rooted in a deep, inclusive, and dynamic understanding of societal needs and challenges, marking a stride toward a future where governance is not just for the people but is intrinsically by the people.

4.2.2. Policy Formulation: A Collaborative Approach

As is the case with agenda setting, the policy formulation process is significantly enriched when it is conceived as a collaborative endeavour, where citizens are not just passive recipients but active contributors. Their involvement transforms policy formulation into a dynamic, interactive, and co-creative process.

Citizens, in many different areas of knowledge, often have a deep understanding of their environment. Alongside data - in terms of granularity as well as the needed quantity - citizens bring diverse perspectives. Every individual interprets data through their unique lens, shaped by their experiences, beliefs, and contexts. When these varieties of perspectives are integrated into the policy formulation process, policies become multidimensional, reflecting the complex, diverse, and pluralistic nature of the societies.

On the other side, as policies are formulated, they need to be validated to ensure they are both technically sound and socially, culturally, and ethically relevant. Here, the citizenry emerges as a critical asset. Their criticism and validations ensure that policies are not abstract constructs but are deeply rooted in the lived realities of the people.

Regarding the role of citizen science, Schade et al. (2021) highlight its relevance in the co-creation process of policy formulation, as well in the achievement of the intended policy outcomes. However, for policies to incorporate results from citizen science - they continue - the corresponding activities must "be highly contextualised and adapted to the actual level of intervention". Furthermore, the analysis of citizen science approaches and the respective impact assessment frameworks should be divided into specific aspects with clearly defined functionality.

4.2.3. Policy Implementation: a More Citizen Ownership

The concept of citizen ownership in policy implementation is a transformative approach that redefines the traditional paradigms of governance and policy making. When citizens are intricately involved in the formulation and implementation of policies, there emerges a profound sense of ownership, a deep-seated conviction that these policies are communal assets, akin to commons that are crafted, owned, and safeguarded by the community.

This transformation from seeing policies as abstract, distant dictates to tangible, living frameworks is profoundly empowering. It is akin to the transition from being passive recipients to active co-creators. Every policy, thus, is not an imposition but a collective creation that takes into account the diverse insights, experiences, and aspirations of the citizenry.

A citizen, imbued with this sense of ownership, transitions from a passive observer to an active participant, not just in policy creation but in its implementation, monitoring, and refinement. Policies, in this framework, are dynamic, living entities that are continuously nurtured, refined, and adapted by the collective wisdom and vigilance of the citizenry. The diversity inherent in citizen science amplifies this effect. Every citizen scientist brings a unique perspective, a distinct insight, and a specific skill set.

Accountability is innate in this framework. A citizen, who sees a policy as a communal asset, is naturally vigilant, scrutinising every stage of implementation, holding authorities to account, and ensuring that policies deliver on their promises. This citizen is not just a watchdog but is a co-guardian, sharing the responsibility of ensuring that policies are not just implemented but are lived, experienced, and validated. A policy that is seen as a communal asset is naturally open to scrutiny, contribution, and refinement. Every stage of implementation is laid bare, not because of regulatory dictates but because of a collective conviction that transparency is not just a regulatory requirement but is a communal ethic.

4.2.4. Policy Evaluation: a Community-centric View

In today's data-driven world, policymakers face a critical challenge: how to effectively assess the impacts of their decisions and policies. One promising approach to address this challenge is through the integration of feedback loops and continuous data collection. In this respect, citizen science also has enormous potential. Precisely, numerous projects involve longitudinal studies: key activities such as monitoring (e.g. of species) by hundreds or even thousands of citizens increase the granularity of data in both space and time. Thus, citizen science also provides a robust framework for assessing the impact of policies. Continuous data updates provide a mechanism for policymakers to gain real-time insights into the outcomes of their policies. For instance, in the realm of public health, citizen scientists can play a crucial role

in tracking the spread of diseases, the effectiveness of vaccination campaigns, or the impact of public health measures (Bonney et al., 2009).

The use of continuous data collection and feedback loops gives policymakers a real-time view of their decisions' impact, facilitating the rapid identification of trends, anomalies, and unexpected outcomes, which, in turn, allows for timely adjustments and refinements, ultimately enhancing policy outcomes.

Another of the key benefits of citizen participation in the evaluation process is the enrichment of perceptions with local and/or everyday life perspectives. When citizens evaluate policies - either in participatory processes or by providing data - assessments are grounded in their lived experiences. This first-hand perspective fosters that evaluations are both technically rigorous and contextually relevant. Furthermore, this participatory approach fosters a sense of ownership among citizens, enhancing public trust in the evaluation process and its outcomes.

Nevertheless, there are well-identified challenges (e.g., by Schade et al. (2021)) that must be taken up by citizen science practitioners, policy makers, and the citizenry as a whole. Scientific integrity is demanded from citizen science as from science in general, e.g. in relation to data quality, open science issues, protection of personal data. From policy makers - as well as from academic science - a fair recognition and support of citizen science is expected. The citizenry as a whole has the right and the duty to participate in matters that belong to everyone. A participatory culture, empowered by citizen science, is essential to achieve not only adequate data governance, but also more robust democracies.

4.3. The Need for a Scientific and Integrative Mindset

In the context of a society that is increasingly data-driven and complex, the need for evidence-based policies is more significant than ever. The creation and implementation of policies must be grounded in robust, reliable data and scientific investigation. However, scientific evidence is not static; it evolves as new insights emerge and as our socio-cultural landscapes shift and transform. A scientific mindset, rooted in critical thinking, rigorous research, and continuous learning, is essential to making sound and reliable policy. Consequently, policies anchored in this scientific ethos are inherently adaptive; they must be designed to evolve, refined by new knowledge and reshaped by unfolding socio-cultural narratives.

While a scientific mindset fosters the credibility and reliability of evidence, an integrative approach permits that this evidence is contextual, relevant, and holistic. As explained in the previous section, policies are not formulated in isolation, they are designed in intricate ecosystems teeming with diverse social, political, and ethical dynamics. These dynamics infuse policies with context, favouring they are not just technically sound but are socially just, politically reliable, and ethically grounded.

Integrative mindset is, thereby, understood as a commitment to embrace diversity, inclusivity, and foster participation. Every social profile, every community, every demographic group provides a unique view, a distinct insight. It is the amalgamation of the diverse voices that favours policies are not monolithic but are multifaceted –reflective of the diverse societies they should serve.

In this regard, we can allude to the human capabilities approach, introduced by economist Amartya Sen (1985), as the key to ensuring individual development, thus enabling citizens to participate in matters that impact diverse interests. In this approach, social justice is redefined as the potential of citizens to achieve a minimum level of these capabilities. Martha Nussbaum (2011), from political philosophy and ethics, complements this approach by focusing on the innate capabilities that individuals possess and that enable their development as active citizens. She emphasises the ability to employ the senses, imagination, thinking and reasoning in a *truly human* way, cultivated through appropriate education, which includes literacy and fundamental scientific skills. Nussbaum proposes as well that people involved in different forms of social interaction are able to imagine the situation of others, while protecting freedom of assembly and political expression. We also underline the relevant findings -from political economy - on the conditions under which sustainability, efficiency and equity are more likely to be achieved in the management of very diverse public and common-pool systems (Ostrom, 1990). Such conditions involve the co-production of rules, which in turn rely on common deliberation among other key factors studied theoretically and empirically by the Ostromian political economy, and which underlines the capabilities approach.

Hence, evidence-based policies combine the scientific and the integrative, the technical and the ethical, the individual and the collective. Policies emerge not just as regulatory frameworks but as living enti-

ties, dynamic and adaptive, reflective of the complex, evolving narratives of the societies they inhabit.

4.4. The DECIDO Project: a Guiding Lighthouse

So far, we have presented the role of citizen science in the different stages of the policy lifecycle, as well as its importance in developing capabilities related to scientific and integrative mindsets. In this section we focus on how the DECIDO project has guided the integration of citizen science into evidence-based policy making. DECIDO employs a co-creation approach (Cristofori et al., chapter 3 in this book) within the realm of public policies, engaging all relevant parties throughout the entire policy development process. This approach offers a detailed account of every phase, identifying the parties participating, and specifying the methods, techniques, and tools that provide support.

When crafting a new policy, those involved in the co-creative policy-making process -decision-makers, organisations, citizens in general - are encouraged to use data, taking into account the scientific and integrative mindset explained above. In this regard, it must be emphasised that citizen science projects contribute concurrently to data provision and the enhancement of a participatory and democratic culture.

The DECIDO project's primary objective is to demonstrate the substantial positive impact of incorporating innovative methods, tools, and data to empower public authorities in the development of more resilient, evidence-based policies. DECIDO plays a critical role as an intermediary, connecting the public sector, the citizen science community, and the European Cloud Infrastructure (ECI). The main objectives of this project are to examine how to adopt data and cloud technologies within the public sector, determine how this data can contribute to evidence-based policymaking, and facilitate collaboration among multiple stakeholders in the policymaking process.

During the DECIDO project, the co-creation methodology plays a significant role in policymaking, where citizens actively participate in the development of public services throughout various phases of the project. Co-creation in DECIDO is understood as a collaborative effort that involves both public and private entities, as well as third sector entities, working together to address common problems, challenges, or tasks by sharing various forms of knowledge, resources, skills, and ideas (Sørensen & Torfing, 2010; Filograna et al., 2023). These co-cre-

ation activities occur in the DECIDO project through the four key steps above mentioned.

The DECIDO methodology was created with the aim of converting user requirements into valuable information that enhances the decision-making process. This approach involves co-creation sessions combined with the use of digital tools for gathering data. The collected raw data is then subject to analysis, and the resulting information strengthens the decision-making process. Each pilot project identified its specific needs and challenges, illustrating how DECIDO's tools could enhance their policies, as explained in more detail in chapter 5.

The DECIDO methodology is illustrated in figure 1 within chapter 2, figure in turn extracted from Filograna et al. (2023). In collaboration with the technical team, they assessed and selected services from the EOSC based on their requirements and DECIDO's standards, promoting the adoption of cloud services within the public sector. Subsequently, they redirected their attention toward data discovery and collection. The DECIDO Data Catalog serves as a repository for data essential in the policy formulation process. In addition to this, insights generated during co-creation sessions were captured as implicit knowledge and later converted into data through participant surveys, co-creation documents, and similar sources.

After the data collection phase, stakeholders assessed its applicability in shaping data-driven policies. Algorithms played a key factor in transforming this data into actionable information, which was then presented through interactive dashboards. This information, in turn, facilitated the development of evidence-based policies. Finally, all those involved in the policymaking process evaluated the policies and provided feedback to guide future enhancements.

4.5. Challenges for Citizen Science Integration in Policy

A broad picture of the integration between citizen science and the policy life cycle has been presented so far. We have also highlighted the importance of scientific and integrative thinking as a basic human capacity for democracy. However, we cannot fail to mention the challenges and difficulties that still need to be overcome in order to achieve quality participation, both in terms of citizen science and political participation.

Amid the expansion of citizen science, as elaborated by Shanley et al., (2019), in contemporary policy-making landscapes, inherent

challenges regarding data quality, reliability, and representation persist. These hurdles, if unaddressed, could potentially undermine the prolific impact citizen science aims to imbue within the complex structures of governance.

Data quality and reliability stand at the forefront of these challenges. Citizen-collected data, though abundant and diverse, oscillates in terms of quality and consistency. Shanley et al. (2019) underscored the increasing adoption of citizen science in addressing intricate societal and scientific issues, yet the reliability of such data in policy-making paradigms is often subjected to scrutiny. Policies, especially those attuned to intricate frameworks like UN Sustainable Development Goals, demand data that is not only ample but also accurate and reliable.

In the context of representation, insights drawn from studies like those of Soleri et al. (2016) or Cooper et al. (2021) delineate the emergent grassroots nature of many citizen science endeavours. These initiatives often originate from communities' intrinsic interests and capacities, rather than institutional or governmental directives. This is particularly the case in the field of sustainable and equitable resource conservation (often without the *citizen science* label), especially in the field of *socio-ecological systems* (Ostrom 1990). While this spontaneous emergence is a testament to citizen science's vibrancy, it also raises questions about ensuring representation and the potential for elitism. The democratising potential of citizen science could be compromised if participation becomes disproportionately representative of certain societal sections. The challenge is to balance the grassroots emergence of citizen projects with efforts to ensure broad-based participation, capturing the eclectic and multifaceted perspectives that enrich policy-making.

Human development and policies to promote it constitute a permanent challenge. As we have seen, quality citizen science must be based on the capability of its participants to think scientifically and integratively. This is a prerequisite for the necessary synergies between citizen science and the policy cycle. But it is also one of the greatest challenges of democracy itself in any field. It is increasingly important to develop these capabilities of participation and deepen democracy. Citizen science is discovered - like science in general but with greater emphasis - as a valuable political tool, not in a partisan but in a civic, co-responsible sense, and at the service of the development of humans and socio-ecological systems.

Addressing these challenges involves co-creating technology, policy, and citizen participation in a cohesive way. Technology must refine the quality of citizen-collected data and democratise participation, mitigating elitism and fostering broad-based representation. Policies need to be adaptable, evolving to incorporate citizen science's dynamic insights while citizen engagement must be nurtured to be inclusive, diverse, and informed.

4.6. The Future of Policy-Making: a Prospection

Incorporating citizens into all phases of policy-making is seen as both a progressive stride and a necessary evolution. This approach aims to create policies that are characterised by transparency, evidence-based decision-making and democratic robustness. The future of policy-making is a landscape filled with opportunities and challenges, promising a governance model rooted in inclusivity, informed choices, and critical thinking.

However, integrating citizens into policy-making comes with multifaceted risks. These include concerns about data privacy, data quality, and the potential for biases due to diverse perspectives and varying levels of expertise. There is also the risk of oversimplifying or diluting complex policy issues when trying to make them accessible to the general public. Despite these risks, the imperative to establish a more inclusive, transparent, and accountable governance framework outweighs these concerns. In a rapidly evolving technological and societal landscape, failing to involve citizens in policy-making can result in governance that is outdated and unresponsive. On the other hand, citizen competencies should not be underestimated: various citizen science activities reveal relevant expertise beyond institutions, even at the individual level.

Technology and digital platforms play a fundamental role in this transformation. They not only help mitigate the risks associated with citizen integration but also amplify the benefits. User-friendly digital tools make policy-making accessible to citizens, simplify data submission, facilitate informed discussions, and foster that citizen contributions are systematically integrated into the policy-making process.

Looking forward, the convergence of citizen science and policy-making is set to redefine governance. It creates an environment where transparency, evidence-based policies, and public accountability are intrinsic characteristics of the governance model. In this evolved

landscape, every citizen is an active participant in policy formulation, implementation, and evaluation. Education and awareness campaigns, collaborative platforms, and policy frameworks are essential components of this collaborative journey, ensuring the seamless integration of professional expertise and citizen insights in the future of policy-making.

4.7. Conclusion

Scientific research plays a pivotal role in anchoring political decisions in evidence, offering a robust foundation of comprehensive data. At the same time, citizen science emerges as a valid methodology for conducting research, creating valuable insights and information that supports the policy-making process.

In each phase of the policy life cycle, from agenda setting to evaluation, citizen science has a relevant role. It is a collective effort, where policies are shaped, refined, implemented, and assessed not just by a select few but by the many. Each citizen scientist can become a policymaker, an evaluator, a contributor. Policies, in this context, are communal artefacts, shared, owned, and lived by the collective.

This participative nature of policy formulation through citizen science favours a sense of ownership among citizens. They are not only recipients of policies but active contributors to their creation and refinement. Each policy is not just a directive but a shared pathway, co-created and co-owned, instilling a sense of collective responsibility and shared accountability.

In the DECIDO project, policies emerge from diverse insights, experiences, and perspectives contributed by citizen scientists. Every policy is evidence-based, not only anchored in data but because it is infused with the lived experiences and insights of the collective.

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5. The four pilots

Jorge Joshua Campozano, Matteo Maritano, Lucía Moreno, Dimitris Papaleloudis, Davide Prette, Filip Sever, Jaakko Schroderus

5.1. Pilot's Introduction

Filip Sever

The purpose of the pilots is to trial the DECIDO approach through four use case scenarios in the participating partner countries. Pilots are facilitated through regional stakeholder organizations, and in close cooperation with public authorities and civil organizations.

The Finnish pilot focuses on forest fires and improving communications to citizens. Forest fires in Finland are relatively small compared to southern Europe. However, climate change estimates show an increase in both the number of fires and their size. The Kainuu Rescue department works with other stakeholders in the civil security sector to examine current practices and engage with citizens to propose and adopt the chosen guidelines. The Italian pilot addresses three emergency areas: 1) Floods, 2) Food distribution, and 3) Ukrainian refugees. Volontariato Torino ETS, KPRF, and the Municipality of Turin work with the local community to assess and improve the policies of management, preparedness, and response to these emergencies. The Greek pilot focuses on the management of power outages that occur in rural areas and islands. The Sustainable City Network and municipality of Halki work to collect and examine GIS and energy data of Halki island in order to formulate energy-efficient policies, as well as a roadmap for specifying parameters for power outages, develop prognostic measures, and co-create emergency response mechanisms. The Spanish pilot focuses on wildfire policies in the region of Aragon. Ibercivis collects and presents wildfire evolution data and engages citizens, firefighters, and policy makers. The stakeholders participate

to workshops to contribute towards the designing of information and policies for evacuation.

5.2. Finnish pilot description

Filip Sever, Jaakko Schroderus

5.2.1. Description of the problem

Forests in Finland cover more than 70 percent of the land surface area (The World Bank, 2020). Forest fires in the region are common, but small in comparison with southern Europe. Large scale forest fires in neighbouring Sweden in 2014 and 2018 showed that northern countries need to prepare for the future. With increasing temperatures and longer drought periods due to climate change, forest fire occurrences will increase and become more severe. As most of the fires are caused through human actions, efforts to mitigate and minimize damages are done through forest management, cooperation with forestry operators, forest owners and rescue services (Finnish Meteorological Institute et al., 2021). Data from the Finnish resource and statistics system highlighted that most forest fires in Finland are caused by human actions (*PRONTONET.FI*, 2023). The Kainuu Rescue department, the local end users and pilot hosts of the Finnish pilot chose to examine how human-caused incidents could be reduced.

5.2.2 Reaction with DECIDO project

At the start of the project, time was devoted to examining the statistics surrounding forest fires as well as current research in the domain. From the findings, the pilot working group chose the working title of ''Risk mitigation and preparedness for fires'' for the policy work. Next a stakeholder group was selected to steer and contribute to the policy development process. The regional stakeholder organizations were the Kainuu Rescue Department (host), City of Kajaani, and the Kainuu Social Welfare Authority (social and healthcare services), while national organizations included the Finnish Forestry Centre, Emergency Services College, and the Finnish National Rescue Association. To facilitate collaboration among the stakeholders, the four-stage pol-

icy process was used to account for the wide range of expertise and actors involved (Quevauviller et al., 2005). The DECIDO portal was used throughout the policy development process, resulting in the development of an internal working model, as well as three objectives addressed in the created policy.

5.2.3. Challenges and achievements

In the early stages of development, the stakeholders agreed on two principles to guide the policy development work: 1) organizational needs, and 2) civilian needs (Figure 4). The principle refers to means that the organization and citizens require to contribute towards the policy goal of mitigating risk and improve preparedness for forest fire. Following the model, the group worked through a four-phase policy development process: 1) agenda setting 2) policy formulation, 3) implementation, 4) evaluation. A wide range of publicly available data on weather, awareness campaigns, past and current research, incidents, as well as classified data were used to identify and prioritize ideas. The ideas where then reviewed and sorted into three objectives addressing the identified shortcomings of the current policies: 1) Resourcing, the identification and sharing of available resource information among direct emergency actors and support organizations, 2) citizen safety during emergencies, the means to evacuate,

Fig. 8. Organization needs and civilian needs

shelter, and keep track of citizens for a limited amount of time during emergencies, and 3) prevention and preparedness planning, mitigation strategies to reduce forest fire risk and educate citizens (formal and informal ways) on emergency actions.

As a result, a four-phase policy making process was used, emphasizing evidence-based policy making and collaboration of a diverse group of stakeholders. This methodology was facilitated through the DECIDO portal, allowing all stakeholders to contribute and co-create the policy in real time. Prior policies were uploaded into the portal with data used to identify and guide policy decisions, while the most recent research was used to estimate future needs and shape the final policy. The stakeholders had a positive reception towards the methodology and the DECIDO portal. The policy development process in Finland includes space for citizens to review the policy draft and comment on it. However, in the first phase of the policy creation process, only a limited number of citizens participated.

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5.3. Italian pilot description

Davide Prette, Matteo Maritano, Jorge Joshua Campozano

5.3.1. Description of the problem

The Meisino Park, at the confluence of the Po and Stura rivers in Turin, has a history of recurrent flooding. Heavy rainfall in the hilly area of the city provokes the rising of the Po river, resulting in widespread

flooding. Currently, the Civil Protection Department, NGOs and the Regional Environmental Agency (ARPA Piemonte) have limited alerting and monitoring for potential evacuations.

In the submission phase of the DECIDO project (beginning of 2020) the Turin pilot experience was designed to deal exclusively with the flood emergency in the Meisino area. This same policy was then extended to the Murazzi area, in order to have a greater involvement of economic actors (night clubs and rowing clubs) that carry out their activities alongside the banks of the Po river. The Murazzi area is often subject to flooding and the current system of warning messages strongly affects the activity of the above-mentioned economic actors.

As a result of the new crises caused by the Covid-19 pandemic and the war in Ukraine, the Turin pilot team (Municipality of Turin, Volontariato Torino ETS and ENGINEERING for the technical part) chose to incorporate new social emergency factors into its experience, which was then extended to three different scenarios:

a) **Flood** emergency in two areas of the city of Turin, along the river Po: Murazzi (Città di Torino, 1-2020) and Meisino Park (Città di Torino, 2-2020)
b) Fighting against the **food** waste, in the increased distribution of basic necessities following the Covid-19 pandemic
c) Supporting the reception of **asylum** seekers from Ukraine in Turin and in Piedmont region (Regione Piemonte, 2022)

5.3.2. Reaction with DECIDO project

The experience of the Turin pilot is aimed at improving the design of emergency-related policies in three different scenarios, using the co-creation methodology applied in all phases of the project life cycle and based on the use of the DECIDO portal:

a) In the '**Floods**' scenario, the issues to be addressed included low public awareness in at-risk areas and unclear warning messages from institutions. These messages are often not well-targeted, causing an overload of messages and diminishing people's perception of the actual risk. The Data Catalogue of the DECIDO portal gathered relevant data, including Piedmont Region's weather alerts and historical flood event recordings in Turin.

b) In the '**Food**' scenario, it has been observed that current policies excessively emphasize food expiry dates instead of recommended consumption intervals (Banco Alimentare, 2018). This creates communication challenges, especially for beneficiaries already stigmatized due to socio-economic difficulties. The Data Catalogue included Food Bank data, food waste statistics in Turin and Piedmont, information on food poverty and relevant European and national food waste regulations.
c) In the '**Asylum**' scenario, the main issue was the Ukrainian refugees' difficulty in accessing services and resources in the City of Turin due to language barriers and lack of information from institutions. The Data Catalogue was used to collect statistics regarding the presence of foreigners and asylum seekers in Italy, in the Piedmont Region and in the metropolitan area of Turin.

5.3.3. Challenges and achievements

Throughout the Agenda Setting and Policy Formulation phases, monthly co-creation sessions were conducted for each scenario with groups of selected stakeholders. These sessions included both technical preparatory meetings and larger "hackathons" where different stakeholders (from public, private, and non-profit sectors) worked together to break down complex issues into micro-problems to be tackled one at a time, generating thoughts and potential solutions with the support of a facilitator. The process led to the definition of the policy to be implemented for each scenario:

a) '**Floods**' scenario: development of targeted warning messages, depending on the type of weather phenomenon and the target audience. At the end of the first phase of policy creation, a simulation was carried out with people belonging to specific categories receiving alert messages as a test. These people gave positive feedback regarding the structure and communicative style of the messages, filling out a questionnaire developed with the Survey Tool component of the DECIDO portal. In the second phase the pilot team will proceed with the development of increasingly targeted alert messages for a larger number of categories of recipients.
b) '**Food**' scenario: design and testing of a system of labels showing recommended consumption intervals and a QRcode referring to mi-

nisterial tables. During the first policy creation phase, two labelling and food distribution sessions were carried out with the support of the DECIDO portal Co-creation Tool. In both distributions the labels have been appreciated but it has been suggested by many users to increase their size to improve their effectiveness. In the second phase, in addition to making the labels larger and more readable, an attempt will be made to extend this experiment to a larger scale with the support of the Food Bank.

c) '**Asylum**' scenario: creation of a web portal in Ukrainian language containing useful information on the following topics: school, job orientation, housing, health, renewal of residence permits, sports and leisure time. The Ukrainian website - developed from the documentation collected through the DECIDO portal Data Catalogue - was positively evaluated by the native volunteer testers who, however, stressed the importance of keeping it constantly updated. The sustainability of the site will eventually be the priority of the second phase of policy creation.

The successful engagement of citizens in the co-creation process demonstrates the potential of bottom-up approaches to tackle complex problems. The DECIDO portal has represented a useful repository and management platform alongside each session. Technologies can effectively support co-creation processes, even if face-to-face meetings have an added value.

However, the co-creation process revealed a disconnection between decision-makers and citizens, underscoring the need for more involvement from associations, volunteers, and public bodies. Challenges in citizen participation may stem from time constraints and trust issues with institutions.

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5.4. Greek pilot description

Eleni Lytra, Dimitris Papaleloudis

5.4.1. Description of the problem

Halki is a small island in the southern eastern part of Aegean Sea with approximately 400 habitants. It is located at a considerable distance from the mainland in close proximity to the island of Rhodes from which it derives its power supply. Halki experiences recurring power outages, which can be caused by several factors such as technical faults, extreme weather conditions and primarily, excessive energy demand - exceeding supply capacity. During the last summer period, more than thirty power outages occurred, ranging from a few minutes to even many hours. Such outages can lead to inconvenience, economic losses, and even pose risks to health and safety. The municipality may lack effective tools and strategies to adequately prepare for and respond to power outages. Consequently, this situation may lead to delayed responses, prolonged outages, and inefficient resource allocation during crises. Power outages can affect various aspects of community life as well, including businesses, healthcare facilities, schools, and daily activities of the residents, particularly in the summer season. Citizens and business owners, based on surveys conducted, have developed their own procedures to deal with such events, however this cannot compose a solid solution for the problem. Ensuring a reliable power supply is essential for the overall well-being and economic development of the municipality. Effective solutions require collaboration among stakeholders from different sectors, including local authorities, utility providers, businesses, and residents. Coordinating efforts and sharing information is crucial to achieving sustainable power resilience. Halki is paving the way in the fields of innovation and energy sustainability, being the first Greek ECO island[1], however due to its

[1] The initiative "GR-eco Islands" foresees the provision of free electricity to the members of the energy community generated by a photovoltaic system (PV), the delivery of electric vehicles, the installation of a 5G telecommunications network

dependency from Rhodes electricity network, still some challenges required to be handled.

5.4.2. Reaction with DECIDO project

To tackle the challenges, the DECIDO project adopts a multidisciplinary approach that leverages technology through data analysis, stakeholders' engagement, and policy development. Through these concerted efforts, it aims to transform Halki into a more resilient community, well-equipped to mitigate the impact of power outages and thereby pave the way for an improved quality of life for its residents. The Project 's emphasis on involving the local community and stakeholders is commendable. By considering their needs, ideas and concerns, Greek Pilot's approach ensures that the solutions are tailored to the unique challenges faced by Halki. The project fosters a unique co-creation methodology, combining stakeholder's engagement and collaboration with the utilization of the DECIDO Portal and its associated tools. The focal point for the case of Halki lays on the evidence and specifically the extensive datasets compiled, comprising numerous co-creation conclusions and real-time tracking of power consumption in selected buildings. Regarding the abovementioned data, a sensor installed in the town hall, demonstrates the inconveniences the power outages come along with, quantifying the power outages occurring and the energy consumption of the building during different periods. The pilot's approach, that focuses on collecting and **analysing these data to create a risk index for future power outages**, reflects a strategic and informed approach to problem-solving. Through the outcomes of the analysis, the local government will have in its possession a powerful tool to plan a thorough response to a power outage event that is going to occur. The creation of a comprehensive policy for power resilience underscores a commitment to long-term sustainability. This policy can serve as a blueprint for future actions and guide the municipality in times of crisis.

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and (IoT) technologies that will facilitate access to education (e-learning) and telemedicine, among others. The Chalki project includes the installation of a 1MWp PV farm, which will cover the energy needs of the island's inhabitants. It also includes equipping the municipality with six electric vehicles to be used by the police, the Coast Guard and the municipality, and the installation of four electric vehicle chargers at the port as well as "smart" management systems for the operation of public lighting.

The findings emphasize the importance of continuous refinement and adaptation of strategies to respond to changing seasonal and weather conditions. The DECIDO Project serves as a model for other communities facing similar challenges, showcasing the potential for innovation, collaboration, and data-driven solutions. Above all, it spotlights the significance of using data as a foundation for decision-making.

5.4.3. Challenges and achievements

The challenges faced by the Greek Pilot team and the stakeholders connected, are firstly linked to its low population associated with the lack of technical staff. With a small number of residents, the responsible authorities often grapple with limited technical solutions, insufficient response mechanisms, and a scarcity of resources and staff in general, as well as for DECIDO's case. However, the unseen benefit lies in the heightened level of citizen engagement, as the small community is actively involved and willing to resolve these challenges, making it a driving force for overcoming any adversity. DECIDO, through innovation and citizen engagement, is actively addressing and mitigating these issues, fostering citizen engagement and integrating it through the Portal.

Significant milestones have been achieved that collectively underscore the Project's commitment to enhancing power resilience in Halki. Central to these accomplishments is the establishment of a diverse Stakeholders Group, which ensures the inclusion of voices and perspectives from various sectors. This engagement not only fosters collaboration but also garners essential support. A crucial element throughout the Project's implementation is the successful organization of fruitful hackathons and co-creation sessions, where the pilot team along with the stakeholders converged to generate solutions and strategic moves addressing Halki's power outage challenges. These events show how dedicated the project is to coming up with creative solutions. Equally remarkable is the development and demonstration of the DECIDO portal, accompanied by comprehensive training sessions for stakeholders. The continuous feedback and refinement process applied to the portal, improved its function and tools, making them more user-friendly and accessible to a diverse range of stakeholders. This achievement empowers stakeholders with the requisite tools and knowledge, transforming them into active contributors to the project's

success. To confirm its data-driven approach, the Greek Pilot team installed a sensor at the town hall building. The sensor monitors energy consumption and swiftly detects power outages. Among the notable technical accomplishments is the creation of the algorithm, which generates the customized risk index, a warning system designed for predicting power outages in Halki and sending alerts to responsible bodies. This index is a guiding light for the path towards timely preparedness for potential challenges due to power outage events.

A Policy for Resilience

Constant efforts manifested in the form of this new policy. The results of this process serve as a stepping-stone for energy resilience focused on preparing for and managing power outages, energy demand forecasting, and conservation. Stakeholders will continue to play a critical role in refining this policy through additional co-design sessions, ensuring that the voices of the community are heard and their optics are incorporated into policy development.

The policy will be implemented so as to provide timely alerts and adaptation actions tailored to seasonal demand and weather conditions. The vision is to empower social actors and citizens with the knowledge and tools to face any power outage with preparedness. Halki's journey towards power resilience continues, and the best is yet to come.

5.5. Spanish pilot description

Lucía Moreno, Francisco Sanz

5.5.1. Description of the problem

Forest fires in Aragon, Spain, are largely attributed to meteorological elements like drought, wind, and elevated temperatures. There are generally two primary catalysts: human negligence, which is often observed in late winter and early spring, and lightning strikes during dry, summer thunderstorms. Over two decades, a marked escalation in both the frequency and intensity of such fires has been observed. Agricultural professionals rely on controlled burns as an essential tool for vegetation management. However, a report by INFOAR (2022)

highlighted a deficiency in the existing permitting protocols, particularly the lack of stringent measures to pinpoint the timing of these burns. Consequently, imprecise timing can exacerbate the risk of uncontrollable fires.
To fortify fire prevention and management, implementing rigorous scheduling controls for burns, supported by insights derived from satellite and other data sources, is pivotal. This integration aims to facilitate a meticulous assessment of associated risks, ensuring informed and timely decision-making to mitigate the potential of uncontrolled wildfires effectively.

5.5.2. Reaction with DECIDO project

Here we are outlining key co-creation activities under the DECIDO project, spotlighting citizens' active participation. At Etopia in Zaragoza, over 60 participants joined NASA's SpaceAppsChallenge hackathon, a globally recognized event, to address space-related challenges using NASA's data. Supported by Ibercivis and H2020-DECIDO, 14 teams, including developed solutions, some of them related to wildfires. The Team "No Rocket No Paradise) created a fire spread simulator utilising NASA's open data, emerging as a global finalist.
"The Future of Data" datathon, marking Aragon Open Data's tenth anniversary, tasked participants with utilizing open data to address societal issues, including forest fires. In alignment with the DECIDO project, diverse data sets facilitated the design of solutions for forest fire mitigation.

The third event saw Aragon citizens participating in data-driven public policy decision-making exercises, focusing on forest fire data and proposing both institutional and localized preventive solutions.

Lastly, the fourth event, a technical hackathon, analysed Twitter data to understand behavioural patterns during crises, identifying influential individuals and those spreading misinformation, offering insights to enhance public safety protocols and policy-making through strategic social media utilization.

5.5.3. Challenges and achievements

In our activities, we address a pivotal challenge: substantiating the instrumental role that citizens can assume in aiding policy institu-

tions in data analysis. The premise that underpins our endeavours is anchored in the conviction that a collaborative dynamic between the citizenry and institutional experts is not only possible but can yield enriched insights and perspectives, instrumental in the formulation of evidence-based policies.

Our activities have emphatically demonstrated this potential. Citizens, equipped with the appropriate tools and platforms, have exhibited a remarkable acumen in data analysis. The synergy of diverse perspectives and specialized institutional knowledge catalyses a comprehensive and multifaceted analysis process. This collective intelligence approach amplifies the depth, breadth, and quality of analysis, underpinning the formulation of policies that are not only empirically grounded but are also responsive to the nuanced and diverse needs and challenges of the community.

Furthermore, this collaborative dynamic imbues the policy formulation process with enhanced transparency. As citizens engage in active dialogues and collaborative analyses with institutional experts, there is a demystification of the policy-making process. This transparency fosters an environment of trust, accountability, and inclusivity, integral to enhancing public confidence in institutional processes and policies.

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6. Achieved results and lesson learnt and other elements

Cristian Bonfili, Fabio Perossini, Vanni Resta, Francesco Mureddu

6.1. Summary of Thesis "The new horizons of the policy making: the DECIDO project"

Cristian Bonfili

My name is Cristian Bonfili, I'm from Italy and just a few months ago I graduated at the University of Rome "La Sapienza", from the Department of Communication and Social Research (CoRiS). There, I got a master's degree in "Social planning for sustainability, innovation and gender inclusion". For my graduation thesis I carried out an in-depth analysis of the European project DECIDO.

Why did I choose this theme? At the end of 2022 I attended the course "PROJECT AND FINANCING MANAGEMENT OF INNOVATION PROJECTS", held by Professors Vanni Resta and Massimiliano Meschini, during which I had the opportunity to explore the field of Euro planning. In particular, Professor Resta, who is also Member of the DECIDO team further to be Editor of this book, held lessons about the functioning of European funds and programmes indirect and direct (such as HORIZON 2020 and Erasmus plus) explaining stages and tools of planning techniques like Project Cycle Management. These themes sparked such a strong interest in me that I chose Professor Resta as supervisor of my thesis, with whom I decided to deal with the DECIDO Project.

Today, our society is forced to deal with events that are more and more complex and difficult to predict. Governments deal with phenomena that require different treatment: they need to be treated with a systemic approach that considers the multiple relationships that each individual event has with others. Often, the solutions identified by governments prove to be ineffective, and in some cases they produce

unwanted effects. It is in this context that DECIDO, a project funded by Horizon 2020 programme, was born.

The paper aims to analyse the DECIDO project by identifying its potential. The analysis focuses around four main key points: policy making processes, evidence-based policy making, co-creation and citizen science. DECIDO responds to collective problems by promoting a new way of policy making activating co-creation processes in which stakeholders and public authorities (including citizens) develop innovative solutions; using digital technologies to facilitate the implementation of evidence based policies.

6.1.1. Some definitions

In order to fully understand the potential of the project, it is necessary to acquire a good knowledge of its key elements: co-creation, citizen science, policy making and evidence-based policy making.

6.1.1.1. Policy making

In DECIDO when we talk about policies we mean public policies. The latter are the set of actions performed by a set of actors, which are related to solution of a collective problem (a need, an opportunity or an unsatisfied demand) that is generally considered to be of public interest.

Several academics have tried to identify the stages of a "policy process", outlining a sequence of activities as follows:

- Agenda setting
- Policy formulation
- Implementation of the programme
- Evaluation of the policy

The stages mentioned are not just steps that proceed linearly but co-existing activities throughout the decision-making process. In fact, every stage is a political arena , autonomous and interdependent, i.e. institutionalised patterns of behaviour in which specific actors pursue a specific objective. Several variables are involved in each decision-making process: the actors, the resources used by the actors during the process, the interaction modalities between the participants, the stakes, the strategies of the actors, the decision-making context. More specifically, the outcomes of a decision-making process depend on the interaction of dif-

ferent types of actors, with different objectives and different roles who, within a network and a given decision making context, achieve a stake by exchanging resources and using different interaction modalities.

6.1.1.2. Evidence based policies

Evidence-based policy is the process in which high-quality data is collected and used to orient a government's decision in various fields. Data collection and analysis is often carried out rigorously using specific research methods, which precisely enable the elaboration of the "evidence" on which decisions will be based.

"Evidence-based policy helps people to make well-informed decisions about policies, programmes and projects, by placing the best available evidence from research at the heart of policy development and implementation", Philip Davies 1999.

"Evidence" refers to a set of data and information that can confirm or disprove expectations about the future effectiveness of policies. "Evidence" also provides information on the best way to implement them.

The generation of evidence-based policies gives governments many benefits:

- Increased effectiveness of the policies themselves.
- Increased efficiency, enabling public authorities to use limited resources with maximum effect.
- A higher satisfaction of citizens' expectations and needs.
- Accountability, i.e., transparency about what is decided.
- A growth of democratic processes.
- More trust in government and public services.

The creation of "evidence" is a collaborative process as it involves the participation of heterogeneous actors, such as experts, researchers, programme managers, evaluators, and statisticians. Among them, some come from public sector while others come from the private sector, universities, think tanks and non-profit organisations.

6.1.1.3. Co-creation

Co-creation is the process in which a group of interdependent actors work together to define a common problem. They subsequently attempt to find new and better solutions to this problem through a

mutual exchange of knowledge, ideas and skills. In this case, the aim is the creation of "public value" (value for society), which is assured by the inclusion of relevant and interested actors, i.e., those who are really able to contribute to the implementation of services, policies and programmes with a positive impact on society. The programmes and solutions identified are the result of interaction between all parties. Institutions can empower and facilitate the co-creation process. Co-creation has a great potential because it makes possible to overcome some of the most pressing problems of contemporary governments:

- Low social cohesion
- Democratic crises
- Ineffective policies
- Unsatisfactory public service

Tools and methodologies of co-creation are used in citizen science projects. Citizen science is defined as all activities that involve the public in scientific research bringing together science, policy makers and society. Through citizen science all people can participate in many stages of the scientific process: the design of a research question, data collection and volunteer mapping, data interpretation and analysis, and publication and dissemination of results.

6.1.2. Data Driven Policy Cluster

DECIDO is not the only project focused on improving policy making processes: it collaborates with other four EU projects funded by the Horizon 2020 programme, with which it forms the Data Driven Policy Cluster. The aim of the cluster is to join forces to define a new way of governance that makes decision-making processes effective and fast. The projects involve the use of "disruptive" technologies, such as artificial intelligence and high-performance computing (HPC), and the integration of European Open Science Cloud infrastructures. The main beneficiaries of this transformation will be European citizens, who will enjoy better public services and consequently better living conditions.

The other four European projects are:

- AI4PublicPolicy: It represents a joint effort of policy makers, cloud experts and artificial intelligence to demonstrate the ability of AI in fostering the development of automated, transparent and citizen-centred evidence-based policies. To this end a new platform was

developed, which consists in a Virtualised Policy Management Environment (VPME).

- DUET: Duet is a project with a clear objective, i.e., enabling policy makers from different sectors to create innovative solutions to complex urban problems. DUET provides virtual models of the city that facilitate the understanding of the interrelationships between different variables such as traffic, air and noise pollution and other urban factors.
- IntelComp: the aim of the project is to support decision makers at each stage of the policy life cycle by providing them with useful tools for policy development in the STI (Science, Technology and Innovation) field. Intelcomp is a platform which collects knowledge from different data sources, provided by a multitude of actors, such as public administrations of different levels, STI stakeholders and civil society.
- Policy Cloud: The main objective is to provide a data-centric, cloud-based platform that supports the entire policy making process. In particular, Policy Cloud provides a unique and integrated environment of data sets, analysis tools, management and manipulation of data sources.

6.1.3. DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies)

DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies) is a three-year project funded by the European Union, in particular by Horizon 2020. It aims to increase the use of the European Open Science Cloud (EOSC) by the public sector, attempting to innovate the policy making sector, making it more effective in solving collective problems. The consortium consists of fourteen partners from eight different countries: Italy (4 partners), Belgium (1 partner), Finland (2 partners), Spain (2 partners), Greece (2 partners), Netherlands (1 partner), Malta (1 partner), Germany (1 partner).

The vision of the project is to develop and disseminate an innovative method to face the progressive complexity of modern society, in which challenges such as migration, climate change and poverty make the search of solutions difficult for public authorities.

The mission of DECIDO is to concretely demonstrate how the methodologies, tools and systems promoted by the project can generate an innovative impact in the contexts in which they are applied.

To achieve the mission, i.e., to demonstrate the actual innovativeness of the project methodologies and tools, DECIDO partners set the following general objective: to guide and direct the public sector towards the use of the data and services of the European Open Science Cloud. The objective described in the previous lines can only be achieved through the pursuit of some specific objectives:

- Supporting public authorities in the development of evidence-based policies
- Engagement of local actors and stakeholders
- Experimentation of methodologies and tools in the field of disaster risk management

6.1.3.1. Project Outputs

DECIDO will deliver three core outputs, which can also be used for future policy formulation:

- A methodology to perform co-creation processes
- A portal (DECIDO Portal)
- An observatory of good practices

The first two outputs will be discussed in detail.

The methodology developed by the project involves co-creation sessions during the entire policy life cycle. The policy life cycle is divided as follows:

1. Agenda Setting
   - Understanding the problem
   - Resource planning
2. Policy formulation
   - Formulation of the challenge
   - Generation of ideas
   - Selection and prioritisation of ideas
   - Conceptualisation
   - Prototyping
3. Implementation and Maintenance
   - Implementation
   - Launching
4. Evaluation of the policy.

It is not a simple sequential process, but an iterative and circular one. It involves the development of extended meetings, also known as Hackathons, in which participants after a training period break down macro-problems into micro-problems and bring out possible solutions, also with the help of a facilitator. Moreover, thanks to hackathons, stakeholders can participate in training sessions in which the solution is explained to them in detail. In this case, DECIDO assumes the role of an innovator as it defines a new path for co-creation, which breaks away from traditional methodologies.

The DECIDO Portal is the front-end of the DECIDO platform, consisting of several digital tools and services and designed to support policy actors in the policy making process. The DECIDO Platform, by using the services of the European Open Science Cloud, can work with data coming from heterogeneous sources. It favours the use of "open data". The portal is the unique access point to the different functionalities, services and guidelines provided by the DECIDO ecosystem for the different stakeholders. The platform includes a data catalogue through which users can easily access collected and generated data. The catalogue contains:

- Open data from municipalities
- Data from co-creation activities
- Satellite data provided by Copernicus or Corine
- Data from the European Open Science Cloud
- Data from the European Data Portal
- Data from Geographic Information Systems (GIS)

6.1.3.2. How participatory data promote innovation

The application of co-creation practices in DECIDO has been showing a great benefit: they promote innovation. One of the innovative aspects related to the participation of heterogeneous stakeholders is the generation of new ideas adapted to the needs of citizens. The "idea generation" process shows its full effectiveness when stakeholders with different perspectives, knowledge and skills discuss, developing solutions that meet the needs of the participants. Moreover, stakeholders play a key role in the validation and prototyping phase, where they provide feedback to understand whether the policy needs improvement.

Another related innovative aspect concerns the development of positive relationships within the community in which the project operates. Co-creation practices develop a sense of trust in public institutions. By engaging public authorities, they increase transparency and foster a sense of ownership of the solution created. In addition, the involvement of citizens in the resolution of pressing problems, such as fires and floods, pushes them to develop a strong sense of responsibility and engagement, which encourages proactive and supportive behaviour towards the policies.

Also from a purely economic point of view participatory data are innovative: their use makes it possible to collect data at a lower cost than traditional methods, improving the efficiency of resource allocation in policy making processes (especially in citizen science projects).

6.1.4. Pilots

DECIDO started the testing of its tools and approaches through four pilots, in four different countries, with different economic, social and cultural backgrounds and with a different attitude towards the use of evidence-based and co-creation approaches. The pilots are the following:

- Spain, Region of Aragon

In the Spanish pilot, the problem of forest fires has been addressed: in recent years, the number of fires has increased significantly, causing damages to the region and to the health of the inhabitants of the affected areas. Public decision makers and stakeholders have been meeting to develop solutions to the problem.

- Greece, Halki Island

In Greece, the problem of unexpected power outages pushed public authorities to identify possible solutions: co-creation sessions were organised, where stakeholders, with the help of data, defined the problem and possible solutions.

- Finland, Kajaani

The vulnerability of the area to forest fires has highlighted the need to develop a risk prevention and management system, across all levels of the community. Stakeholders and public authorities started the development of new solutions, such as the creation of education programmes and alert systems about forest fires.

- Italy, Turin

Three areas of intervention were chosen in Italy: flood emergency, food waste, and the reception of Ukrainian refugees. The policy formulation process ended up with the definition of three possible solutions: a warning system depending on the area affected and the target population; the development of new labels with instructions for food consumption beyond the minimum shelf life; the creation of a 'Ukrainian info point', containing information on education, job orientation, sports, health services, etc.;

Conclusion

DECIDO defines a new way of governing, in which the key words are collaboration, participation, transparency and effectiveness. These aspects are fully applied through two of its fundamental pillars: evidence-based policy making and co-creation.

The use of technologies for processing and collecting data offers policy makers the opportunity to acquire a comprehensive and detailed view of the reality. Decision makers have opened the 'black box', studying processes and cause-effect relationships and developing effective policies capable of addressing complex phenomena.

DECIDO is showing all the advantages that collaborative practices generate in the contexts in which they are applied. Co-creation processes foster a sense of community; they strengthen and renovate trust in governments; they provide a broad range of knowledge and experience that, combined with the use of digital technologies, strengthen governments' problem-solving skills in critical situations.

All these observations give us reason to believe that the changes introduced by DECIDO represent a benefit not only for governments but for all communities included. The project is a true driver of innovation, which has been proving it is capable of improving the quality of citizens' life and increasing the wellness of society.

6.2. Social Life Cycle Assessment Oriented Behaviour Change Games: the DECIDO project lesson learnt

Fabio Perossini

The DECIDO project joint the challenge to support the change toward Social Life Cycle Assessment addressing social innovation processes

in a selected range of public services and could count on a wide concept of Processes Digital Twins that could be the main structure for a Serious Game oriented to change community behaviours toward deliberative attitudes. DECIDO platform provided a kind of processes twins that can play a significant role in performing digital twins-based S-LCA[1] even sup defining accountability tools supporting ISO 14040[2], providing needed data. The use of both Behaviour Change Games and Processes Twins raises a GDPR[3] issue due to the need to profile communities' members in terms of needs and behavioural attitude. In recital 71 states: "The data subject should have the right not to be subject to a decision, which may include a measure, evaluating personal aspects relating to him or her which is based solely on automated processing. Such processing includes 'profiling' that consists of any form of automated processing of personal data evaluating the personal aspects relating to a natural person, to analyse or predict aspects concerning the data subject's performance at work, economic situation, health, personal preferences or interests, reliability or behaviour, location or movements, where it produces legal effects concerning him or her or similarly significantly affects him or her". The adoption of Processes Twins in serious gaming could help in managing the potential gaps deriving from the use of large amount of data coming from the urban environment that necessarily include citizens personal data (direct or indirect), in the DECIDO project this issues has been addressed asking specific informed consent to citizens participating the experiments while all personal data where stored inside the institution storage and circulated outside them only in anonymised way.

6.2.1. Social Performance Assessment: S-LCA

S-LCA is a methodology capable of assessing the social and socio-economic aspects of services, projects, and products, accounting for both actual and potential positive and negative impacts along the life cycle. In the project we applied the methodology to processes and procedures ranging from institutional emergencies management to manage-

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[1] Al-Obaidy, M., Courard, L., & Attia, S. (2022). A Parametric Approach to Optimizing Building Construction Systems and Carbon Footprint: A Case Study Inspired by Circularity Principles. Sustainability, 14(6), 3370.

[2] https://www.iso.org/standard/37456.html

[3] https://gdpr-info.eu/art-22-gdpr/

ment of food waste and refugees. There exist no standardised methodologies for S-LCA[4] as of now. However, one significant step towards addressing these issues and developing a methodology that may eventually become standardised is the Guideline, published by UNEP/SETAC Life Cycle Initiative[5]. The S-LCA methodology provides an adequate technical framework from which a larger group of stakeholders can move towards social responsibility while assessing the lifetimes of goods and services[6] or social ethics when addressing public services as in the DECIDO experience.

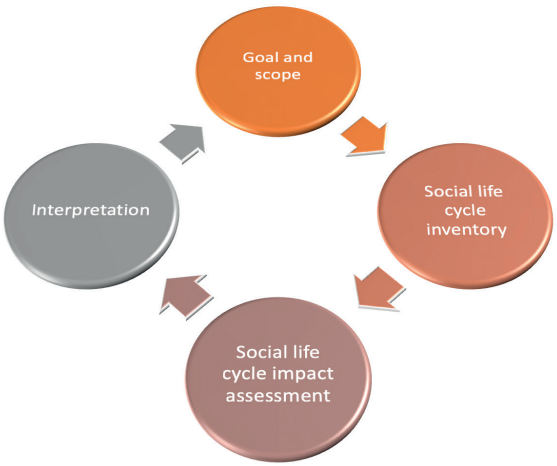

Fig. 9. The four iterative phases of S-LCA (adapted from Benoît Norris, 2012)

6.2.2. Behaviour Change Games (BCG)

In the last four decades, games have been designed purposely for behavioural change. This is due to their popularity in providing leisure

[4] Norris CB, Norris GA, Aulisio D. Efficient Assessment of Social Hotspots in the Supply Chains of 100 Product Categories Using the Social Hotspots Database. Sustainability. 2014; 6(10):6973-6984. https://doi.org/10.3390/su6106973

[5] Benoît-Norris, C., Vickery-Niederman, G., Valdivia, S. et al. Introducing the UNEP/SETAC methodological sheets for subcategories of social LCA. Int J Life Cycle Assess 16, 682–690 (2011). https://doi.org/10.1007/s11367-011-0301-y

[6] UNEP-SETAC, B. C., & Mazijn, B. (2009). Guidelines for social life cycle assessment of products. UNEP, Paris.

activity and entertainment to players. Researchers exploited the appeal of playing games to influence players' behaviours after witnessing significant behaviour changes while playing[78]. New terms have emerged to define these types of games such as: serious gaming, gamification, persuasive games, etc. DECIDO is using that approach in the design and in the simulation of new or improved policies. Designing a persuasive game for serious purposes requires a thorough understanding of the relevant behaviour change theories that can feed into the design process. Games that have been employed to make an impact on players' behaviours are often aided by well-known behavioural change theories and the engaging characteristics of game design elements and mechanics.

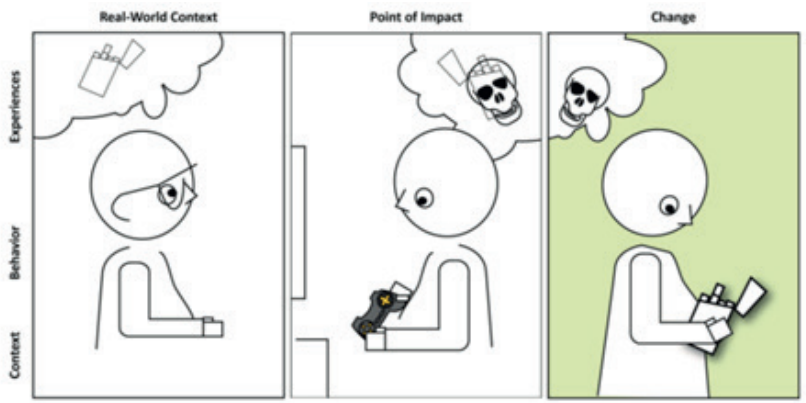

Fig. 10. Behavioural change

Games can facilitate a behavioural change by first aligning the game process with the user's real-world context, using Process Twin representations, secondly by introducing the change catalyst in the user experience, deeply related to profiles, during interaction with the serious gaming process and thirdly by letting the change catalyst affect the user' post-play behaviour[9]. Again, here in the DECIDO project high GDPR issues were managed with the previous described actions.

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7 Boyle, E.; Connolly, T.M.; Hainey, T. The role of psychology in understanding the impact of computer games. Entertain. Comput. 2011, 2, 69–74.

8 Baranowski, T.; Buday, R.; Thompson, D.I.; Baranowski, J. Playing for real: Video games and stories for health-related behavior change. Am. J. Prev. Med. 2008, 34, 74–82.

9 Doumanis, I., & Smith, S. (2015). Validation of Games for Behavioral Change:

Behaviour Change Games (BCG) form a subset of serious games, which were designed to support attitude and change behaviours; in the project case to introduce innovative policies. BCG have the same nature as what are often called persuasive games. Persuasive technology is defined as "an interactive product designed to change attitudes or behaviours by making desired outcomes easier to achieve"[10]. Persuasive games have applications in many fields, such as health games, political and social games, and advertising games aiming to change behaviour regarding certain issues, such as encouraging recycling, discouraging smoking, or increasing voting[11]. The ethical implications of that process could be dramatic and need to adhere to GDPR, in all cases a DPIA is strongly suggested when applying BCG.

6.2.3. Self-Determination Theory (SDT) and Theory of Planned Behaviour (TPB)

The most adopted theory for designing BCG is 'Self-Determination Theory' (SDT)[12], as it is empirically based on human motivation[13]. SDT together with the gaming technology dimension is presenting more evidence on how processes simulation can support citizens engagement and enable their motivational orientation to progress in social innovative attitudes. During DECIDO experiments citizens, practitioners and volunteers had the opportunity to test innovative policies simulated or applied in small scale adopting the BCG schema. In this way DECIDO motivated citizens to be engaged in Social Lifecycle Assessment addressing their specific selected processes. Accordingly, the digital

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Connecting the Playful and Serious Parnassia Addiction Research Centre Brijder, The Hague, r. spijkerman@ brijder. nl. Int. J. Serious Games, 2(3), 63-75.

[10] Fogg, B.J. Persuasive technology: Using computers to change what we think and do. In Ubiquity; Association for Computing Machinery: New York, NY, USA, 2002; Volume 2002, p. 5

[11] Wright, W.; Bogost, I. Persuasive Games: The Expressive Power of Videogames; MIT Press: Cambridge, MA, USA, 2007

[12] Cheng, K. M., Koo, A. C., Shariza, J., & Wong, S. Y. (2022). An Evaluation of Online Edcraft Gamified Learning (EGL): Understanding Motivation and Intention of Recycling Among Youth During COVID-19 Period.

[13] Thomas K. F. Chiu (2022) Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic, Journal of Research on Technology in Education, 54:sup1, S14-S30, DOI: 10.1080/15391523.2021.1891998

support, represented using frameworks' Processes Twins in a Serious Gaming environment, provided a realistic vision of applied processes.

Fig. 11. Self-Determination Theory Conference 2013 by Richard Ryan

The second most adopted theory was the 'Theory of Planned Behaviour' (TPB). According to the theory, human behaviour can be explained by three factors — behavioural beliefs, normative beliefs, and control beliefs. When this process could be implemented in a simulation environment with the use of Process Twin will be evident the risk to have privacy infringement collecting data to model the simulated actor behaviour. Beliefs can lead to favourable or unfavourable attitudes and normative beliefs, which may result in subjective (so profile conditioned), norm and control belief that may turn into perceived behavioural control. Subjective norm refers to the social pressure that people experience when deciding whether to do anything. The views of community members can easily influence an individual's decision to engage in a particular behaviour. Here, gamified activity might have a positive outcome if there is a positive influence among friends within the activity; during DECIDO project Hackathons one of the main objective is to create that "positive influence".

6.2.4. The three phases process

A propaedeutic framework should be designed to guarantee all ethical requirements are followed even if profiling of actors is in a way

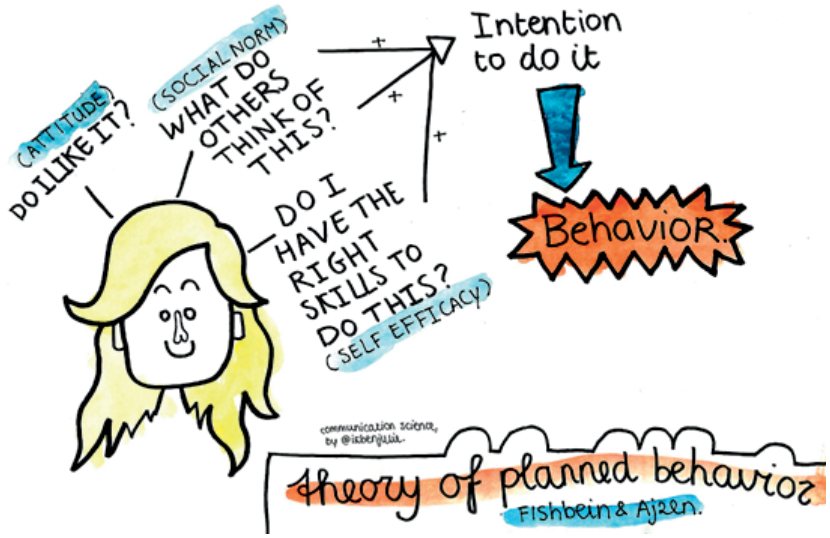

Fig. 12. https://www.comminit.com/la/content/theory-planned-behavior

mandatory to run the proper simulated process. In view of that DECIDO project team is submitting specific informed consents to all participants to each simulation.

A three phases process has been identified. The first phase should be the representation of the innovation process we would like to address in a serious game ready Process Twin collecting all information needed, both public available (EOSC) ones and specifically collected, to evaluate the real process. This will be probably the most delicate action due the border between fare and not fare behaviour is not so

Fig. 13. Process twinning to reach BCG

defined, and it could even happen that we could infringe regulation not being aware of that. In this step probably an external ethical audit could be welcome.

Once the process could be fully simulated through its process twin, we can proceed applying S-LCA principles being advantaged by Process Twin data which will allow a precise accountability of all action performed in the full respect of ethical regulations.

When the revised process will be ready the simulation and its use for Behaviour Change could be performed and a further ethical and privacy check could be assessed.
From the ethical point of view each of the three phases must face some risks and the following table try to summarise them:

Phase	Risk	Contingency
1	During the Process Twin preparation some privacy issues could be hidden (e.g., behavioural patterns identifying fragilities).	External (or internal), ethical audit is needed to guarantee creation and use of Digital Twin is respecting defined ethical principles. In all cases the proper informed consent, according to the GDPR, should be used.
2	S-LCA accountability standards are not consolidated: most of the experience is related to production processes either than services.	The use of Process Twin can help providing data related to processes that can help the assessment of potential standards going beyond ISO 14040.
3	Behaviour Change Games is a challenge due two counter approaches will be in place: BCG and TBP.	DECIDO Social Hackathons should be flexible enough to adapt the flow to different types of communities and person so to smoothly move from self-determinate to normalised approaches seamlessly.

Tab. 1. Risks Contingency

6.2.5. The gained capital of DECIDO experience

During the DECIDO experience the described methodologies have been used in a transparent way and the positive reaction experimented should suggest our team to go ahead improving three main components of our strategy: Engagement, Involvement, Accountability as described in the infographic.

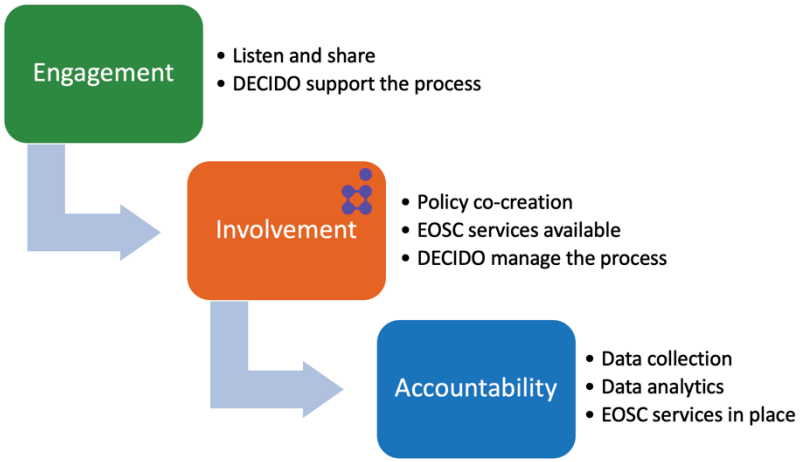

Fig. 14. DECIDO capitalising Social Lifecycle Assessment

The integration of DECIDO platform with EOSC services provides the full coverage to the Social Lifecycle Assessment processes, providing support for stakeholders' engagement while for the involvement DECIDO platform provides a set of services that covers the process twinning allowing to evaluate simulated policy.

For the results accountability DECIDO is counting on EOSC services for data collection and data analytics.

6.3. The training within DECIDO

Vanni Resta

This section is dedicated to training as one of the relevant components within the DECIDO project work programme.

As happens with many innovations project it is not possible to derogate from dedicating some effort to the training activities. Considering DECIDO project schedule, since its creation phase, it was logically decided to start this item at the nineth months from the kick-off.

DECIDO training is based over the consideration that three are the relevant types of audience:

- Citizens and other stakeholders providing input via the co-creation
- Students approaching the emergency management themes
- Public Authorities in charge to adopt policy making.

The mentioned categories are represented in a totally different manner in the project's pilot sites. So, as a first consequence was that all the training activity were necessarily tailored over the two phases of experimentation to test the DECIDO outcome in the 4 pilot sites:

1. Forest fires in Kajaani, Finland. Were the analysed case being the prevention and protection against forest fire with the co-creation of procedures to mitigate damage to nature, infrastructure and life.
2. Floods response to the Pandemic and hospitality of Ukrainian refugees in Torino, Italy. Here it is relevant to mention that against the idea to improve design of emergency policies related to floods and weather alerts in two areas of the City of Turin (Meisino Park and Murazzi), due to the climate change it was agreed to switch all the piloting activities to the social crisis following the pandemic event and, afterward, as a consequence of the war in Russia against Ukraine to increased flow of incoming people management.
3. Power outage in Greek Municipalities. Taking into consideration the impact mainly on small islands of power outage management of public infrastructure and cultural assets via a shared emergency response mechanism.
4. Wildfires in the Aragon Region, Spain. Were in a different way of the first use case improve the design of emergency policies related to wildfires and management of controlled fires.

Something to mention is that not all the Consortium Partner had a dedicated budget to perform training activities. The main players were: KPRF with the role of Coordinator and LC, KAJ, Vol.to, CTO, SCN, IBERCIVIS, ARAGON. A peculiarity in the configuration of the training provision is that the two universities belonging to the Consortium: KAMK Kajaani University of Applied Sciences and NTUA National Technical University of Athens were not directly involved in providing didactic activities.

The training provided during the DECIDO life cycle followed the logical schedule of the overall project plan and, of course, incorporated the illustration of the pilot results with the following project declared outputs, since the proposal writing phase. In detail:

- Output 1: Recommendations
  Identification of a set of pathways, recommendations and lessons learnt addressing Public Authorities through the transition towards the use of the European Cloud Infrastructure and the application of evidence and co-creation in the policy lifecycle.

- Output 4: Citizen Engagement
  The focus for the involvement of local actors will be on: (1) the methodological side (e.g. co-creation of indicators), (2) the identification of needs and priorities, and (3) the data generation (e.g. through citizen science experiments where applicable).

In line with the characteristic of novelty of the project the DECIDO training comprised both innovative and traditional channels and tools. An example of the first category is the hackathons. About the second category, during the project life a huge number of frontal and/or online courses and webinars took places.

For better detailing the first category a methodology on how a "DECIDO hackathon" should be implemented was developed and the "training team" of the Consortium customized processes behind that as will be presented in the next pages.

Before starting the description on what done in twenty-seven months of activity it is the case to mention two basic assumptions made planning the training within the project reported in the next.

6.3.1. The Gender Equality Strategy in providing training

Keeping into consideration a Gender Equality Strategy (GES) while planning and providing a didactic path was considered a crucial aspect since the beginning. A sort of pillar inspiring the planning of methodologies, kind of actions to be put in place to maximise the learning and collection of feedback to be provided both by trainers and trainee statistically balanced to evaluate what achieved. In other words, a special effort was dedicated to provides participants, in all the phases starting from the selection of learner participating to any training action, with the relevant knowledge, skills and values that allow them to contribute to the effective implementation of the gender-mainstreaming strategy in their field, organisation, institution or country.

To effectively mainstream gender, DECIDO training actors were able to:

- Define gender-equality objectives as the most important things more than considering the simple statistic gender balance
- Take account of gender affecting the capability of creating new policies and implementing action in general, taking into consideration different gender priorities

- Identify gender inequalities in all the domain of DECIDO project of field activity
- Evaluate programmes two folded with a gender perspective.

All these actions required adequate theoretical knowledge, practical skills and sometimes also a change in attitude and behaviour. Recognising that no political or organisational practice is gender neutral and this is a learning process too.

A well-designed legal and institutional GES framework as well as good organisational management were essential for achieving the expected results. But it was equally important to equipe individual staff members with the understanding and tools that enable them to perform their gender-mainstreaming duties well.

6.3.2. The respect of the Do Not Significant Harm (DNSH) principle on training

Another pillar on which the training of DECIDO had been based on was related on the environmental sustainability. As known, on April 2021 the EU Commission adopted a delegated act laying out assessment criteria regarding the contribution of certain economic activities to objectives of the European Green Deal. These environmental objectives are defined as part of the EU Taxonomy Regulation, a classification system for environmentally sustainable economic activities, which came into force in July 2020. Planning and supplying training activities in DECIDO was considered as one of the sustainable activities withing the taxonomy. Of course, training could not be related to all the six objectives but, at least, to the first two environmental ones (climate change mitigation and adaptation).

Making the DECIDO Training Green meant to be, as much as possible, paper-less and where this was not possible using environmentally compatible materials like: eco-ink, recycled paper and reducing the use of any kind of pollutants.

6.3.3. The listeners of DECIDO training compared with their skills

The audiences within DECIDO included technical professionals, user professionals, data entry clerks, clerical staff members and executives. Based on the information available on each project's pilot sites, the on-field activities took place and the actors involved, followed an in-depth

classification of stakeholders useful for training purpose. These categories were:

Social actors: related to group or community that is the passive subject of an emergency situations and may be directly involved in them.

- Citizens: residents, people close to emergencies or directly affected by them. Within the citizenry there is a group of public service users whose actions may have an impact on some emergency situations (i.e., wildfires)
- Civil Society organisations such as local NGOs: that can raise awareness and provide guidelines to citizens and businesses to help the local communities better handle power outages
- Press: audio-visual media (local/regional radio and television) responsible for informing the public (mainly the affected local citizens) about the emergency situations when they occur.

Intervention actors, including all those actors involved in direct intervention in emergency situations. This is a heterogeneous group of stakeholders that depends on the intervention structure of each pilot and is made up by the following stakeholders:

- Civil protection authorities
- Rescue department
- Fire department
- Emergency medical services
- Police
- Social welfare authorities
- Local businesses
- Volunteers
- Public bodies at different levels: municipalities, regional governments, national.

Advice, knowledge and expertise providers: based on their knowledge and experience, this stakeholder group can contribute ideas, suggestions and solutions to complement and improve the emergency protocols in place:

- Researchers in the technologies or research areas of the project
- Technology providers experienced in systems integration
- Consultants: providing expert advice in fields such as improving operational processes or interacting with public entities.

Political actors: not directly intervening in emergency situations but responsible for making decisions affecting emergency response protocols:

- Policy makers, including all levels of government from local to regional and national bodies involved in shaping policies and strategies to address emergency situations
- Funders, funding bodies, organisations that would finance DECIDO-like initiatives in other areas as well as future initiatives based on DECIDO results.

Worldwide, there are currently more than 600.000 extension workers comprised of administrative staff, Subject-Matter Specialists (SMS), fieldworkers, and some multipurpose unidentified people; the Asian and Pacific countries have absorbed more than 70% of them. The percentage of extension personnel by position, was 7% administrative, 14 % SMS, and 79 % field staff, with regional differences. Almost 13% of extension workers are women, with significant regional differences. The ratio of SMS to field staff is also low in Asia, Africa, the Near East, and Latin American countries, varying from about 1:11 to 1:14. The ratio for countries of Europe and North America varies from 1:1.5 to 1:1.6. The worldwide ratio of SMS to field staff is around 1:11.5.

Deficiencies in knowledge, skills, and ability among extension personnel, particularly those of Asia, Africa, and Latin America, are remarkable. About 39% of the extension personnel worldwide have a secondary-level and 33% an intermediate-level education. Moreover, within each region, there is a lot of variation in basic academic qualifications of the frontline extension workers, SMS, and administrators. Differences in training received are also wide. In Africa, most frontline extension workers still have only a secondary school diploma. The poor educational background of extension personnel necessitates regular training.

6.3.4. Approach in providing training

A possible definition of training is "the process of acquiring specific skills to perform a job better". It helps people to become qualified and proficient in doing some jobs. These two statements are the base of the DECIDO training strategy.
There are at list three relevant approaches to training:

1. the traditional approach
2. the experiential approach
3. the performance-based approach.

DECIDO training action, in a sense, is a mix of them and its actions to be realised are the mirror of that. In the traditional approach, the training staff designs the objectives, contents, teaching techniques, assignments, lesson plans, motivation, tests, and evaluation. The focus in this model is intervention by the training staff. In the experiential approach, the trainer incorporates experiences where in the learner becomes active and influences the training process. Unlike the academic approach inherent in the traditional model, experiential training emphasises real or simulated situations in which the trainees will eventually operate. In this model, the objectives and other elements of training are jointly determined by the trainers and trainees. Trainers primarily serve as facilitators, catalysts, or resource persons. In the performance-based approach to training, goals are measured through attainment of a given level of proficiency instead of passing grades of the trainees. Emphasis is given to acquiring specific observable skills for a task. This Performance-Based Teacher Education (PBTE) model is mostly task or skill centred and is also applicable to non-formal educational organisations such as extension.

Training may also broadly be categorised into two types:

- preservice training
- inservice training.

Preservice training is more academic in nature and is offered by formal institutions following definite curricula and syllabuses for a certain duration to offer a formal degree or diploma. Inservice training, on the other hand, is offered by the organisation from time to time for the development of skills and knowledge of the incumbents.

Furthermore, preservice training is a process through which individuals are made ready to enter a certain kind of professional structured job such as agriculture, medicine, or engineering. They must attend regular classes in a formal institution and need to complete a definite curriculum and courses successfully to receive a formal degree or diploma. They are not entitled to get a professional job unless they can earn a certificate, diploma, or degree from the appropriate institution. Preservice training contents emphasise mostly technical subject matter as well as pedagogical skills to prepare learner to work.

Inservice Training and Staff Development is a process of staff development for the purpose of improving the performance of an incumbent holding a position with assigned job responsibilities. This is, of

course, the case closer to DECIDO project. It promotes the professional growth of individuals. "It is a program designed to strengthen the competencies of extension workers while they are on the job meaning real conditions". Inservice training is a problem-centred, learner-oriented, and time-bound series of activities which provide the opportunity to develop a sense of purpose, broaden perception of potential users, and increase capacity to gain knowledge and mastery of techniques.
Inservice training may broadly be categorized into five different types:

1. induction or orientation training
2. foundation training
3. on-the-job training
4. refresher or maintenance training
5. career development training.

All of these types of training are needed for the proper development of extension staff throughout their service life.

While the first and the second type are dedicated to new workers after the employment, within DECIDO scope, only the third, the fourth and, partially, the fifth are relevant and it is the case to better detail them.

On-the-Job Training. This is *ad hoc* or regularly scheduled training, is provided by a subject-matter specialists to the field staff (e.g. DECIDO pilots). This training is generally problem or technology oriented and may include formal presentations, informal discussion, and opportunities to try out new skills and knowledge in the field. The trainee must play a role in providing on-the-job training to the staff while conducting day-to-day normal activities (as is happening i.e., in a hackathon).

Maintenance or Refresher Training. This training is offered to update and maintain the specialised subject-matter knowledge of the incumbents. Refresher training keeps the specialists, administrators, subject-matter officers, extension supervisors, and frontline workers updated and enables them to add to the knowledge and skills they have already. Maintenance or refresher training usually deals with new information and new methods (i.e., new policies co-created in DECIDO project), as well as review of older materials. This type of training is needed both to keep students at the peak of their possible performance and to prevent them from getting into a routine.

Career or Development Training. This type of in-service training is designed to upgrade the knowledge, skills, and attitude or ability

of employees to help them assume greater responsibility in higher positions. Although extension workers are responsible for designing their own career development education, the extension organisation sometimes sets some criteria and provides opportunities for the staff by offering options.

6.3.5. The main two DECIDO training actions and the methodology behind

Training methods used in the DECIDO project descended to the needs and skills identified. In other terms before planning any training a needs and skills analysis was performed taking into account factors such as: course objectives, target audience, media characteristics, training criteria, and effort needed. The materials for the chosen training, such as course outlines, audio-visual aids, instructor and student guides, student workbooks, examinations and reference manuals will be presented in this section. Before doing that, it is good to present the two way to implement project's training actions.

6.3.5.1. Hackathon methodology and guiding principles

A special attention is here dedicated to the methodology to organise this kind of creative training action. This is because this training channel is considered the most adherent to the DECIDO project goals and the trials foreseen.

In terms of hackathon types, one of the obvious ways of splitting hackathons into different types is by segregating them according to the way they are conducted. This allows us to figure out three main groups – offline, or on-site hackathons (mainly for the DECIDO pilot phase), online hackathons and hybrid one.

The main similarity between the three is still the main goal of a standard hackathon – to either collaborate or compete as teams of specialists to solve a specific problem while running a hackathon.

There are other common points, of course, but the main goal of either of the hackathon types remains the same. Additionally, online events hosted using dedicated hackathon-related platforms are capable of receiving a number of advantages over the traditional offline events, such as: better chances of reaching someone via social media sites, way bigger audience due to the geographical constraints hav-

ing much less impact, and the overall better community engagement as a whole.

Online hackathons do have to have a unique set of rules about specific parts of the event, including submissions, judging, etc. This is due to the number of potential problems that may or may not arise in the middle of your online hackathon.

DECIDO hackathon methodology for organisation could be split in the following guidelines.

It is possible to figure out a list of tips that could be applied to most of the online hackathons. It's possible that there will be some smaller nuances in the process of planning/performing a hackathon, but the general idea could be boiled down to the following important tips:

Figure out the goal of the hackathon

An actual goal that's supposed to be accomplished is a crucial part of any hackathon in any field. While hackathons could easily be considered one of the most valuable networking resources, the prime goal of any one of those is still to solve a specific problem. Additionally, the clearer the goal is, the more likely it is to bring results in the first place. A clear, detailed goal, like "solving an issue about flooding in a park or decreasing the damages created by a wildfire or containing the effect of a power outage and its related problems" is much clearer than anything that is more abstract or less precise.

Set the correct date for the hackathon (before, during and after a pilot operation)

The correct scheduling is also as important, meaning that it is possible to have a much higher participant counter while organising a hackathon in a way that is not interfering with some other event especially considering the case of dealing a situation of emergency.

Notify your participants in advance

Even this could be considered trivial, depending on the scope of your hackathon, it's recommended to provide the participants with information about their participation from weeks to months before an actual event, especially when more popular professionals are involved.

Limit the number of participants

This part depends heavily on the peculiarity of the hackathon in question and is actually much more relevant for organising a hack-

athon offline, rather than online. Having too many participants might result in a plethora of issues without the possibility to solve all of them at once. This also goes for online hackathons, as well, which is why thinking about the potential number of participants in advance could do an hackathon a lot of good in the future.

Split people into groups (teams)

Effectiveness is one of the more important parts of organising a hackathon, since all of them have a defined goal. It might not seem that important if a collaborative hackathon is organised, but on the other hand, if a competitive hackathon is in the first place, there will be the need to carefully think through how to separate attendees in groups without making it unfair. In that case, it's recommended for any group to consist of both subject experts and the relative newcomers, so that the entire effort would not seem like an unwinnable situation.

Set up a clear set of rules beforehand

A clear set of rules is another requirement that mostly concerns the competitive part of running a hackathon, but also applies to all of the collaborative ones, as well. Since the competitive environment usually forces different groups of experts to compete with each other, it's highly important for the entire event to have a defined set of rules that applies to everyone with no exceptions. This goes for both the competitors, having the same amount of time for the job, and the organisers, having specific rules about judgement, submissions, permitted/forbidden technologies, and so on. At the same time, a collaborative effort might not need to have a strict and complex set of rules in place to succeed.

Decide between having one large award and several smaller ones

Competitive hackathons also have the choice between having one award for the winning spot and several awards for different achievements. Having multiple different competition fields usually attracts more competitors, especially when the event in question is an external one to begin with.

6.3.5.2. The traditional training action methodology and principles

It is thus clear that any kind of online or frontal action that is not an hackathon had been considered in the DECIDO project language as a

"traditional" didactic event. For these kinds of events the methodology comprises the following steps:
Main elements

- Creation of a training module
- Definition of training programs
- Logistic organisation (classrooms, facilities, etc.)
- Development of an e-learning supporting platform.

Key features

- Pilot site characteristic for: preparedness, protection, assistance, emergencies knowledge, etc.
- Multidisciplinary themes for courses
- Network of stakeholder interested in trained professionals
- Increased risk awareness for the end-users
- Creation of a body that promotes the role of the new professionals and ensure constant training.

How to reach people

- Involve other on-field training entities (from schools to universities) and other student's basins with presentation and meeting
- Promotion through stakeholder networks with whom DECIDO already has an established relationship or a memorandum of understanding
- Targeted campaigns (social media and e-mail).

To offer diversified training courses after which the trainees may be inserted into working environments while remaining within a completely new professional network (professional association of prevention & disaster manager).

Prevention interventions, to be effective, must be maintained over time and updated in accordance with legislative rules and regulations. Solutions for end-users include: monitoring, continued consulting over time, heritage valorisation.

The network of professionals would also collect data on the invisible assets and gain a vertical mapping on the DECIDO Countries territory.

Expectation were:

- To strengthen relations with national and international partners, to establish an ongoing dialogue with the Professional Association of Risk & Disaster managers, with the Civil Protection Department and with the main European voluntary associations.

- DECIDO TP should grow aiming at a European market, particularly in those countries more culturally sensitive and geographically more prone to climatic disasters (Netherlands, Germany, Austria, United Kingdom, etc.).
- Propose memoranda of understanding with leading European universities for research aimed at studying and developing new models and tools applied to prevention and restoration of cultural heritage.

6.3.6. Post-Training Evaluation

At the end of any DECIDO training action (hackathon or traditional one), an assessment based on learner feedback was foreseen. So, at the end of the learning action a post-training questionnaire had been distributed to the learners. What's commonplace though is that these post-training learner surveys often get less attention compared to the development of learning content and course materials (or sometimes omitted entirely). Giving that within DECIDO training framework any design concept of post-training assessment had been considered.

This mindset had been applied to the evaluation questionnaire preparation also taking into consideration the different categories of learners' goals in mind. Since evaluation is a crucial part of course design, the following five aspects had been included creating the Learning/eLearning evaluation questionnaires.

1. Effectiveness

As a critical element for measuring the performance of the training program. It is also the most important aspect when it comes to creating a post-training evaluation questionnaire. It establishes learners' perception of whether or not the course helped them attain their learning objectives.

Moreover, the learners' opinions on the effectiveness of eLearning courses are an indicator of how relevant the lesson is for them. It will tell you if they think that the skills, they've learned can actually be helpful for their everyday work. This part of the survey asks if the learners' "What's In It For Me?" (WIIFM) question was addressed and if they are satisfied with what they have learned. About this aspect it had been asked to the learners how effective the course or program was in achieving their learning objectives. Asking what they think the

best and worst aspects of the program were and some suggestions on how to improve those.

2. Comprehension

The comprehension aspect of a post-training evaluation questionnaire refers to the effectiveness of the course delivery. This section in learner satisfaction survey asks questions about the way the course content was delivered. This element also includes the conciseness and clarity of content. Was the subject matter easy for the learners to follow and understand? Was the wording of any written materials clear? Were the multimedia materials clearly visible and audible? In case of ah hackathon, was the problem object of the exercise totally considered/solved?

For face-to-face or synchronous training, this part of the survey also included the manner in which the lesson was facilitated. Was the trainer knowledgeable in the subject matter? Was the facilitator able to explain the topic in a way that the audience can relate to? Did the instructor offer enough support to the learners during the session? These were some of the questions included in the post-training evaluation questionnaire.

3. Attractiveness

The course's overall look and feel had been also an integral part of a post training evaluation questionnaire. Any type of course-related material like participant handouts, presentation slides, or multimedia fall under this aspect. This is a critical component – particularly for eLearning courses – because it considered if the course interface, learning environments, and multimedia resources were aesthetically appealing. Since eLearning is a medium that's heavily dependent on visual design principles, course creators paid a lot of attention to the attractiveness factor.

While it may seem trivial to most, the learners' exposure to the look and feel of the course can greatly affect the learning experience. Thus, having well-crafted multimedia resources also matter – especially for self-paced, asynchronous courses.

When feedback had been solicitated, it was asked to the learners to rate the multimedia components (video, audio, and images) of the program based on how attractive the course attendees think those were. A question will be related to solicit suggestions on how to make the course more appealing in terms of visual and/or auditory aspects.

4. Engagement

Mainly for hackathon and face-to-face sessions, engagement came in the form of active learning approaches like simulations, activities, and collaborative work. For eLearning, these can be in the form of games, interactive quizzes, and branching scenarios. For the post-training evaluation questionnaire, it had been asked to the learners to rate the course based on how engaging it was. Another question was how satisfied the learners were with the interactivity provided by the course.

5. Suggestions

Of course, no post-training evaluation questionnaire is complete without a part that asks for suggestions. The main challenge, however, was that this part is usually skipped by learners. Most of the time, these open-ended questions require them to take a little bit of time to come up with responses. A friendly tip on how to do this: require the learners to put at least three suggestions to improve training effectiveness. If they don't put anything in the "suggestion box" the system did not allow them to proceed and complete the course. In the "suggestion box" was asked to learners on what changes they would like to apply to the program as it is and it was also asked for future ideas on program improvement.

6.3.7. Final section's notes

Training is a circular process that begins with needs identification and after a number of steps ends with evaluation of the training activity. A change or deficiency in any step of the training process affects the whole system, and therefore it is important for a trainer to have a clear understanding about all phases and steps of the training process. A training programme has a better chance of success when its training methods are carefully selected. A training method is a strategy or tactic that a trainer uses to deliver the content so that the trainees achieve the objective. Selecting an appropriate training method format described in the previous sections was perhaps the most important step in training activity once the training contents were identified. There are many training methods, but not all of these are equally suitable for all topics and in all situations. To achieve the training objective DECIDO trainer tried to select the most appropriate training method for the content to involve the trainees in the learning process. Four major factors were

considered when a training method had been selected: the learning objective, the content, the trainees, and the practical requirements.

6.4. Impact on the European Stakeholders

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6.4.1. Introduction

The DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies) Project aims to boost the use of the European Open Science Cloud (EOSC) by public authorities, enabling innovation in the policy-making sector and promoting cross-support and collaboration across Europe. By harnessing innovative methodologies, tools, and data, DECIDO seeks to empower policy-makers with the necessary competencies, resources and tools to integrate and leverage data from multiple sources for evidence-based decision-making.

6.4.2. The importance of European stakeholders in EU policy-making.

The involvement of European stakeholders in EU policymaking is crucial for the effective development and implementation of evidence-based policies. As highlighted by the DECIDO project, the collaboration between public authorities, the citizen science community, and the European Cloud Infrastructure (ECI) is essential in addressing the complex challenges European societies face.

Advancements in information technology, such as cloud computing and big data analytics, have increasingly advanced decision-making processes in the corporate sector. The public sector can also benefit from these advancements by having access to diverse data sources and integrating and analysing them in a scalable and effective manner. DECIDO addresses the technical and policy challenges related to data discovery, access, and exploitation while ensuring a secure environment for data processing.

In order to develop evidence-based policies, it is vital to ensure the availability of the right data and information in an accessible format. The data support the monitoring and evaluation of political strategies

and programs, enabling agile and responsive policymaking. Monitoring systems should align with key political objectives, priorities, and needs, and provide insights into trends and implications. DECIDO highlights the importance of a participatory approach, involving relevant stakeholders and users from the beginning of the project, to ensure a data-driven approach and ICT-related measures based on stakeholders' feedback and suggestions.

The involvement of local actors and stakeholders in the policy-making process through co-creation approaches builds legitimacy and decreases citizens' distrust in government. DECIDO recognises the significance of analysing the context of various factors in a balanced way, including the questions posed, incentives offered, and tools to be used. The project provides a mixed framework with instruments, guidelines, and approaches that foster co-creation and citizen science, enabling effective involvement of actors throughout the policy lifecycle. This approach aims to gather a thorough understanding of the impact of cloud computing and big data technologies in evidence-based policy-making, leading to recommendations and lessons learned for the introduction of these technologies and approaches by public authorities.

Furthermore, DECIDO focuses on assessing transformative impacts in disaster risk management through pilots conducted in different EU countries. These pilots, which cover various domains including floods, fires, and power outages, demonstrate the applicability, impact, reusability, and scalability of the proposed tools, models, methods, and approaches.

The involvement of European stakeholders and policy-related actors is essential in EU policy-making to effectively develop evidence-based policies. The DECIDO project highlights the importance of collaboration between public authorities, the citizen science community, and the European Cloud Infrastructure, leveraging innovative methodologies, tools, and data. By promoting cross-support, collaboration, and the use of advanced technologies, DECIDO aims to enhance the policy-making process and enable more informed and effective policies for the benefit of European societies.

Overview of stakeholders and benefits:

- Policymakers: To reduce the time needed to generate high-quality services and improve policy-making services.
- Citizens: To actively participate and contribute to public policy-making, to have higher data access for better and informed decisions.

- Businesses: To accelerate innovation and business development and to reduce costs on innovation generation.
- Academia, Research centers and scientists: To access a large volume of data for scientific purposes.

Boosting the use of European Cloud Infrastructures:

- The DECIDO pilots act as intermediaries between the public sector, citizen science, and the European Cloud Infrastructure (ECI) through direct collaboration with EOSC.
- Storage capacity and processing power through the EGI infrastructure are provided for the successful pilot implementation of the project.
- The pilots use EOSC's catalogue and marketplace, external services/tools, data from EOSC and other providers (e.g., European Data Portal), including public administrations.
- Integration of identified datasets, workflow execution, and result refinement and publication are facilitated by EOSC.
- EGI provides federated cloud, notebooks, EOSC-compatible AAI, cloud storage, and computing resources.

Handling Big Data in Evidence-based Policymaking:

- Creation of the DECIDO Data Catalogue consisting of datasets provided by the pilots.
- Collection of data from EOSC, such as satellite data.
- Gathering of information provided by stakeholders (citizens, businesses, policymakers, etc.) during co-creation workshops.
- Analysis of the collected data during the implementation phase.

6.4.3. Building a Community for Next-Generation Policymaking

At its heart, DECIDO is dedicated to forging a robust community of stakeholders aligned with the vision of "Next Generation Policy Making." The Project bridges individuals and organisations, fostering an environment in which expertise and experiences flow seamlessly. This collaborative approach underscores the push for European Open Science Cloud (EOSC) adoption by Public Authorities. By doing so, DECIDO addresses the European fragmentation while amplifying cross-collaboration, promoting support networks, and tapping into secure, data-intensive services.

The added value of the DECIDO project is its stakeholder community. The project engages various actors and contributors, from social

actors, including citizens affected by crisis emergencies, to Civil Society organisations (NGOs/CSOs) that raise awareness and guide local communities. The role of the press, especially local media outlets, in conveying information during emergencies cannot be overstated. Moreover, intervention actors like the Fire Department, the Police, Emergency medical Services, (EMS) and various public bodies work tirelessly and intensively in emergency responses. In the backdrop, advice, knowledge, and expertise providers, such as researchers, technology providers, and consultants, provide invaluable insights to enrich emergency protocols.

The DECIDO project's impact is not limited to immediate responses. Political actors and policymakers in various governmental sectors shape vital policies and strategies to tackle emergency situations. Beyond this, funders and investors play a crucial role, potentially financing future initiatives influenced by DECIDO's outcomes and exploitable results.

With its encompassing approach, DECIDO is not only about cloud and big data technologies in policy making. Within its ambit, stakeholders and experts converge to discuss the evolving needs of policymakers, exploring state-of-the-art tools, technologies, and methodologies to enhance public sector operations.

6.4.4. Representation of Diverse Perspectives

According to the Cambridge Dictionary, a stakeholder is defined as a person involved with an organization, society, etc., bearing responsibilities towards it and having a vested interest in its success.[14]

European stakeholders represent a variety of actors, starting from industry representatives, civil society organisations, trade unions to professional associations and advocacy groups. The wide range of participating stakeholders allows for a holistic approach to policymaking, capturing various perspectives, concerns, and even expertise. As a result, the formulated policies are comprehensive, and balanced, aligned with the needs and interests of European citizens.[15]

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[14] *Stakeholder* (no date) *Cambridge Dictionary*. Available at: https://dictionary.cambridge.org/dictionary/english/stakeholder

[15] European Economic and Social Committee. (2020). The Role of Civil Society Organizations and Non-Governmental Organizations in Shaping the European Policy Agenda. Retrieved from https://www.eesc.europa.eu/en/news-media/news/

In recent European policy initiatives, the involvement and impact of the DECIDO project have become increasingly prominent along with the engagement of relevant national and European stakeholders.

This is evident from the numerous collaborations and participations in notable events:

The Annual Conference and General Assembly of the Cities Network "SUSTAINABLE CITY", held on 16/12/2021, provided an apt platform to underscore the role of DECIDO in sustainable urban development. The main theme, "Designing tomorrow's environment today," reflected the project's ambitions. Notably, insights were offered into the project's milestones, presenting the vast strides DECIDO has made since its inception.

Another event that showcased the project's clout was the online session on 10/02/2022, in collaboration with EUROPE DIRECT Peloponnisos. Titled "A European Green Deal," the session sought to address the multifaceted challenges of climate change while spotlighting the European Green Deal's goals. Here, DECIDO's strategies and objectives played a pivotal role, elucidating how they align with the broader European sustainability agenda.

Hackathons have been a focal point of DECIDO's active engagement with stakeholders. The one held in Turin on 27/01/2022 is a case in point. It delved into a range of societal concerns, from flood emergencies to specific support measures during the COVID-19 pandemic. DECIDO's commitment was crucial for fostering dialogue and finding proposed solutions.

In Finland, on 7/04/2022, DECIDO organised another hackathon, that took place in the Kainuu region, centred around evacuation preparedness. It brought together emergency services, public actors, and civil representatives, culminating in constructive discussions and collaborative strategies for future initiatives.

Yet another significant chapter in DECIDO's journey was the hackathon on 9/05/2022, focusing on the situation with Ukrainian refugees. Held in Turin, this event highlighted the discrepancies in data management concerning refugees and emphasized the need for a unified information platform. DECIDO's recommendation of a multilingual

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role-civil-society-organisations-and-non-governmental-organisations-shaping-european

hub to streamline communication and data has been a significant highlight in its proactive approach to policy issues.

In sum, the DECIDO project's active participation in these initiatives underlines its growing influence in shaping European policies and its commitment to fostering collaborations for a sustainable future.

6.4.4.1. Digging deeper

The DECIDO's stakeholder categories are as follows:

i. Social Actors: Representing groups or communities that may be directly impacted by emergency situations.
ii. Citizens: Encompassing residents affected by emergencies, as well as a subset of public service users influencing certain situations, like wildfires, floods, earthquakes etc.
iii. Civil Society Organizations: Local NGOs, play pivotal roles in raising awareness and offering guidelines to citizens and businesses, facilitating better responses to challenges like power outages.
iv. Press: Local and regional media outlets, responsible for disseminating crucial information during emergencies.
v. Intervention Actors: This category of stakeholders captures those directly intervening in emergency situations and includes but is not limited to: Civil Protection Authorities, Rescue Department, Fire Department, Emergency Medical Services, Police, Social Welfare Authorities, Local Businesses, Volunteers, Public Bodies ranging from municipalities, regional to national governments.
vi. Advice, Knowledge, and Expertise Providers: This group, enriched by their specific expertise, offers valuable suggestions and solutions to enhance emergency protocols. It comprises from: researchers specializing in project-related technologies, experienced technology providers in systems integration, consultants, experts in domains like operational processes and public entity interactions.
vii. Political Actors: Though they might not be at the forefront during emergencies, their decisions influence emergency response protocols.
viii. Policy Makers: Encompassing various levels of governance, from local to national, they play a decisive role in formulating strategies addressing emergency situations.
ix. Funding Organisations: Organizations potentially financing future projects inspired by DECIDO's outcomes.

6.4.5. Expert Knowledge and Advice

European stakeholders bring valuable expertise and knowledge on specific policy areas. They are often well-versed in the intricacies and nuances of their respective sectors, making them a valuable source of advice and insights for policymakers. Their input supports the effectiveness of evidence-based policies, as well as they ensure feasibility of implementation.

6.4.5.1. Clustering with other EU-funded projects.

In the contemporary digital landscape, the confluence of Cloud, Big Data, and Artificial Intelligence (AI) has contributed to transformative changes across government services. However, a glaring dichotomy exists, where rapid technological advancements often outpace the evolution of policymaking processes. Acknowledging this disparity, five pivotal EU-funded projects - Policy Cloud, Decido, AI4PublicPolicy, DUET, and Intelcomp - orchestrated the seminal "Evidence-Based Policymaking in Europe Summit 2021."[16]

This virtual summit, held on the 9th and 10th of December 2021, offered a platform to address the urgent need for agility in public sector decision-making. The digital era demands not just faster, seamless service delivery but also anticipatory, data-driven policy frameworks that can adapt to an ever-evolving sociotechnical environment.

The discourse revolved around modernizing the policymaking process to be more agile and responsive. The subsequent day, which garnered 64 participants, delved deep into innovative tools, stakeholder engagement, policy prediction, and governance ethics. Each session culminated in the creation of a policy brief, providing tangible takeaways for the attendees.

The Clusters active collaboration was continued with the joint participation in the Data for Policy Conference series of 2022. During the event, the Data-Driven Policy Cluster facilitated a session titled "Data Usage Improving Public Policies and Policymaking." It was within this framework, DECIDO was showcased with attention to the nuances of data sharing and the categorization of data that necessitates sharing. A primary takeaway from the presentation was the significance of

[16] The post event report is available at this link.

raw data. It was underscored that while raw data should be open and accessible to data scientists, the post-analysis resultant information, rather than the raw data itself, is what necessitates dissemination to policymakers. This delineation between raw data and processed information is pivotal for effective policymaking.

Moreover, it was agreed that the conceptualization of business models and the strategic exploitation of solutions should pivot around this derived information, ensuring that policies and decisions are informed, precise, and effective.

The participation of DECIDO in this session, and its insights into data-driven policy formulation, highlights its instrumental role and contribution to shaping European policy discourses, reiterating its commitment to fostering a data-informed European policy landscape.

6.4.5.2. The Advisory Board and Its Pivotal Role in the DECIDO Project

The DECIDO project, aimed at transforming the way policy decisions are made, acknowledges the need for seasoned guidance to ensure high-quality scientific results and impactful outputs. The Advisory Board of experts plays a supervisory and consultative role, guiding the project Consortium and acting as the backbone that ensures the project's alignment with its overarching goals. The Board with its assemblage of experts, assists in covering multi-disciplinary areas ranging from policy domain nuances to the spheres of science and innovation. Their role further incorporates offering recommendations and guidance for achieving top-notch scientific outcomes and facilitating the dissemination of project results and engagement of national and European stakeholders through their expansive networks.

6.4.6. Bridging the Gap between Citizens and Policy-Makers

European stakeholders act as a bridge between citizens and policymakers, fostering citizen engagement and participation in policy-making processes. They provide a platform for citizens to voice their concerns, interests, and aspirations, ensuring that policies are more responsive to societal needs. By involving stakeholders, EU policymaking becomes more democratic, inclusive, and accountable.

The DECIDO project's co-creation approach demonstrates the commitment to collecting feedback from users and stakeholders on policy

documents and materials. This practice indicates the active involvement of stakeholders in shaping policy through direct engagement and collaboration.

The involvement of European stakeholders in EU policy-making is of utmost importance. Their representation of diverse perspectives, expertise, and ability to bridge the gap between citizens and policy-makers ensures that policies are well-informed, inclusive, and responsive to the needs of European societies. By recognizing and valuing the contributions of stakeholders, the EU can strengthen its democratic processes and enhance the effectiveness of its policies for the benefit of all European citizens.

6.4.7. Stakeholder Perspectives: Feedback and Viewpoints from Key European Stakeholders on DECIDO's contribution.

In order to understand the impact and effectiveness of DECIDO's contribution, valuable insights were gathered from key European stakeholders through interviews, surveys, and testimonials, throughout the project duration and in parallel with the project activities and events that provided the opportunity to share experiences and impressions. The example of the Halki in Greece is quite a good one.

During the period from September 2022 to March 2023 significant advancements have been made in achieving the objectives of the DECIDO project. The primary focus of this initiative was to address power outages in Halki.

DECIDO team effectively formed a stakeholder group comprised of representatives from diverse sectors. This group was instrumental in providing invaluable input and steering the direction of the project's evolution. Within this framework, the Greek Pilot team organized and executed three hackathons. These events gathered a variety of stakeholders and resulted in the generation of innovative solutions tailored for the power outage challenges that Halki faced.

Furthering their collaborative approach, the team initiated two co-creation sessions. These sessions were pivotal in fostering a synergy between stakeholders and the DECIDO project team. During these interactive sessions, participants had the chance to explore the DECIDO portal in-depth, acquainting themselves with the essential tools and knowledge needed for its proficient use.

To underscore the importance of a data-informed methodology for policy development, the team commissioned a survey to gather more comprehensive data regarding emergency scenarios and power outages specific to Halki. By

amalgamating data from existing repositories, hackathon outcomes, and survey insights, a preliminary version of the Policy on Power Outages for the Municipality of Halki was drafted.

This evolving policy aimed to enhance the readiness and management procedures for power outage events. It emphasised the anticipation of potential blackouts, energy demand forecasting, strategies for energy conservation, and outlined actionable recommendations for the local governing body to pre-emptively address the challenges of power outage events.

The subsequent phase involved disseminating timely alerts and adaptive measures to social entities and the general public, calibrated according to seasonal variations and meteorological factors.

Collectively, these accomplishments underscored the unwavering dedication of the Greek Pilot team to the DECIDO project and bore testimony to their pivotal role in shaping the project's trajectory.

Their feedback provides a comprehensive understanding of their experiences and viewpoints on participating in DECIDO. The following section highlights the key themes and feedback derived from stakeholder input.

6.4.7.1. Interviews with Key Stakeholders: Gaining Valuable Insights

DECIDO conducted interviews with influential European stakeholders including policymakers, experts, and representatives from relevant organisations. These interviews aimed to capture stakeholders' feedback, experiences, and critical opinions regarding their participation in DECIDO.

Key themes and feedback that emerged from the interviews include:

i. Concise and Focused Co-creation Activities: Stakeholders emphasized the importance of keeping co-creation activities short and to the point. This approach was found to be appealing and stimulating, encouraging broader participation.
ii. Adapting to Stakeholders' Needs and Availability: Stakeholders highlighted the significance of aligning co-creation activities with the needs and availability of participants, especially citizens. By considering their occupations and availability constraints, stakeholders noted increased engagement and involvement.
iii. Continuous Communication and Information Sharing: Stakeholders stressed the importance of maintaining effective communication

channels with participants throughout the co-creation process. Providing pre-information before sessions, engaging in preparation meetings, and having clear and informative introductory parts during sessions were recognised as essential to facilitate informed participation.

6.4.7.2. Survey Results: Broadening the Scope of Perspectives

To gather a wider range of viewpoints, DECIDO conducted a comprehensive survey targeting diverse European stakeholders across sectors and domains. The survey aimed to gain insights into stakeholders' perspectives on the co-creation process, citizen participation, and approaches to addressing policy challenges.

Key findings from the survey include:

iv. Citizen Participation and Understanding: Stakeholders emphasized the crucial role of citizen participation in co-creation processes. Involving citizens affected by the issues being addressed was seen as crucial for gaining a comprehensive understanding of the problem.
v. Accessible and Secure Data Formats: Stakeholders stressed the need for data used in the co-creation process to be expressed in an understandable format, which can be accessed securely by citizens. The use of sensitive or confidential data was found to hinder citizen participation.
vi. Collaboration with Citizen Events: Some pilots successfully involved a larger number of citizens in the co-creation process by collaborating with other citizen events, such as hackathons. This approach was found to be effective in expanding citizen engagement and fostering diverse perspectives.

6.4.7.3. Testimonials: Amplifying Stakeholder Voices

To provide firsthand accounts of the impact and benefits of DECIDO's stakeholder involvement, testimonials were collected from European stakeholders who actively participated in the project. These testimonials offer personal narratives and insights into their experiences.

Common benefits and success stories highlighted in the testimonials include:

Building a Strong Stakeholder Community: Stakeholders commended DECIDO for fostering a stakeholder community that provided access

to a diverse network of experts and innovators. This community has facilitated collaboration and knowledge sharing and influenced policy-making direction.

Early Exposure to Innovation: Testimonials emphasized the value of being exposed to cutting-edge methods, tools, and technologies facilitated by DECIDO. Stakeholders appreciated the opportunity to enhance their knowledge and awareness of policy-making trends through the project.

In conclusion, the feedback and viewpoints gathered from key European stakeholders highlight the importance of tailored co-creation activities, citizen involvement, and effective communication in promoting stakeholder engagement. The experiences shared by stakeholders validate the significance of the DECIDO stakeholder community in shaping evidence-based policy-making and influencing the future of policymaking in Europe.

6.4.8. Contributing to Evidence-Based Policymaking and Empowering Stakeholders in Data Generation

DECIDO recognizes the importance of involving communities and relevant actors in the policy-making process. Through co-creation approaches, where citizens and public organizations collaborate, DECIDO aims to increase legitimacy and decrease citizens' distrust in government. By carefully analysing the context and adopting the right tools, incentives, and approaches, DECIDO facilitates effective involvement of stakeholders throughout the policy lifecycle. This approach not only ensures the quality and relevance of data but also provides a comprehensive understanding of the impact of cloud computing and Big Data technologies in evidence-based policymaking. DECIDO aspires, by the end of the project, to provide recommendations and lessons learned, enabling public authorities to embrace these technologies and approaches.

In addition, DECIDO recognises the significance of data availability and accessibility in evidence-based policy development. The project acknowledges the crucial role of monitoring and evaluation in driving agile and responsive policy-making. To this end, DECIDO focuses on providing data and information in an accessible manner, enabling policymakers to monitor, evaluate, and adjust political strategies and programs. By emphasising a participatory approach, DECIDO ensures

that relevant actors, including citizens, businesses, NGOs, and civil servants, are actively involved in the policy-making process. Through the adoption of co-creation and citizen science approaches, DECIDO strives to build legitimacy, enhance trust, and foster a strategic planning culture that promotes evidence-based decision-making.

DECIDO has been actively involved in various EU main policy initiatives, making a significant impact on European stakeholders. By participating in these initiatives, DECIDO has contributed to shaping and influencing emergency response and preparedness policies at the European level.

One notable initiative where DECIDO made its presence felt was the Biennale Democrazia 2023. This cultural event, promoted by the City of Turin and realized by the Foundation for Culture of Turin, aimed to spread a culture of democracy that can be translated into democratic practice. The 8th Edition of Biennale Democrazia, dedicated to the theme "At the Edge of Liberty," provided an ideal platform for DECIDO to showcase its project as an example of active and participatory citizenship. DECIDO's aim to improve emergency response policies through co-creation sessions involving representatives of public bodies, small local businesses, non-profit organizations, volunteers, and ordinary citizens perfectly aligned with the goals of the Biennale Democrazia. By participating in this event, DECIDO not only demonstrated its commitment to democratic practices but also highlighted the importance of involving various stakeholders in emergency response decision-making processes. This participation showcased how DECIDO enables citizens to play an active role in shaping emergency response protocols and transform themselves from passive receivers of rescue interventions to active contributors.

DECIDO also actively engaged in the Critical Communication World conference, a significant gathering that focuses on technology developments and user requirements driving change in mission-critical communications worldwide. The conference emphasized the increasing importance of collaboration and knowledge-sharing among organizations, sectors, verticals, and nations to advance the field of critical communications. By participating in this conference, DECIDO showcased its dedication to collaboration and knowledge exchange. It highlighted its expertise and influence in mission-critical communications, contributing to the ongoing advancements in this domain. This participation further established DECIDO as a credible and influential player in the field of critical communications.

In addition, DECIDO organized a presentation event during the Civil Protection Training Camp, which was held as part of a week of Italian Civil Protection exercises. This event provided an opportunity for DECIDO to present the results already achieved by the project. The focus was on the pilot carried out in Turin, specifically for the scenario concerning the testing of new types of weather alert messages in the event of floods in the "Meisino Park" and "Murazzi del Po" areas. By showcasing the successful implementation of these innovative emergency response measures, DECIDO contributed to the advancement of civil protection practices. This participation demonstrated how DECIDO is actively addressing real-world challenges and developing practical solutions that can enhance emergency response capabilities.

The DECIDO project has also been presented at the 6th Annual Conference and General Assembly of the Sustainable City Network. This highlights the involvement of stakeholders in promoting sustainable urban development and the consideration of their insights in shaping policy objectives and strategies. DECIDO also actively participated in the Rescue Operation Research and Development Days 2023. This conference, organized at the Rescue College in Kuopio, focused on future security, particularly from the perspective of cyber security and rescue operation preparedness for a war situation. The event featured five themes for experts to engage with their peers, including future safety technology innovations, well-being at work, and management building a safe future in the rescue industry, the rescue industry as an equal working community today and tomorrow, anticipation, preparedness, and accident prevention, and climate and environmental change as a future security challenge. By participating in this conference, DECIDO showcased its commitment to staying at the forefront of research and development in the field of emergency response and contributed to the exchange of knowledge and ideas among experts.

Furthermore, DECIDO presented its project at the "Freedom is Participation" round table during the Libertà è Partecipazione event, which was part of the Biennale Democrazia. This event aimed to illustrate the results achieved by the DECIDO project and present the co-creation method as a tool for debate around emergency response protocols. By involving different actors from the public, private, and civil society sectors, DECIDO highlighted the importance of collaborative approaches in emergency preparedness and demonstrated the potential for effective integration of various stakeholder perspectives.

Through its participation in these EU main policy initiatives, DECIDO has actively engaged with stakeholders, shared its expertise, and influenced the development of emergency response policies. These initiatives have provided a platform for DECIDO to showcase its commitment to enhancing emergency preparedness and its dedication to democratic practices. By involving various stakeholders in decision-making processes and collaborating with organizations and institutions at the European level, DECIDO has demonstrated its credibility and expertise as a leading contributor in the field. The impact of DECIDO's participation in these initiatives goes beyond the immediate project objectives, as it contributes to the overall improvement of emergency response capabilities and policy frameworks at a European level.

6.4.9. Reflecting on the overall significance of DECIDO's participation in shaping EU policies.

DECIDO's participation in shaping EU policies holds tremendous significance for several reasons. The project's focus on transformative impacts in disaster risk management and sustained use of data analytics in policy-making showcases its commitment to driving innovation, promoting evidence-based decision-making, and fostering collaboration within the European policy-making landscape.

6.4.9.1. Transformative Impacts in Disaster Risk Management

DECIDO runs pilots in different disaster risk management domains, including floods, fires, and power outages, across various EU countries. By conducting these pilots in countries with diverse economic, social, and cultural backgrounds, DECIDO demonstrates the applicability, impact, reusability, and scalability of its tools, models, methods, and approaches in different scenarios and geographical dimensions.

Through cross-pilot replicability activities, DECIDO not only seeks to improve disaster risk management practices in individual countries but also contributes to the development and adoption of best practices across Europe. This approach allows for the sharing of knowledge and experiences, enabling policymakers and stakeholders to learn from each other and enhance their preparedness, response, and recovery measures. By showcasing the effectiveness of its solutions, DECIDO plays a crucial role in shaping EU policies related to disaster risk management.

6.4.9.2. Sustained Use of Data Analytics in Policy Making

DECIDO is dedicated to developing pathways and business plans that ensure the sustained use of its tools, services, methodologies, and approaches. Collaboration with the European Open Science Cloud (EOSC) is a key element of DECIDO's strategy. By including its portal in the EOSC portal, DECIDO aims to expand the accessibility of the European Science Cloud and European Data Infrastructure to the public sector.

Furthermore, DECIDO continues and seeks to establish guidelines and pathways as the foundation for the EOSC Competence Centre for Public Authorities and Policymakers. Through these efforts, DECIDO contributes to the wider adoption of evidence-based policymaking and the European Cloud Infrastructure throughout Europe. By leveraging cloud computing and big data technologies, DECIDO empowers public authorities to make informed decisions based on robust evidence. This collaboration with EOSC and the focus on data analytics in policymaking positions DECIDO as a key player in shaping EU policies in the digital age.

6.4.10. Overall Significance

DECIDO's participation in shaping EU policies is significant as it addresses crucial challenges in disaster risk management and policy making. By promoting evidence-based decision-making, involving stakeholders, and exploring the potential of cloud computing and big data technologies, DECIDO contributes to the effective development of policies by public authorities.

Additionally, DECIDO's collaboration with EOSC and its efforts in disaster risk management highlights its commitment to driving innovation and fostering collaboration within the European policy-making landscape. Through the provision of recommendations, lessons learnt, and a sustainable business plan, DECIDO empowers public authorities to transition towards utilising the European Cloud Infrastructure and embracing evidence and co-creation in the policy lifecycle.

In conclusion, DECIDO's participation in shaping EU policies addresses critical challenges and showcases the potential of data-driven approaches and collaborative efforts in policymaking. By driving transformative impacts in disaster risk management and promoting the sustained use of data analytics, DECIDO is contributing to the

development of effective and evidence-based policies that can have a profound impact on European societies and improve the overall resilience of communities.

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7. After DECIDO the epilogue

Iacopo De Angelis, Lorenzo Ciaschi, Andrea Pepe

7.1. DECIDO Solution

Iacopo De Angelis, Lorenzo Ciaschi, Andrea Pepe

The idea behind DECIDO is to establish a connection between Public Authorities and EOSC, with the dual purpose of increasing the accessibility of European Cloud Infrastructure services and data for Public Authorities, and to facilitate and motivate Public Authorities to use suitable infrastructures, services, data and methodologies to adopt a more informed approach to their policies[1]. DECIDO exploits data for support the decision-making process, using an algorithm that can transform a wide range of raw data into digital one. Big data refers to data volumes larger than those that can be handled quickly by commonly available technology, requiring a more specialized and sophisticated analytics approach.

The goal of DECIDO is to develop a disaster risk management model that is based on communication and collaboration between Public Authorities, in order to support creating policy to mitigate the negative effects of potential disasters, through the adoption of the four pilots described above.

The Key Exploitable Results of the solution are:

1. **DECIDO Approach for Evidence-Based Policy Making**: it is based on two main principles:
    - Leveraging both existing and newly generated data (through appropriate innovative tools);

[1] https://www.decido-project.eu/what-is-decido/

- involving all stakeholders in a structured, effective and efficient manner, promoting the ideas of collaboration and Co-Creation.

1. **DECIDO Portal**: it can be the initial unique point of access for diverse functionalities, services and guidelines provided by the DECIDO ecosystem for different stakeholders.
   As a web application, the portal permits the collaboration of policy decision-makers and various entities, leveraging data and evidence-based facts, supporting the users in all the phases of the Policy Life Cycle.
2. **EOSC Competence Centre for PAs and Policy Makers**: it aims to encourage cooperation between the Public Authorities and the EOSC supply side. Initially, the framework will focus on the four Public Authorities within the DECIDO project, and gradually open to other PA pilots and ventures that want to collaborate with the EOSC.
   The Competence Center will establish a platform for exchanging experiences, offering support, and sharing technical expertise between these parties, facilitate service utilization and expand outreach to policymakers. Additionally, the center enables stakeholders to share best practices with one another, as well as with the general public.
3. **Co-Creation Methodology**: it is a methodology designed to involve all stakeholders in the Co-Creation process aimed at designing or improving emergency response policies. The methodology is specifically intended to engage citizens in the Co-Creation of public services, by encouraging their participation in the design, implementation, and evaluation of these policies.

The 4 KERs complete the description about the exploitation of the DECIDO solution, which may lead to support creating policy in order to obtain positive impacts towards society and the environment. The next section explains the behavioural impacts that DECIDO can bring.

7.2. Behavioural impacts beyond the DECIDO project

7.2.1. Cultural & Social impact after DECIDO project

Based on the results that the four pilots can achieve, they may contribute to supporting decision making policy in order to reduce the risks of flooding, forest fires, and power outages within society. In addition,

the implementation of targeted support for policy making could have far-reaching impacts on the population socially and culturally. These positive changes could significantly influence the quality of life and well-being of communities.

From a **societal** perspective, the DECIDO pilots aim to support the co-creation of policies to reduce the risks of catastrophic events and, as a result, can lead to a significant decrease in human casualties, property damage, and disruptions in daily activities: there may be an overall improvement in quality of life. Communities will be able to live in a safer and more resilient environment, reducing the stress and anxiety associated with emergency situations. This may contribute to greater social cohesion, with closer cooperation among community members and greater solidarity in times of need.

From the **cultural** point of view, society may develop a culture of prevention and environmental awareness through greater decision-making involvement by being able to become leading actors in Policy Making. Generations may grow up in an environment where prevention of natural hazards will be a priority, leading to greater respect for the environment and a more ecologically responsible culture. Citizens, through increased sensitivity and awareness, may become more responsible and more alert to potential causes, being able to mitigate risks and being more likely to be actively involved in planning and preparing for emergency situations. The Evidence-Based policy making approach promoted by DECIDO may allow local policies to be guided by reliable data and information, ensuring more rational and effective territorial management.

Overall, the DECIDO project may have significant **socio-cultural impact**: the approach for Evidence-Based Policy Making may ensure that policy decisions are evidence-based, improving policy efficiency; the Portal may provide an important source of information for citizens, enabling them to easily access data and resources on risk prevention; the EOSC Competence Center for Public Administrations and Policy Makers may provide support and training, ensuring that local institutions are well prepared to deal with emergency situations; and finally, the Co-Creation methodology may promote active citizen participation in local policy-making, ensuring that decisions are tailored to the needs of communities.

DECIDO may have fundamental impacts on citizen behaviour related to cultural, social, and environmental resilience in future society.

Beginning with increased citizen awareness through their active participation and inclusiveness in activities concerning Public Administration, a net impact can also be achieved at the climate level. The following section specifically lists aspects that summarize how the DECIDO project through citizen first-hand participation may bring about radical changes on the territory.

7.2.2. Environmental & overall impacts after DECIDO project

The environmental and overall impacts of DECIDO solution may be:

1. **Environmental Resilience and Energy Reliability**: DECIDO's support in Co-Creating policies related to reducing risks from flooding, forest fires, and power outages may contribute to greater environmental sustainability through increased citizen cooperation. This could result in a cleaner and healthier environment, and less destruction of ecosystems, with benefits for biodiversity. In addition, there may be a greater focus on ecosystem protection, sustainable management of natural resources, and development of renewable energy sources. This can promote the adoption of more advanced technologies and greater energy efficiency, increasing the reliability of supply.
2. **Quality of Life**: DECIDO may have a direct impact on people's quality of life as combating food waste, increased distribution of necessities following the Covid-19 pandemic, helping asylum seekers from Ukraine to be better received after their arrival in Turin, and managing the flood emergency in two areas of the city of Turin along the Po River - Murazzi and Meisino Park - could mean fewer human casualties and less property damage. In terms of mitigating the risk of power outages, DECIDO would be able to support the creation of policies for PAs to better manage electricity resources to ensure a continuous supply of power and avoid unexpected power blackouts. In addition, DECIDO may support the co-creation of policies with an impact related to improving the air in relation to reducing the risk of forest fires resulting in a reduction of harmful and toxic substances in the surrounding areas.
3. **Resilient Infrastructure**: DECIDO may support policy creation in order to increase the resilience of public and private infrastructure by reducing the risk of forest fires and flooding that could lead to extensive structural damage.

4. **Sustainability**: DECIDO may be able to support policy creation in order to increase control over environmental risks and encourage more sustainable practices and policies. For example, activities related to better forest management to prevent wildfires, better land control to prevent flooding, and better management of power outages caused by surplus peak demands could become more common.
5. **Technology and Monitoring**: DECIDO may be able to influence the creation of policy in order to adopt techniques to monitor environmental parameters necessary for mitigating forest fires and flooding, as well as parameters related to average energy consumption in order to reduce power outages. Reducing these risks may require greater integration of technology into territory management: advanced sensors, monitoring systems, and forecasting models may be used to constantly monitor environmental conditions and respond promptly in emergencies.
6. **Participation and Local Policies**: DECIDO may support Public Agencies in creating proper policies in order to mitigate risks, as communities may have greater involvement in planning and implementing preventive measures. This could lead to local policies that are better adapted to the needs of communities.
7. **Food and Water Security**: DECIDO may be able to support the creation of appropriate policies for a reduction in forest fires and maintenance of water conditions in order to mitigate destructive impacts on agricultural resources caused by pollutants from fires or flooding.
8. **Economy**: DECIDO may be able to support policy creation for the purpose of increased conservation of raw materials, cornerstones of the world economy and necessary for business activities. Environmental stability may then contribute to greater economic stability by reducing the cost associated with restoring initial conditions altered by catastrophic events.

In conclusion, DECIDO's methodological approach to reaching proper policy formulation leverages big data analysis using an algorithm to digitize the data and visualize the results.

The implementation of the DECIDO project may be of crucial importance in order to have an impact on the socio-cultural behaviour of society and have greater results in aspects related to the mitigation of environmental risks.

Consequently, DECIDO's solution may be of relevance in order to support the policy making process, being able to ensure positive impacts on quality of life, culture and the environment, and promoting a more conscious, resilient and sustainable society. These changes may require continued commitment and cooperation among governments, communities and organizations to be fully realized and obtain tangible long-term results.

Authors

In the following pages are presented the list of authors with their affiliation and a short biography. The given order, is the one of the DECIDO project grant agreement number 101004605 signed with the EUROPEAN COMMISSION - RESEARCH EXECUTIVE AGENCY - Unit REA.B.3 Inclusive, Innovative and Reflective Societies; excluding some Partner which not contributed to the present editorial project.

So, authors, belong to a subset of the organisations in the below table in which the overall DECIDO project Consortium in presented:

No	Participant organisation name	Short name	Country
1	Engineering - Ingegneria Informatica S.p.A. (Coordinator)	ENG	IT
2	Fundación TECNALIA Research & Innovation	TECNALIA	ES
3	The Lisbon Council for Economic Competitiveness and Social Renewal asbl	LC	BE
4	Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V. / Fraunhofer Institute for Open Communication Systems	FOKUS	DE
5	Kpeople Research Foundation	KPRF	MT
6	Stichting EGI	EGI.eu	NL
7	EY Advisory S.p.A.	EY	IT
8	National Technical University of Athens	NTUA	EL
9	Kajaanin Kaupunki	KAJ	FI
10	Kajaanin Ammattikorkeakoulu Oy / Kajaani University of Applied Sciences	KAMK	FI
11	Città di Torino	CTO	IT

No	Participant organisation name	Short name	Country
12	Volontariato Torino	Vol.To	IT
13	Diktyo Poleon Gia Ti Viosimi Anaptyxi Kai Kykliki Oikonomia / Cities network for sustainable development and circular economy	SCN	EL
14	Fundación Ibercivis	Ibercivis	ES
15	Kainuun Hyvinvointialue	KAHY	FI

Tab. 2. DECIDO Partner list

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Finally, out of the DECIDO Consortium an additional author of the present book is a former student who made his graduation thesis over the DECIDO project thanks to an idea of his supervisor who also is the curator of this book that, further to participate with a role of a Partner's representative is lecturer at the Sapienza University of Rome at the Department of Communication and Social Research (CoRiS).

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Decido

THE CONTEXT

DECIDO consortium brings together innovative public administrations, leading European ICT service providers and research institutions to create new solutions to complex problems.

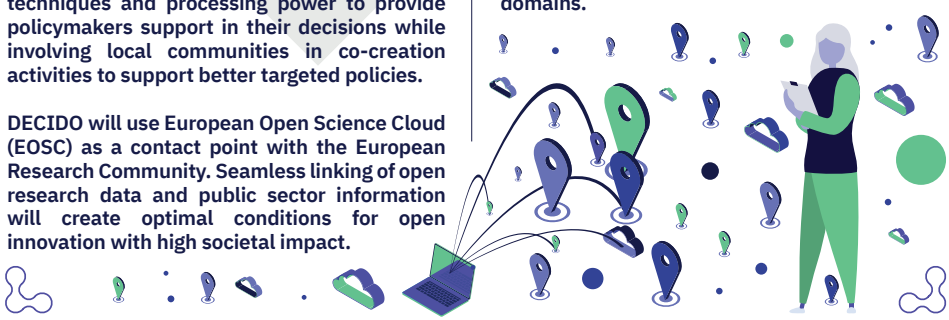
The opportunities that digital technologies offer are yet to be fully seized by Public Authorities. Complex problems such as migration, poverty, and climate change faced by today's society are increasing complexity for European governments as they do not have a single optimal solution. To cope with such challenges, data-driven policymaking aims to make use of data sources, analytical techniques and processing power to provide policymakers support in their decisions while involving local communities in co-creation activities to support better targeted policies.

DECIDO will use European Open Science Cloud (EOSC) as a contact point with the European Research Community. Seamless linking of open research data and public sector information will create optimal conditions for open innovation with high societal impact.

OUR MISSION

The mission of DECIDO is to demonstrate the groundbreaking impact of the adoption of innovative methodologies, tools and data enabling the effective development of better evidence-based policies by Public Authorities.

DECIDO will link Public Administrations to the data and compute infrastructure of the European Open Science Cloud – piloting the access to and exploitation of a great wealth of additional resources. The project will identify and assess the benefits and limitations in using current big data methodologies and infrastructures in policymaking in several domains.



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SUSTAINABLE CITY CITY NETWORK

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DECIDO (eviDEnce and Cloud for more InformeD and effective pOlicies) project
edited by Vanni Resta

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, consisting of several different phases, such as agenda setting, policy formulation, policy implementation & monitor and policy evaluation.

DECIDO is a project funded by the European Commission focused on "the use the European cloud infrastructure for public administrations" in the context of policymaking. The liaison between the adoption of the disruptive technologies in the public administration, and the methodology to follow each step of the policy life cycle using a citizen science approach relying on the co-creation, is the main achievement of the experiments executed in four European cities (Kajaani, Turin, Halki island, Aragon region) with the involvement of citizens, businesses, decision makers, associations.

This book highlights the outcomes, the recommendation and the lessons learnt collected during the development of the project that can be used as best practices in the policymaking.

Vanni Resta, President of the Manlio Resta Foundation, he is a lecturer at the Sapienza University of Rome. He also teaches the theme of European project planning at other universities. He began his professional activity after graduating with honors in economics in the 1990s. With Kpeople Ltd (UK) and afterword with Kpeople Research Foundation, he participates in the submission and management of projects, especially in the Horizon field, collaborating with numerous national and international public and private institutions. He is the author of books also with the same Publisher.

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