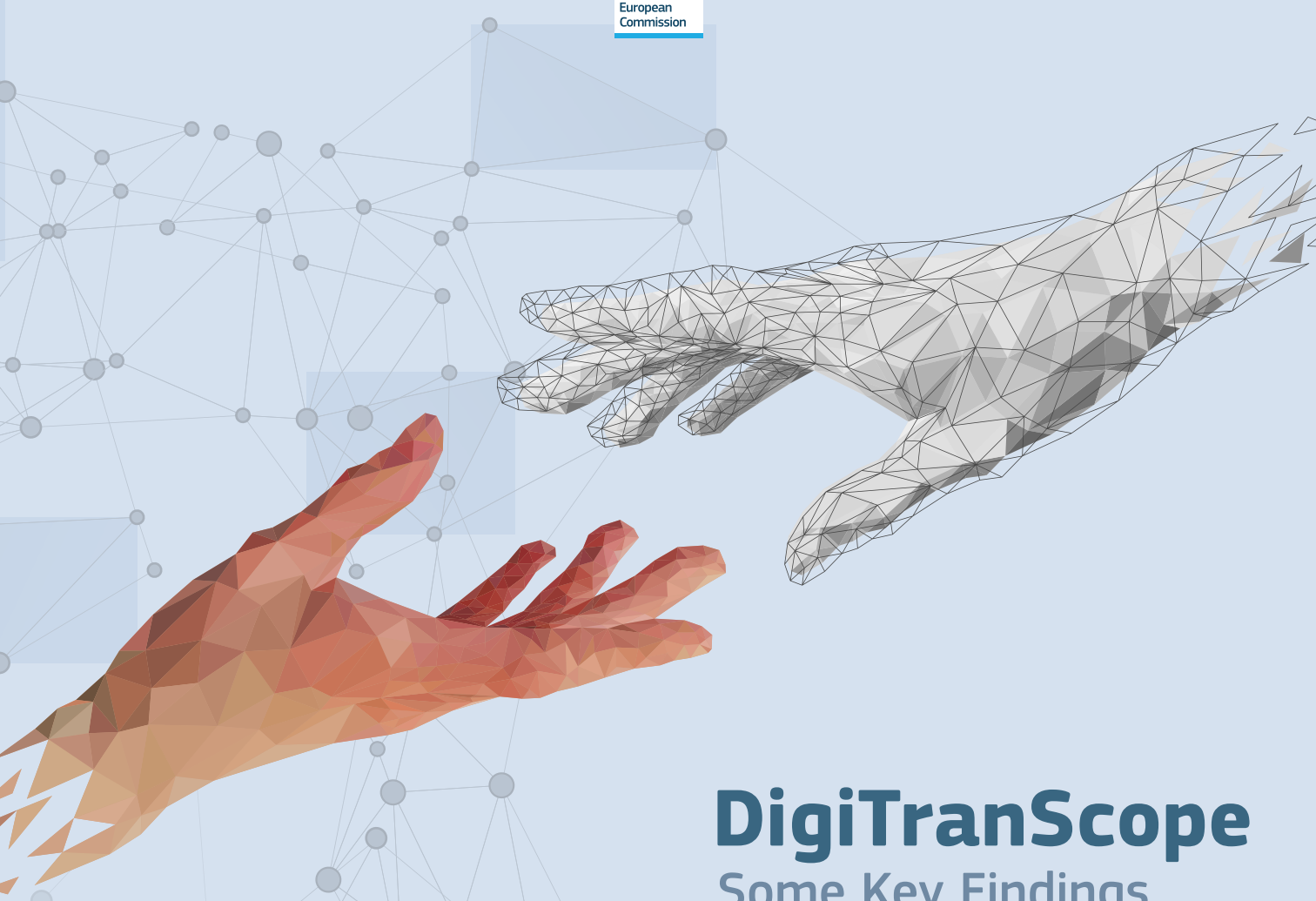
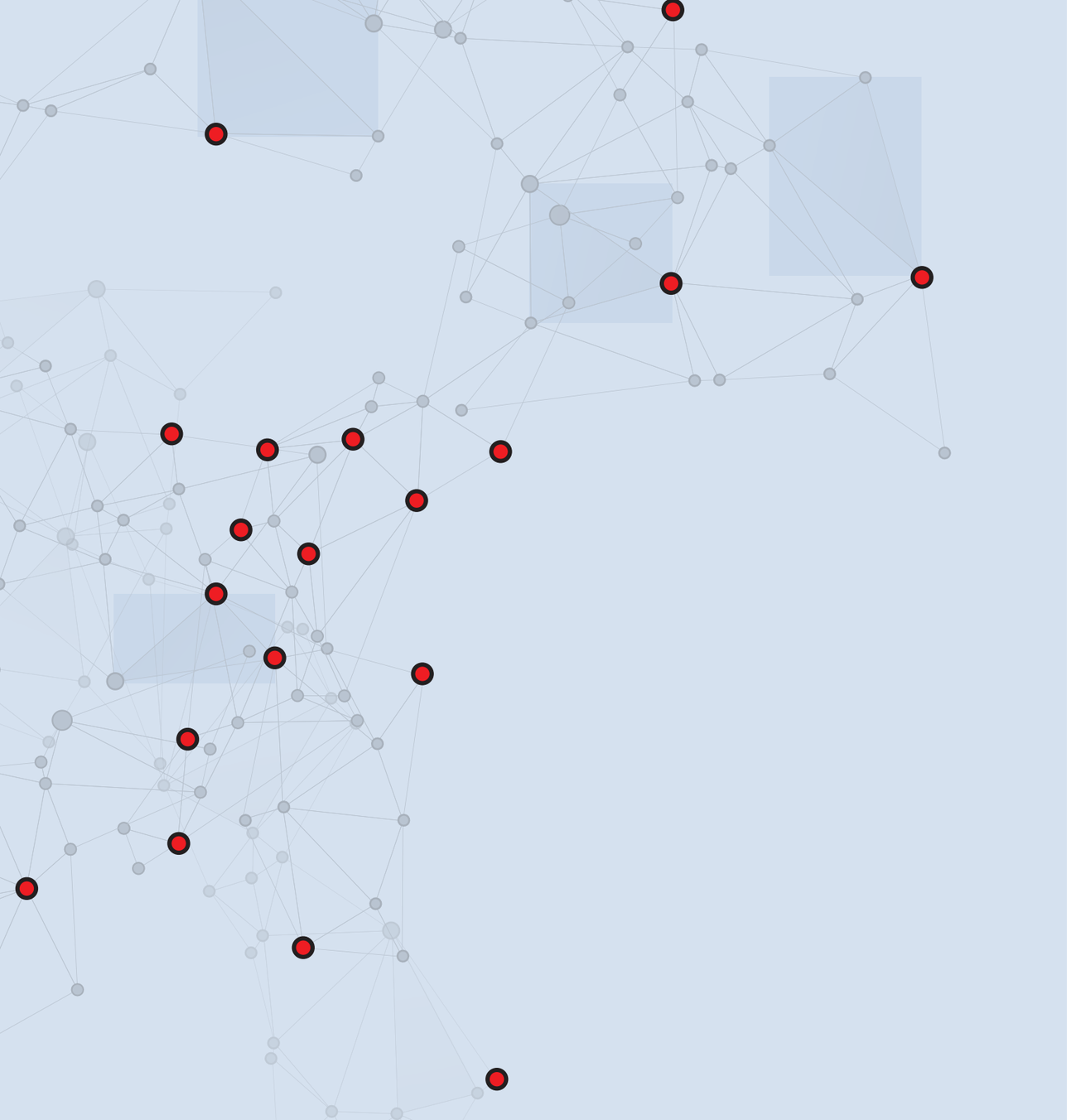
European Commission



DigiTranScope

Some Key Findings

Joint Research Centre



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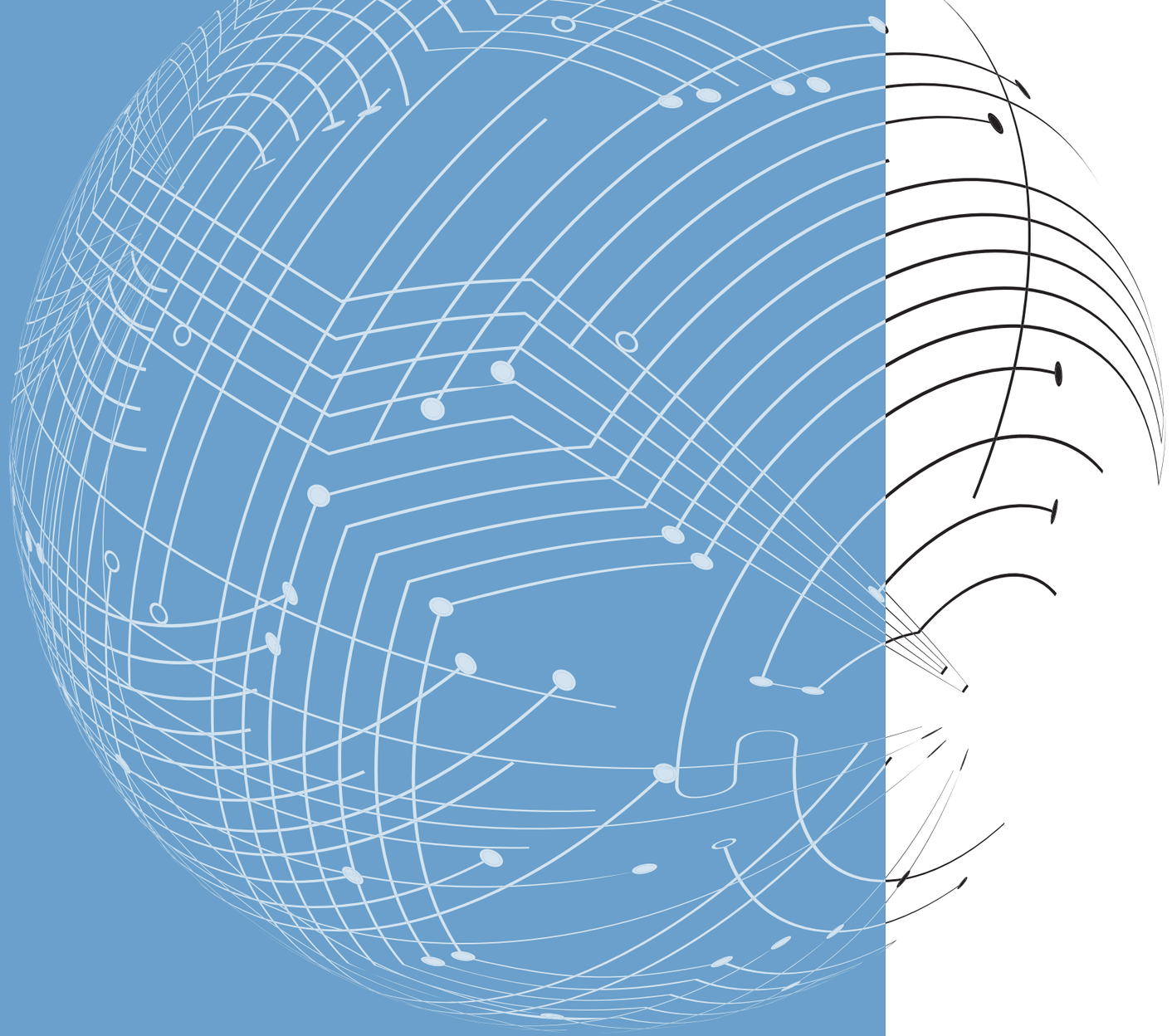
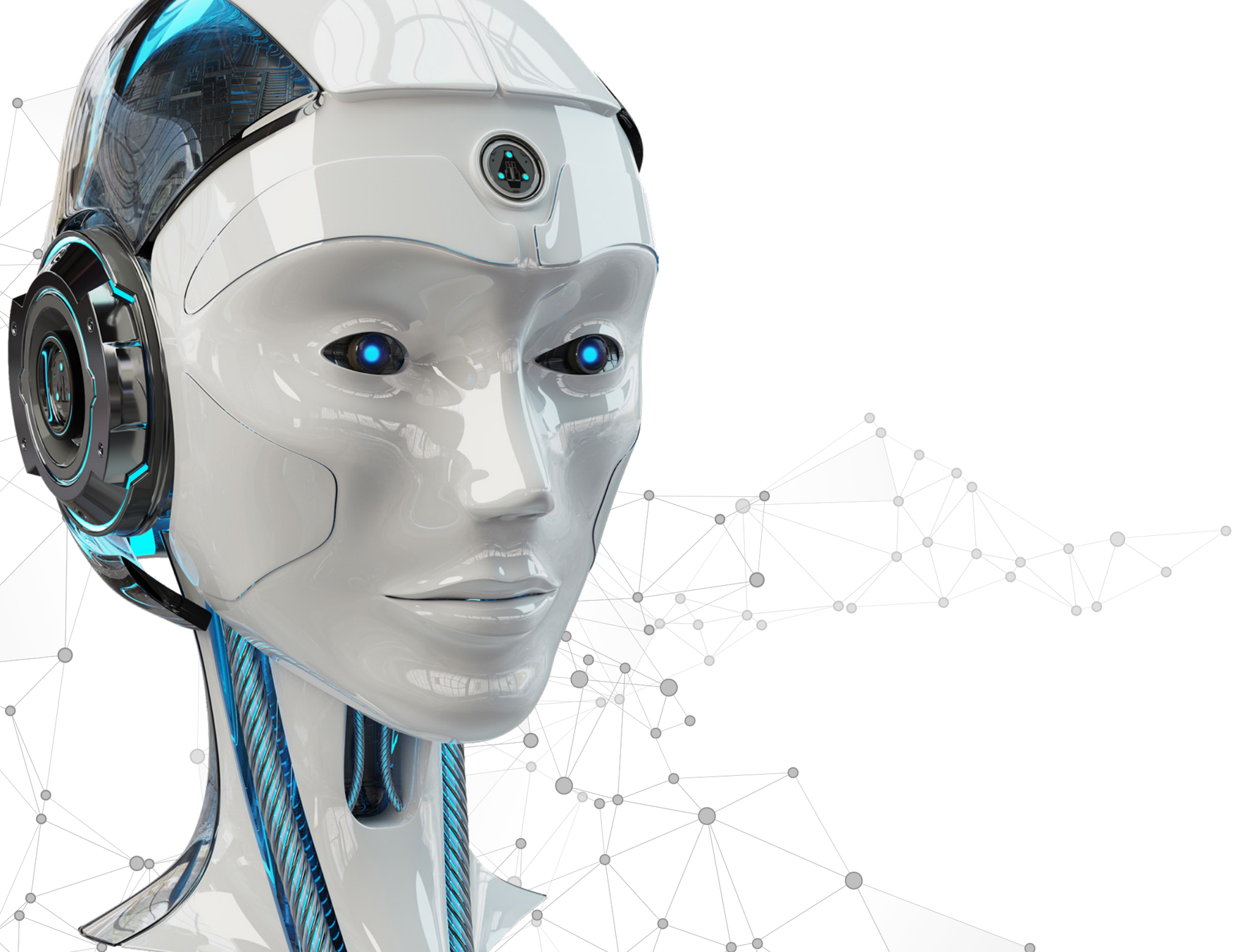


Centre for Advanced Studies

The Joint Research Centre (JRC) of the European Commission carries out ~~re¬search~~ in order to provide independent scientific advice and support to EU policy. The JRC's Centre for Advanced Studies (CAS) was created in 2016 to give the JRC a leading edge on societal issues that may become relevant for EU policy making and to assist societies as a whole.

By creating the conditions necessary for innovative and interdisciplinary re¬search, as well as offering a creative and generative space in which ideas and knowledge in emerging thematic fields across different scientific and technological disciplines can thrive and flourish, CAS has become an incubator for cutting edge research, formal inquiry, stimulating ideas and activities. It provides the JRC with new insights, data projections and solutions for the increasingly complex medium and long-term challenges facing the EU. So far topics addressed included artificial intelligence, demography, big data and digital transformation.

The CAS project, Digitranscope (Digital transformation and governance of human society) is a three-year CAS project that began in 2017 and finished at the end of 2020. This brochure provides an overview of the project and its main achievements.



About Digitranscope

Digitranscope originated from the JRC Strategy 2030[1]. The strategy identified ten ~~strategic~~ topics on which the JRC should concentrate to anticipate future policy requests. One of these topics was 'Data and Digital Transformation', to which the JRC set up two initiatives: the first being a transversal project on 'Artificial Intelligence and Digital Transformation', the second being a CAS research project on digital transformation, which was to be more exploratory in nature.

The CAS project originally proposed to address two key issues: i) how the information glut triggered by digital transformation reverses the cognitive balance between humans and machines, and ii) the impact of digital information technology on the rules and institutions that guide modern societies. This proposal therefore led to the establishment of two projects in 2017: 'Human behaviour and machine intelligence' (HUMAINT)[2] and our project, 'Digital transformation and the governance of human society' (Digitranscope).

1 https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-strategy-2030_en.pdf
2 https://ec.europa.eu/jrc/communities/community/humaint

What are the objectives of Digitranscope?

The project's objectives are:

- To explore the changing flows, ownership, quality and implications of digitised data and information.
- To identify the key policy challenges relating to massive interconnection, such as the 'Internet of Things' (IoT) and the associated opportunities and risks.
- To determine what skills are needed to live fulfilling and healthy lives in a digitally transformed society, and to explore how to offer all citizens the opportunity to develop these skills.
- To explore innovative forms of governance for Europe, leveraging the characteristics of digital transformation.

At the early stages of the project, we recognised that the governance of digitally transformed societies revolves to a large extent around the governance of data: those who control the production, integration, use and dissemination of data have formidable levers of power in today's digitised society. With this in mind, we decided to set the project on two main tracks. The first track (track 'A') investigated issues around the governance of digital data including the role of government in emerging models of data governance; citizen-generated data for public policy; citizenship and data cooperatives, and the perspectives of city governments in accessing and using data held by the commercial sector.

The second track (track 'B') investigated new forms of governance with digital data, including experimenting with the use of publicly available data for profiling, as well as the design of policies targeted to specific needs and groups. We applied these new forms to a number of contexts: we organised experiments to involve children in the participatory planning of moving from traditional energy resources to more sustainable ones, via the use of digital twins in controlled gaming environments. We used the emerging lessons from the deployment of IoT and digital twins for 'smart' cities to develop a City Operating System. We used artificial intelligence (AI) methods to extract knowledge from policy documents and apply it in the context of impact assessment of EU policies; and we examined the risk of infection in the COVID-19 crisis on digital society.

TRACK A: Data governance

> **“We identified four key models: data sharing pools, data cooperatives, public data trusts and personal data sovereignty. The goal of our analysis has been to investigate to what extent they support different, more balanced, power-relations between actors, and how they redistribute more equitably the value generated from data.”**

Emerging data governance models

In the current digital society, the dominant model for the governance of personal data is the one established by a few ‘big tech’ companies that are collecting, aggregating and financially exploiting massive amounts of personal data. Yet, other actors beyond those companies are progressively becoming involved in controlling personal data and producing value from it through different practices. These actors include public bodies (such as local administrations), private entities (comprising of small businesses and start-ups), scientific and civil society organisations, activists, social entrepreneurs, and citizens themselves. We explored some of the models for the governance of data that are emerging from those practices (for accessing data, sharing, control and use) implemented by these actors.

In particular, we identified four key models: data sharing pools; data cooperatives; public data trusts and personal data sovereignty (see Table 1 for a summary of the main features we reviewed). The goal of our analysis has been to investigate to what extent they support different, more balanced, power-relations between the aforementioned actors. In addition, how the key models redistribute more equitably the value generated from data across these actors and society compared to the current practices of ‘big-tech’ corporations such as Google, Apple, Facebook, and Amazon.

In our research, we did not find a single model to be ‘recommended’ or ‘promoted’ for a more balanced data landscape, but, rather, a combination of these models should probably be encouraged. The analysis highlights that civic society and public bodies are both key actors for democratising data governance and redistributing value produced through data (especially through data cooperatives and public data trusts). Furthermore, the results show that the more influential data subjects are in a model, the greater accountability is required to the data holders, which in turn limits risks and data misuses.

Model	Key actors	Goals	Value	Mechanisms
Data sharing pools (DSPs)	• Business entities • Public bodies	• Fill knowledge gaps through data sharing • Innovate and develop new services	• Private profit • Economic growth	• Principle of 'data as a commodity' • Partnerships • Contracts (e.g. repeatable frameworks)
Data cooperatives (DCs)	• Civic organisations • Data subjects	• Rebalance power unbalances of the current data economy • Address societal challenges • Foster social justice and fairer conditions for value production	• Public interest • Scientific research • Empowered data subjects	• Principles from the cooperative movement • Data commons • 'Bottom-up' data trusts • GDPR Right to data portability
Public data trusts (PDTs)	• Public bodies	• Inform policy-making • Address societal challenges • Innovate • Adopt a responsible approach to data	• Public interest • More efficient public service delivery	• Principle of 'data as a public infrastructure' • Trust building initiatives • Trusted intermediaries • Enabling legal framework
Personal data sovereignty (PDS)	• Business entities • Data subjects	• Data subjects self-determination • Rebalance power unbalances of the current data economy • Develop new digital services centred on users need	• Empowered data subjects • Economic growth • Private profit • Knowledge	• Principle of 'technological sovereignty' • Communities and movements (e.g. MyData) • Intermediary digital services (personal data spaces) • GDPR Right to data portability

Table 1: Emerging data governance models alternatives

Platform and data co-operatives

Among the data models studied, one that deserved some additional analysis is that of data and platform co-operatives.

Overall, co-operatives can be considered as a citizen movement that accounts for 130 000 enterprises in Europe in all economic sectors, with 127 million members, more than four million employees, and nearly EUR 990 billion in annual turnover.

However, the understanding, practices and perceptions of co-operatives vary significantly from one European country to another—particularly now in the COVID-19 era—in view of contextual factors derived from local history and current digital and socio-political transformations. As such, the notion of co-operatives in the digital era cannot be dissociated from citizenship in Europe.

Citizenship and the related digital policy issues provide a broad framework to understand better the collaborative forms that might emerge among citizens or peer-to-peer interactions. Moreover, citizenship actually serves as the seed for co-operative forms in the digital economy and society that aim to protect citizens' digital rights, such as platform and data co-operatives.

The research in Digitranscope on platform and data cooperatives was undertaken in collaboration with the New School in the New York City, through its Institute for the Co-operative Digital Economy; and the Mondragon Co-operative Corporation, which was established in the Basque Country, Spain, as the most popular and largest industrial co-operative experience worldwide. Both institutions recently launched an online course for the creation of platform co-operatives across the world.

The research offers an insightful review on co-operatives and focuses in particular on the latest versions of platform co-operatives and data co-operatives. The research aimed at:

- ★ Offering an understanding of citizen participation through the lens of the COVID-19 pandemic in Europe and its inner and multifaceted vulnerabilities.
- ★ Linking that understanding to the idea that co-operatives could potentially harness citizen-to-citizen collaboration and gradually offer the opportunity to stimulate the creation of platform and data co-operatives that can effectively tackle health, education, economic, and social issues in European communities.
- ★ Showing how the citizen participation with the backdrop of the COVID-19 pandemic in Europe should be considered to foster platform and data co-operatives.
- ★ Presenting a taxonomy for platform and data co-operative cases based on the identification of 155 cases.

The study outlines potential future research as well as the future policy

agenda for platform and data co-operatives. It has revealed the following key findings:

- The COVID-19 crisis is reigniting the need to reactivate European civil societies by further experimenting with digital socio-economic innovations such as platform and data co-operatives; although this is still a marginal and small-scale phenomenon.
- Procurement and public incentives are required to push ahead, enhance, and reinforce platform and data co-operatives.
- Existing initiatives around platform and data co-operatives need to find their own strategic pathway amidst the digital and social economy policy agenda of the European Commission. Particularly, the research findings suggest there is a need to employ ongoing institutional arrangements around H2020-Smart Cities and Communities and Digital Innovation Hubs to leverage city-regional platform and data co-operatives.

Citizen-generated data and data altruism

Citizen-generated data (CGD) is defined as data that people or their organisations produce to directly monitor, demand or drive change on issues that affect them. It is data actively provided by citizens ('data altruism') to represent their perspectives and complement the datasets collected by governments or international institutions. The growth of CGD can give the public sector new opportunities for addressing critical social and economic issues and inform policies. We used desk research and interviews to conduct a study on the main features of 18 European projects involving CGD in the following five areas: environment; public health; energy; transport; and infrastructure. The result of the study points to three main aspects of CGD in terms of:

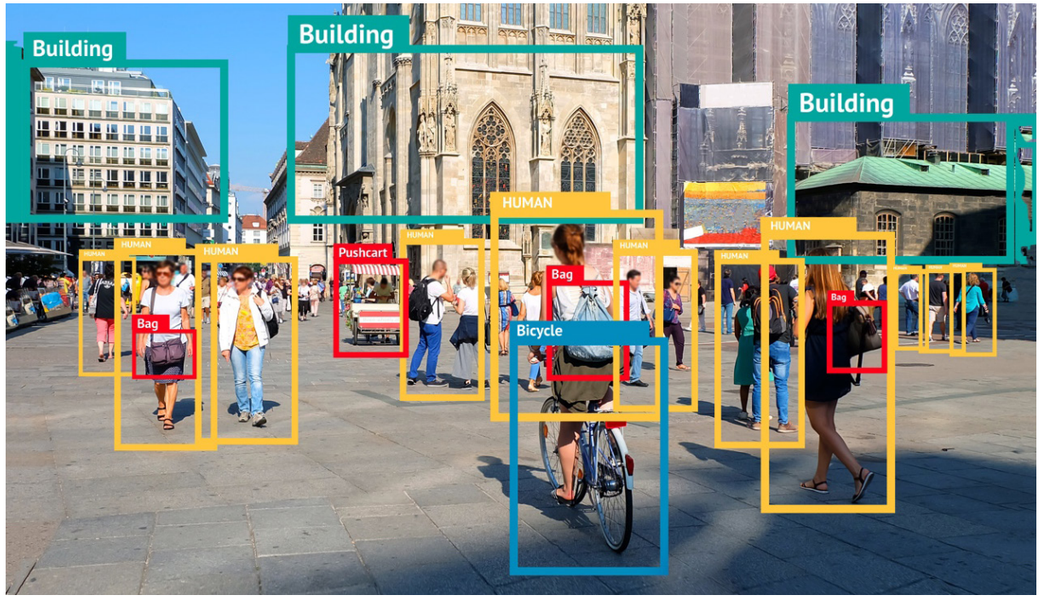
- New forms of public participation and emerging roles for citizens and local governments enabled by digital technologies.
- Rethinking relationships between citizens and local governments.

> **"The growth of CGD can give the public sector new opportunities for addressing critical social and economic issues and inform policies."**

- Generating richer and trusted data to address current challenges.

First, digital technologies can change the way citizens look at their living environments and facilitate data creation as a focal practice, and as a purposeful and meaningful social activity. In turn, CGD projects become practices holding the potential to bring back agency and control to citizens, moving them closer to the role of agents of change in the places where they live. This process can be challenging because it implies shifting agency, accountability, and responsibility towards citizens.

Second, CGD holds the potential to enable citizens in engaging fully in citizenry. Collecting data becomes a way of taking up responsibility as individual citizens and this can go a long way in solving urban problems and being active citizens. However, this is challenging because it requires a "culture shift", such that citizens and communities become active participants.



Third, there is a quality issue with CGD in policy contexts. Most CGD is collected using low-cost sensors and accessible digital technologies to conduct indicative monitoring and generate data over a wider spatial area or more extended periods. This data may not be at the same level of precision or accuracy as data produced for regulatory compliance. However, it could raise different concerns and possibilities useful to describe 'data stories' together with citizens and integrate the representation of reality provided by official data.

Business to government data sharing at the local level

Private data access and (re)use by public actors is an emerging topic in European data policy with no established praxis yet. For this reason, we conducted a qualitative research to explore how local administrations in Europe attempt to access and use privately held personal data (collected by online platforms and other private entities) as an additional source to comply with their public-interest mission. The research consisted in semi-structured interviews with managers and project leaders of twelve European public administrations working in the city department in charge of digital/data/urban innovation.

The findings of this study highlight that local administrations with some experience in accessing privately held data seek to establish a reciprocal relationship with private companies, based on conversations, collaboration and 'co-creation'. Managers at the level of local administrations are in favour of setting up collaborative partnerships with the private sector, instead of turning to the public procurement of data.

The results also point to a divide between cities concerning their chances of finding private companies willing to engage in data sharing. Bigger cities and cities with a reputation as 'smart cities' are in a favourable position: not only do they have more resources and experience, but also private companies are more likely to let them access data for free and collaborate with them. Private companies in fact use such 'use cases' to market their services and products to other cities.

> **"Managers at the level of local administrations are in favour of setting up a "collaborative partnership" with the private sector, instead of turning to the public procurement of data."**

Finally, we identified several strategies adopted by public bodies to facilitate access to privately held data of public interest. In particular, we found that cities are starting to join forces for this purpose: from collective bargaining and setting up a consortium of buyers, to developing a common contractual framework, with the help of specialised lawyers, to use with businesses. These, together with other strategies, could help to level the playing field and increase cities' strength in obtaining access to privately held data of public interest

TRACK B:
To explore innovative forms of governance with digital data

Digital twins, city operating system, dashboards and the role of stakeholders

Our changing society is confronted with complex issues in a number of fields, amongst which mobility, sustainability, health and energy supply. Since we entered the era of the internet of things (IoT) and big data, as well as emerging technologies such as artificial intelligence (AI) and machine learning (ML), we can call upon information and communication technologies (ICTs) to help us address the above challenges. What could be the role of government in coordinating this process?

In order to explore the possibilities, we developed the concept of digital twins, city operating systems and smart city dashboards. We also set up a laboratory environment to test the data and technology components, discuss data governance issues, and involve a diverse community to include children and policy makers. We have applied the experiments with the support of the city of Amsterdam and the Johan Cruijff Arena. The lessons learned have been explored further in the Lekdikj project[1] as well as with the city of Duisburg. Further discussions have taken place in the Digitranscope workshops and the Digital Earth conference in Florence in 2019[2].

A digital twin as described by the W3C[3] consortium is “the digital replica of a living or non-living physical entity... a virtual representation of a connected real thing or a set of things representing a complex domain environment. It can be used ...to run simulations” (W3C, 2020) [4]. Digital twins have been

1 The Lekdijk is a large dyke protecting part of the Randstad area of the Netherlands against flooding. The dyke needed strengthening, and a digital twin of the underlying soils and geology was built to model the intervention needed. See https://digitalearth2019.eu/slide/Martin-Peersmann-1.pdf
2 https://ec.europa.eu/jrc/communities/en/community/digitranscope-digital-transformation-and-governance-human-society/event/digital-twin
3 The World Wide Web Consortium is the main international standards organization for the World Wide Web.
4 Web of Things (WoT) Architecture, W3C Recommendation 9 April 2020

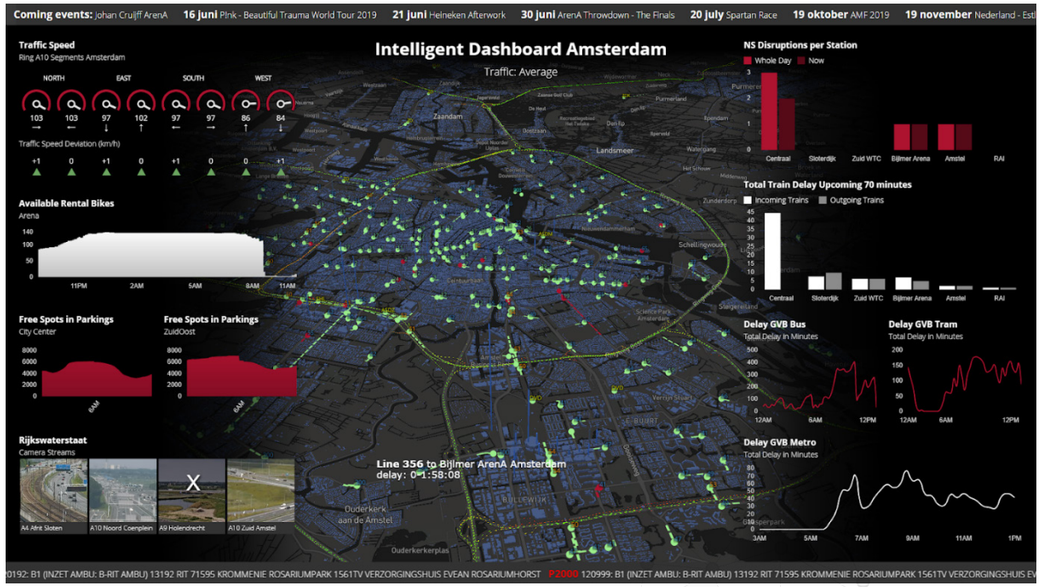


Figure 1: Intelligent Dashboard Amsterdam: Mobility view

around for decades (especially in industry), however, with the advent of transformative technologies (IoT, AI, ML, big data analytics, and ubiquitous connectivity) they are changing most sectors in society, including science and governance. A digital twin of a city is therefore a virtual representation of both its physical assets and non-physical (e.g. social and economic) processes in both space and time.

> **“Bringing together all these different data streams needs a lot of dialogue with all the stakeholders so that it is not just a one-off pilot project but becomes a cultural change.”**

In general, a digital twin provides the software environment for a number of applications including monitoring, predicting, simulating, and visualising data and outcomes. This visualisation function can be coupled with a dashboard that acts as the user interface providing a number of selected indicators and windows on the digital twin to communicate more easily with non-experts. Underpinning the digital twin we need an IT infrastructure layer and, crucially, a data layer bringing together and integrating data from different sources: these might include administrative datasets (such as the Land Registry); data from IoT sensors; privately held data for example on the occupancy of hotels and privately-rented rooms or energy consumption; and even citizen-generated data. In our experiments, we were able to integrate also the subsurface data[5] on the soils and geology.

Bringing together all these different data streams with different ownership, granularity and time-frames is probably the hardest part of any project and needs a lot of dialogue with all the stakeholders so that it is not just a one-off pilot project but becomes a cultural change. To be able to bring all the strands together, it is useful to think of combining such data, layers and supporting IT infrastructure as the smart city operating system (OS), i.e. an integral part of the city system without which the city cannot operate. This OS needs to automatically collect big data from a large number of data sources and real time sensor services, and transform the data via the digital twin applications into custom information services for stakeholders in real time. The data and the extracted information is then made available for users and policymakers via the dashboard (see Figure 1 as an example).

5 Below the surface data, i.e. including data on the characteristics of the soils, the geological data, and data about underground infrastructures and networks.

By analysing the ongoing concurrent processes, as monitored by the OS, the interacting system as a whole can be understood, predicted, handled and fine-tuned. We can use machine learning to determine usual patterns in a variety of data flows. We can also tell when there have been unexpected results and take action to remedy this.

In the project, we have used open standards from the Open Geospatial Consortium (OGC[6]) so that as new sensor networks become available in the city they can be integrated, as long as they support this open standard. We also tested the role of the communication infrastructure for sensors as part of the experiments, including the use of the 5G and Wifi6 new communication and wireless standards.

The concepts of digital twins, city OS and dashboards are all part of the dynamic process of digital transformation. In the experiments, we also focused on the role of government by involving public officials in the cities of Amsterdam and Duisburg in the proofs of concept.

Overall, the main objective of the experiments was to explore: the concepts of digital twinning; city operating systems; the access to complex information by the use of a dashboard; and involve potential stakeholders. The explorations were successful and there is already a request from both Amsterdam and Duisburg for the implementation of the overall system.

6 The OGC is the standardisation organisation for geospatial data and services, including IoT. Many of the OGC specifications are available as ISO standards.

> **“Digital twins of cities may help children in getting involved more easily, particularly when supported by game elements.”**

Digital twins for participatory planning: involving children in renewable energy transition

There is a strong case for the inclusion of children in participatory planning for the transition from traditional to renewable energy, as the ‘adults of tomorrow’ who need to take responsibility for their living environment or even as ‘full citizens of today’ with the right to be heard.

However, how to involve children in a public participatory process is not self-evident. The digital transformation and the advent of digital twins of cities may help children in getting involved more easily, particularly when supported by game elements. To test this idea, two digital twins of a neighbourhood in Warsaw and another in Amsterdam, were developed using the environment of the popular computer game MinecraftTM for an adaptation called Ecocraft. From a data perspective, this is a quite revolutionary step. The 3D model of a physical environment like a city has been translated into the building blocks (lego stones) of MinecraftTM. This translation delivers a playground for children where their own neighbourhood is available in their gaming environment. Children are well aware of the possibilities the game engine provides, and by that they are the next generation of ‘Geographic Information System experts’ with immediate access to all the professional data to provide answers to serious questions.

We conducted a secondary analysis of the experiments with the pur-

pose of reviewing their potential for involving children, through digital twins, in participatory planning and for learning. The Warsaw case showed a strong focus on engagement, inspiring volunteering children, outside school hours, to use the digital twin to design a green 'dream district'. This was supported by gaming elements, such as competition, with an extensive judging process and monetary prizes, and a large celebratory, concluding event. Team video presentations showed how the digital twin and game setting has challenged these children to formulate and present their ideas.

Figure 2 – Snapshot of the gaming environment used in the Amsterdam experiment showing a house that has been fitted with wall insulation and double-glazing.

Figure 3 – Snapshot from one of the digital twins that won the competition among the elementary schools of Warsaw

The Amsterdam case strongly focused on consultation, testing whether a digital twin with a game element of quantitative feedback on choices enables children in a regular class setting to formulate quality advice on where to install solar panels and apply various forms of insulation in their neighbourhood. With different aims, tooling, and implementation, the two sites together demonstrated how the use of a virtual environment, in conjunction with game elements, can be adapted to varying contexts, aims and stakeholders.

On a more abstract level, the two experiments raise the question whether or when involvement in energy transition and participatory planning should follow a form of standard (cognitive) learning or a form of experiential learning. This work provides insights on the opportunities and considerations for the replication of the game or extending it, coupled with a digital twin setting, for the inclusion of children in participatory planning.

"In Digitranscope, we considered how we could use some of the techniques of the commercial sector, and apply them to publicly available administrative data to develop more 'personalised' policies aimed at those who need it the most."

Probabilistic synthetic population modelling for EU policy support

This part of the Digitranscope project premises from the widening gap between on the one hand, the accuracy and timeliness of data available to big commercial platforms to personalise services of users and influence behaviour; and on the other hand, the slow pace of official statistics released at area-level aggregates and often out of date. Governments of course do collect and have at their disposal individual-level data about their citizens and residents but most of the time are forbidden to use it and link it to other individual-level data, because as a society we value our privacy and confidentiality from government intrusion.

For this reason, government policy is normally based on the incorrect assumption that people living in the same arbitrary spatial units at which statistical data is released all share the same characteristics.

In Digitranscope, we therefore considered how we could use some of the techniques of the commercial sector of consumer profiling and targeting, and apply them to publicly available administrative data to develop more 'personalised' policies aimed at those who need it the most. The key way to develop these personalised profiles without having to deal with real personal data was to create a probabilistic synthetic population from disaggregated official statistics.

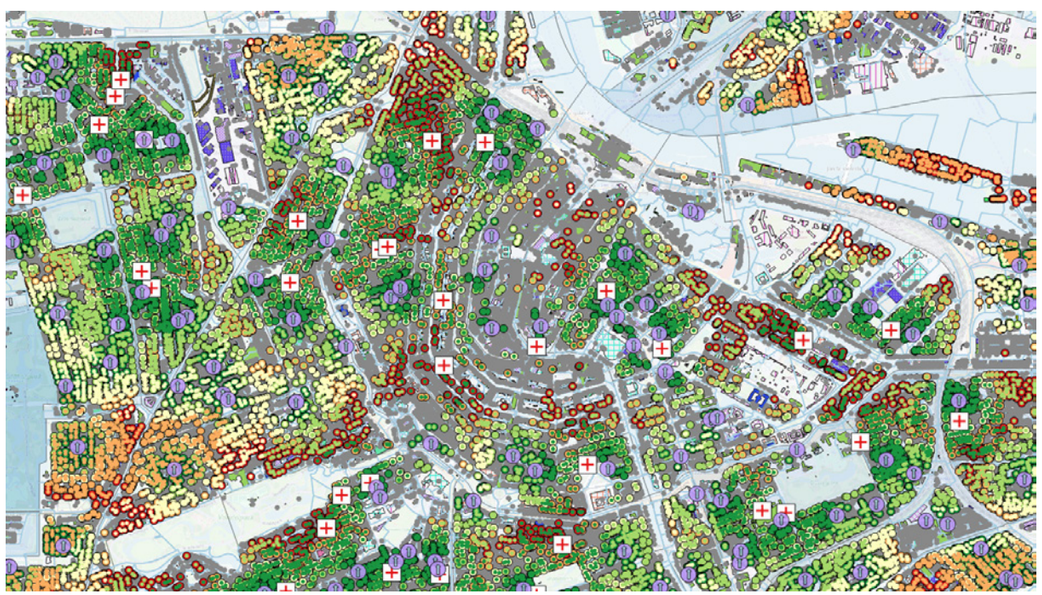
To do so, we took the lowest level of spatial data at which official statistics are released (typically the census track that has a population of 300-500 people depending on country and location). We then used machine learning methods to distribute all the official data available for these areas (sex, age, family composition, housing conditions, and characteristics of the buildings) to a set of 'statistical' individuals so that when aggregated into families and households at the local level, they

give the same data as that of official statistics. If data from the official land registry is available, it is also possible to assign these 'statistical' individuals and families to real individual properties (as registered in the land registry) so as to have an even more fine-grained spatial distribution of official data.

This method is potentially very powerful to estimate needs and design policy interventions targeted to specific groups and neighbourhoods. We applied this method at the local, national and EU level. At the local level, we worked with the city of Amsterdam to identify groups with similar needs (e.g. access of single parent-households to educational establishments and elderly people from health facilities, see Figure 4).

At the national and EU level, we contributed to the work of DG JRC's Coronavirus task force to estimate

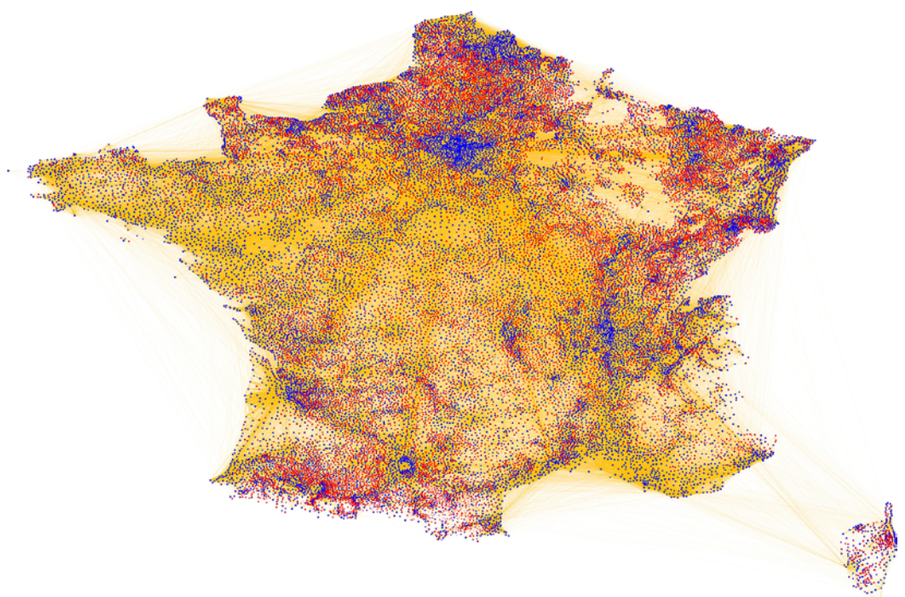
Figure 4: Access to education and health for single-parent families and elderly people



the relative risk of infection of re-opening certain economic activities after the initial lockdown. For this important project, we recreated the synthetic population of 63 million people, in 35 million members of households distributed across 10 million houses in France using data from their official statistical office[7] to model their travel commuting behaviour, also estimating the proportion of people using public transport by economic sector. Figure 5 below shows the model, as devised by DG JRC, of the patterns of 26 million people commuting 2016 for work or for study. Areas in blue show the increased daytime population concentration as people commute to work, while areas in red show the decrease as people leave home.

7 https://insee.fr/en/statistiques?debut=0&theme=1

Figure 5: Influx-outflow of French commuters 2016

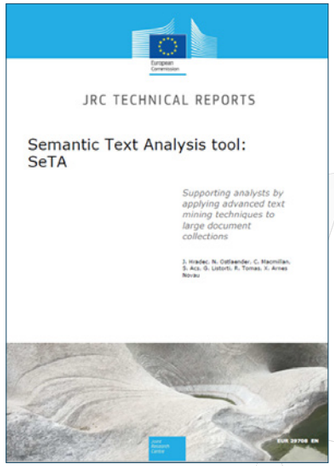


In another line of work, presented in the next section, we have used artificial intelligence tools to identify commonalities and patterns in EU legal and technical documents, helping to make it easier to analyse and extract intelligence from the legal texts. This tool has helped us to move towards analysis of legislation at all levels of European administration, from local and regional by-laws, to national legislation and EU law. Linking this work with the synthetic population modelling may ultimately enable us to completely redesign the policy cycle so that it is built bottom-up with the public placed at the centre of government intervention.

Semantic Text Analysis Tool: SeTA

SeTA is a web application developed in Digitranscope and now accessible to the European Commission to provide support for its staff. It builds on the enormous in-house repository of the Commission's body of legal and scientific documents to assess trustworthy information and enable greater accountability. It relies on a set of neural networks that have been trained on the complete set of the Commission's public documents (EURLEX, the EU Bookshop, etc.) from 1953 to the present day. We have chosen English-language texts due to the sheer volume of available material and because the majority of important documents existing in English. The key advantage of SeTA is its ability to grasp the meaning of terms, and the changes in those meanings over time. Using this ability, it builds up a comprehensive ontology, which makes it possible to carry out semantic searches in more than 500 000 Commission documents.

A dedicated technical report (Hradec et al, 2019)[8] contains a detailed description of the application, together with a host of examples of its application in real-life policy support scenarios. Our ambition is to build a framework, which brings EU policy closer to the EU population. To improve the relevance of the EU institutions and feedback to the public, and to allow the Commission to focus more precisely on the needs of the EU, we need to apply novel tools that can understand policy measures and their impact on people.



> **"Trustworthy information is a key element of accountability. In the age of disinformation, it is becoming increasingly important to separate fact from fakes."**

Artificial intelligence applied to text analysis is one of the key elements of our toolbox. We aim to build assistants to aid experts to focus on what matters, to find biases and to address the hidden inequalities at the source of policy.

Trustworthy information is a key element of accountability. In the age of disinformation, it is becoming increasingly important to separate fact from falsehood. SeTA builds on the in-house repository of the Commission's public documents to extract the relevant facts and data to confirm or refute opinions and claims made in the public arena. It is therefore an important tool to counteract the increasingly well-organised misinformation campaigns.

SeTA's tools, even in their current state of prototype, either as a web application or a web service for information system integration, provide a major opportunity to support the work of the Commission's analysts and policy-makers. The same methodology could be applied to national or local legislation, contributing to the modernisation of public administrations, a priority reaffirmed by the recent Berlin Declaration on Digital Society and Value-Based Digital Government signed by all the EU ministers in December 2020[9].

8 Hradec J., N. Ostlaender, C. Macmillan, S. Acs, G. Listorti, R. Tomas, X. Arnes Novau, *Semantic Text Analysis Tool: SeTA*, EUR 29708 EN, Publications Office of the European Union, Luxembourg, 2019, https://publications.jrc.ec.europa.eu/repository/bitstream/JRC116152/kjna29708enn_1.pdf

9 https://ec.europa.eu/digital-single-market/en/news/berlin-declaration-digital-society-and-value-based-digital-government

Impacts of the Project on EU policy

In this brochure, we have summarised the research activities and the key findings of the project. A more extensive discussion of each strand of the project, and much more, is available in the Digitranscope E-book[1]. What we did not realise at the start of the project is that what we thought was going to be an exploratory project looking 5-10 years ahead turned instead into one providing already direct input to policy as policy priorities shifted much faster than we anticipated.

> **"The most significant event that occurred during the lifetime of the project was the emergence of Artificial Intelligence (AI) as a key geopolitical battleground."**

On Data Governance

The most significant event that occurred during the lifetime of the project was the emergence of artificial intelligence (AI) as a key geopolitical battleground, particularly between the US and China. This brought AI also at the forefront of the European political attention with an initial strategy on AI adopted by the Commission in April 2018[2], followed by a coordinated plan with the Member States in December 2018[3], the establishment on a High-Level Expert Group[4] to advise on the development of ethical guidelines for AI and priority areas for investment in 2019, and a AI White Paper[5] in February 2020 setting the framework for a consultation on a risk-based regulatory framework for AI.

Why is this important? Because it immediately became clear that data is the key asset underpinning the development of AI, and that to govern the future development of such technology it is necessary also to govern better European data. Technological and data sovereignty became key objectives of the

1 Craglia M., Scholten H., Micheli M., Hradec J., Calzada, I., Luitjens, S., Ponti M., Boter J *Digitranscope: The governance of digitally-transformed societies.*, Publications Office, Luxembourg, 2021
2 European Commission. *Communication: Artificial Intelligence for Europe. 2018a.* https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe
3 European Commission. *Coordinated Plan on Artificial Intelligence. 2018b.* https://ec.europa.eu/digital-single-market/en/news/coordinated-plan-artificial-intelligence
4 https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence
5 European Commission. *White Paper on Artificial Intelligence: A European Approach to Excellence and Trust. COM(2020)65final. 2020a.* https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf

> **"Digitranscope contributed to raising the attention on the strategic importance of data governance. Digitranscope contributed directly also to the proposed regulation on European data governance."**

new Commission which took office in November 2019, encapsulated in the key Commission priority: 'A Europe fit for the digital age'.

As a result of this increased attention to data, the Commission organised several workshops and studies on data governance addressing not just the traditional open government agenda, but also business-to-business and business-to-government data sharing. The workshop results fed into the European Strategy for Data published in February 2020[6] which establishing several European common data spaces in different thematic domains (e.g. environment, health, agriculture, automotive, finance, etc.) and a regulation on the governance of data is due at the end of 2020.

Digitranscope contributed to raising the attention on the strategic importance of data governance through the JRC Flagship report on "Artificial Intelligence: A European Perspective" published in December 2018[7], which highlighted also the need for proactive policies at the local level to develop local data ecosystems, applications, and training addressing local issues to foster social inclusion. These recommendations were adopted by the Coordinated Plan on AI[8] published shortly afterwards.

Digitranscope contributed directly also to the proposed regulation on European data governance[9] by sharing the research results reported in ~~Section 4~~ above with the colleagues in the Commission in charge of these data policy initiatives and thus informing them about emerging data governance models including data altruism, and platform and data co-operatives.

6 European Commission. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. *European Strategy for Data COM/2020/66* https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593073685620&uri=CELEX%3A52020DC0066

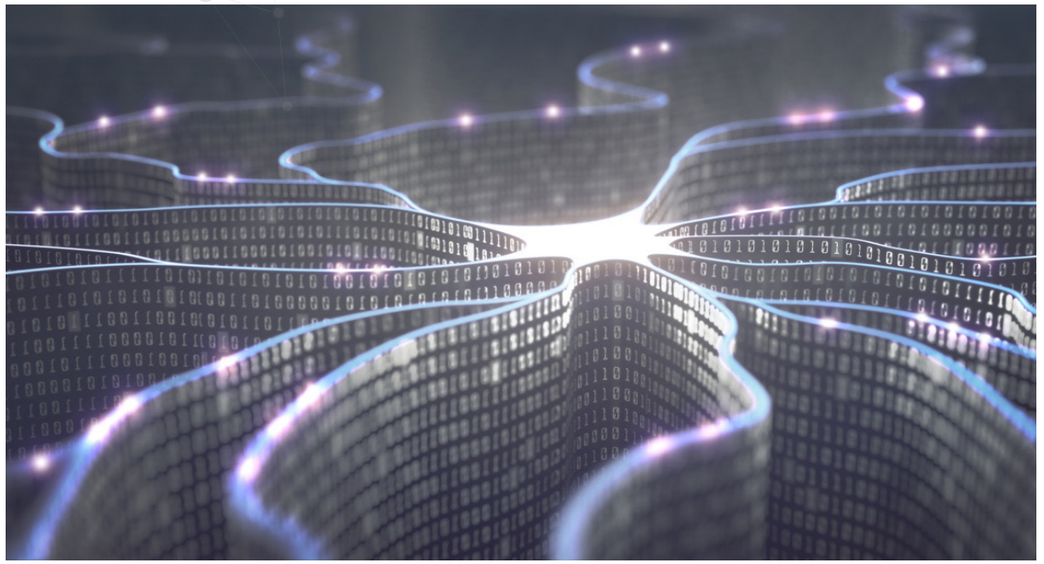
7 Craglia, M. (ed), Annoni, A., Benczur, P. et al. Artificial intelligence – A European perspective. Publications Office. Luxembourg. 2018. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC113826/ai-flagship-report-online.pdf

8 European Commission. Coordinated Plan on Artificial Intelligence. 2018b. https://ec.europa.eu/digital-single-market/en/news/coordinated-plan-artificial-intelligence

9 https://ec.europa.eu/digital-single-market/en/news/proposal-regulation-european-data-governance-data-governance-act

On new forms of policy design

~~significant~~ policy shifts have also emerged in this area during the last few years and become increasingly mainstream. Notably, the increasing use of big data analytics to profile and nudge voters following the example of the commercial sector recognised not only the power of data but also the emotional side of decision-making. The mantra of evidence-based decision-making that was all the rage in the 1990s has come under increasing scrutiny together with the scientific method when applied to social and political phenomena. We have seen therefore a greater acknowledgement of the



multi-faceted dimensions of rationality, decision-making, and post-normal science. Communication, participation, and the use of narratives have gained currency exploiting also the new opportunities of the digital transition, from the boom of citizen-generated content for science and policy to the development of digital twins for policy simulation, co-creation, and communication. Within this changing landscape, Digitranscope has contributed in three main ways:

SeTa, the semantic text analysis tool described in ~~Section 5.4~~, started as a pilot project and is now part of DG JRC's day-to-day work and has been made available throughout the European Commission to support the work of all colleagues required to do an impact assessment, ex-ante or ex-post assessments of European policies. Its enormous value is to have turned hundreds of thousands of separate documents into a coherent and usable repository of the Commission's knowledge.

The Probabilistic Synthetic Population modelling ~~described in Section 5.3~~ contributed directly to the work of DG JRC's Coronavirus task force, which advises the Commission on potential policies and strategies to address the pandemic and its epidemiological and socio-economic effects. A new project has now started with the Dutch Central Bureau for Statistics to develop the model further, validate it against the statistical data held by the bureau and provide advice to the Dutch government on COVID-19 related policies. The ambition is then to extend this collaboration between DG JRC and statistical agencies further, involving also EUROSTAT, to create a Europe-wide synthetic population base for policy simulation and analysis.

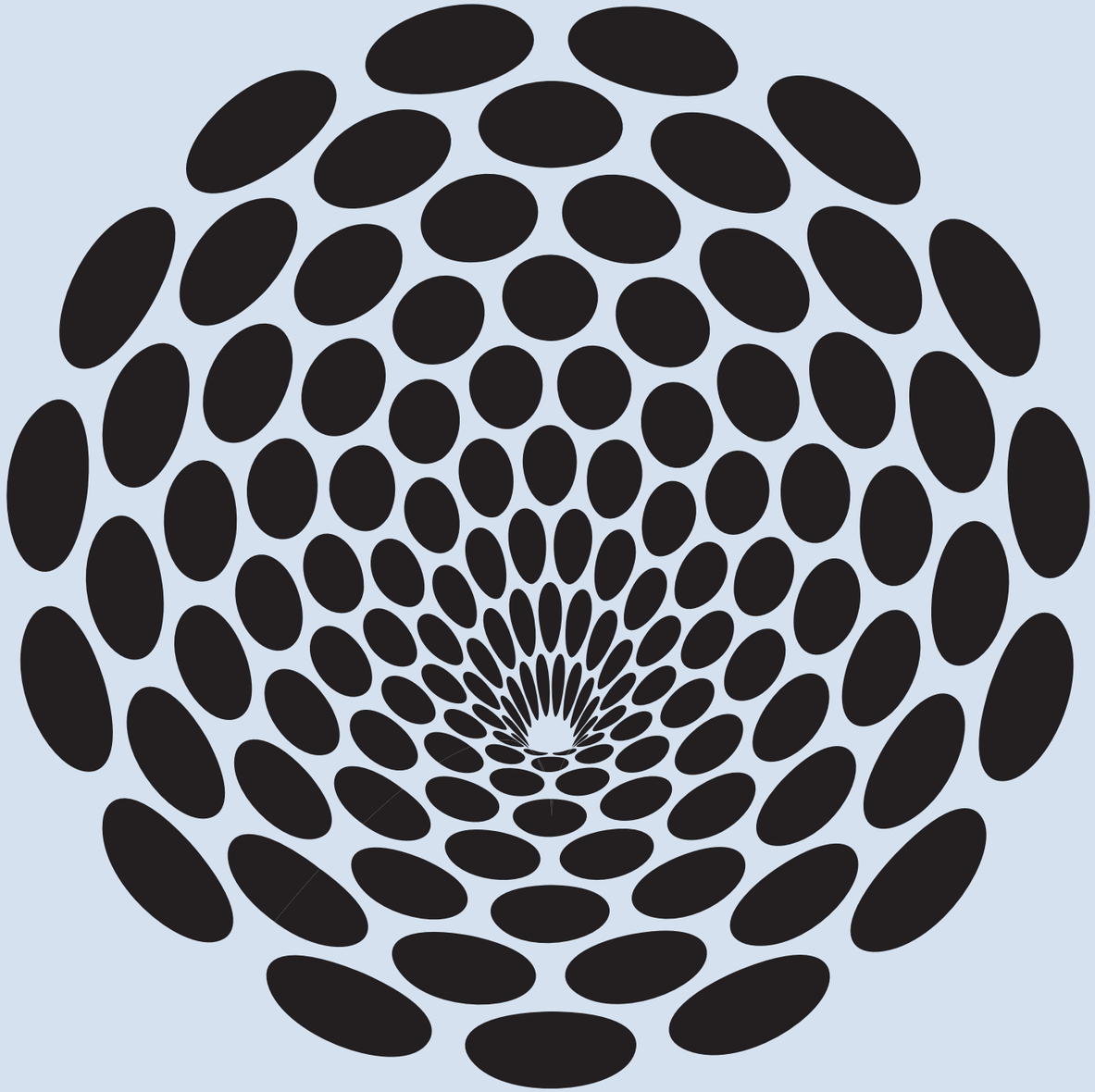
Regarding digital twins, the project was able to leverage the digital twin of the Netherlands developed by the Free University of Amsterdam, Geodan, the Dutch Cadastre and the Dutch Waterboard using Minecraft© to run a series of experiments. In

"Digitranscope was able to show the value of digital twins and gaming as key assets for policy co-creation and testing, and for engaging the new generations of citizens in the decision-making of today that will affect above all their futures."

particular, we were able to use the Ecocraft plug-in developed by the Dutch EduGIS Foundation to raise the awareness of young adults on the trade-offs needed in the energy transition in two schools as described in ~~Section 5.2~~.

Moreover, Digitranscope was able to contribute to a big event in the stadium of the Ajax football team in Amsterdam where 500 kids used the digital twin of their city to design a new sustainable neighbourhood. In that occasion, the UN Environment Program (UNEP) signed a partnership agreement with the Dutch EduGIS Foundation. Under the agreement, geospatial data tools will allow the game to map territories around the globe and simulate environmental challenges related to achieving the UN's Sustainable Development Goals (SDGs).

Environmental education is vital to raising awareness on and achieving the SDGs. A target for citizens to participate more in sustainable urban settlement planning is included under Goal 11 on 'sustainable cities and communities,' while Goal 7 aims for 'affordable and clean energy'. With these experiments and the follow-up promoted by UNEP worldwide, Digitranscope was able to show the value of digital twins and gaming as key assets for policy co-creation and testing, and for engaging the new generations of citizens in the decision-making of today that will affect above all their futures.



Conclusions

Digitranscope set out to explore the challenges and opportunities that digital transformation is posing to the governance of society. We focused our attention on the governance of data as a key aspect to understand and shape the governance of society. Data is a key resource in the digital economy, and control over the way it is generated, collected, aggregated, and how its value is extracted and distributed in society is crucial. We have explored the increasing awareness about the strategic importance of data and emerging models to distribute the value generated from it more fairly across society. These findings have contributed to the new policy orientation in Europe on technological and data sovereignty, as well as on social inclusion.

Digital transformation, and the rise of artificial intelligence and the internet of things, offer new opportunities for new forms of policy design, implementation, and assessment. It can help provide more personalised support to those who need it most, and develop more participative engagement in the policy cycle. The use of digital twins, gaming, simulation, and synthetic data are just at their beginning but promise to change radically the relationships among all the stakeholders in the governance of our society.

As the Digitranscope project comes to its conclusion we are conscious that there is still much work to do. We are only at the beginning of the digital transition of society, and at the early stages of equipping ourselves with the necessary theoretical frameworks, regulatory instruments, and networks of partnerships and international alliances necessary to try and shape our futures effectively. Governments needs to step up their actions to help guide the process, build capacity inside public administrations and society through education and investments in research and innovation, develop greater capacity for foresight studies to try and anticipate change and foster a culture of experimentation without fear of making mistakes. The necessary condi-

tions for this are however openness, transparency and inclusiveness. These important principles are not a given in the current digital transformation. On the contrary, we witness increasing polarization in society and the political discourse, and growing inequality between rich and poor, and among different regions, nations, and continents. The COVID-19 pandemic has illustrated these dangers well with the effects of both the health crisis and the increasing transitions towards digital platforms and services hitting the most vulnerable groups (the elderly, children, migrants, minorities) worst. How we can channel digital transformation so that it helps reduce inequality and injustice rather than increase them remains a key challenge.

We were only able to address these issues partially in Digitranscope looking for example at emerging models to redistribute more equitably the added value of data, or ways to engage citizens and children in particular in taking the advantage of digital tools to shape their future. There is much more work to do, but we are fortunate that we will be able to continue the work started in Digitranscope at the European level thorough the work of DG JRC, at the national level through the new projects we have started with the Dutch geographic council and the statistical agency, and locally through the network of wonderful and committed colleagues we have developed during the three years of the project.

If there is a take-away message from the Digitranscope journey we have described in this volume is that the governance of our digitally-transforming society is challenging and complex, full of opportunities and pitfalls, but that ultimately it is up to all of us to shape it. We cannot afford to leave it to others.

“Take-away message from the Digitranscope journey we have described in this volume is that the governance of our digitally-transforming society is challenging and complex, full of opportunities and pitfalls, but that ultimately it is up to all of us to shape it, we cannot afford to leave it to others.”

Who are Digitranscope?

Henk Scholten is the lead scientist of the Digitranscope project. He is professor in Spatial Informatics at the School of Business and Economics of the Vrije Universiteit Amsterdam. He is also founder and CEO of Geodan Holding, one of the largest European companies specialised in Geo-IT. Furthermore, he is programme director of UNIGIS Amsterdam, distance-learning MSc. in Geographic Information Science.

Marina Micheli is Scientific Project Officer at the European Commission’s Joint Research Centre (JRC) Centre for Advanced Studies since 2018. Previously, she was a senior researcher and teaching associate at the Institute of Communication and Media Research of the University of Zurich and a post-doctoral fellow at the Department of Sociology and Social Research of University Milano-Bicocca, where she earned her PhD in 2013. Her research revolves around technology innovation, adoption and use examined with a socio-cultural and critical perspective.

Igor Calzada is Scientific Project Officer at the European Commission’s Joint Research Centre (JRC), Centre for Advanced Studies. Since 2012 he is a senior researcher at the University of Oxford, Urban Transformations ESRC and Future of Cities Programmes at COMPAS, leading several research projects on smart cities and city-regions: (i) EU-H2020-Smart Cities and Communities-SCC-01-2015-691735-Replicate (2016<), (ii) ESRC-Urban Transformations (2016-2019), and (iii) City-Regions pro[illegible]funded by Ikerbasque (2012-2014) and the RSA (Regional Studies Association) (2014-2015). His main research interest draws on how digital transformation processes driven by AI disruption in the post-GDPR current context are altering techno-political and democratic conditions of data governance for the emergence of new algorithmic citizenship regimes in European (smart) cities and regions.

Jiri Hradec is Scientific Project Officer at the European Commission's Joint Research Centre (JRC) Centre for Advanced Studies exploring personalised policies through data mining, machine learning and econometric modelling. He specialises in the use of text mining, machine learning, and deep neural networks in support to policy across a range of projects and departments at the JRC. Between 2005 and 2012, he was Director of CENIA, the Czech Environmental Information Agency, and between 2000 and 2004 Head of the Informatics Department of the Czech Ministry of the Environment.

Max Craglia is a Senior Expert at the European Commission Joint Research Centre, Digital Economy Unit, responsible for projects addressing digital transformation and the socio-economic impacts of AI in different economic sectors, new forms of governance in digitally-transformed societies, and the evolution of the space data economy and the geospatial sector. He is the coordinator of the Digitranscope project.

Marisa Ponti is Assistant Professor at the Department of Applied IT, University of Gothenburg, Sweden and was a scientific officer at the JRC in 2018 contributing to the activities of the project with respect to data governance and citizen-generated content.

Michael Blakemore is Technical Director of Ecorys UK, Emeritus Professor of Geography at Durham University, and Honorary Research Fellow at Durham Business School. Michael was the co-lead scientist of the Digitranscope project in its first year.

Margherita Di Leo is an earth data scientist and scientific programmer contributing to the development of the probabilistic synthetic population.

If you want to know more about Digitranscope, please visit the our website https://ec.europa.eu/jrc/communities/en/community/digitranscope

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