STAY TUNED TO THE FUTURE

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Lessico Intellettuale Europeo

STAY TUNED TO THE FUTURE

IMPACT OF THE RESEARCH INFRASTRUCTURES FOR SOCIAL SCIENCES AND HUMANITIES

edited by

Bente Maegaard and Riccardo Pozzo

with Alberto Melloni and Matthew Woollard as co-editors

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WELCOMING ADDRESSES

Alberto Melloni

Director of the Fondazione per le Scienze Religiose Giovanni XXIII (FSCIRE)

Jannis Kounellis is one of the greatest artists of the twentieth century: born in Athens, naturalised as Italian citizen, he died in February 2017. In the months after his death, the Alma Mater Studiorum Università di Bologna and the Foundation for Religious Studies were asked to host the conference of the ESFRI strategy committee on social sciences and humanities.

In one of the most important retrospective shows dedicated to him, the one held in Paris at La Monnaie, his «arte povera» was exhibited in a very interesting way: the masterpieces of the artist who, under the guidance of Toti Scialoja, was using very essential and even poor materials for his art, were installed in order to maximise the contrast with the sumptuous palace: and this had an impact – and impact is not a neutral *res*, but a relation between objects, actions and context.

More specifically, among the pieces exhibited in Paris one was leading toward the ESFRI conference. It is a work made in 1969, officially untitled, but usually named «Libertà o morte (W Marat W Robespierre)». A candle is standing in front of a black dashboard where the revolutionary statement is written in Italian and ready to be deleted. The flame consumes the candle and each day the candle has to be replaced by a new one.

The model of the white candle opposing the black was revisited by Kounellis in 2013: the board is replaced by a steel plate, with a square hole: in this case nothing is written on the screen, and also when the candle flame is visible, the hole absorbs its light: the light is there, but it has no impact.

I suggested to use this image for the Bologna ESFRI conference for two reasons.

The first pertains to the location of the conference. FSCIRE uses as its aula magna the former church of san Leonardo: a place secularised during the Italian risorgimento, which used to be one of the most innovative theatres in northern Italy: so a quotation of «Libertà o morte», coming from the French Revolution was at its place saying that disruptive innovation, usability, interoperability, impact as well as many of the categories which

are the 'lingo' of research policies were already around us. They are visible and at the same time undetected, as if they were waiting for 'humanities' capable to take them out of the oblivion and offering them as food for thought.

The second reason is what the 2013 masterpiece is mostly telling that science – and humanities are part of science, even in fields which were not represented in their strategic potential up to now – may have no impact on the small darkness absorbing its intellectual energy. Because impact cannot be activated by a mere positive sequence of acts or by good will: it requires a proper background.

Needless to say, no explanation was offered to this small artistic clue: and it was a choice coherent with the three-day discussion that from its very beginning offered precious insights and suggestions both to the Member States' delegates into the ESFRI forum and to the scientific community. True art is actually capable to uncover the real feelings of the human beings: uncultivated visitors may 'understand' a masterpiece not because they have hermeneutical skills in order to decipher the meaning of an art work; they can understand it because it speaks to their human sensibility and to the open heart that makes science possible. And if those who do not understand art are insensible to it, that is not because they are not specialists of art history, but because they are incapable of the openness and freedom that is necessary to all scientific disciplines.

Once again, in these proceedings of the conference supported by FSCIRE, Kounellis is there. He speaks of impact and research infrastructure, even if he probably never thought of them. His voice comes to us and speaks to scientists of hard science, biomedical scholars, historians and philosophers – all the *universitas magistrum et scholarium* who welcomed the ESFRI conference and is now offering an unreplaceable participation for the proceedings.

Closing this short preface, let me say that FSCIRE is very grateful for the proposal to host the conference and proud of the services offered in its Library – which is one of the most important ones in the world for the history of Christianity and now complemented by the new Library founded in Palermo for the history of Islam. I am personally grateful to all our staff, especially to Irene Iarocci and Francesco Coppola, to the scholars and the secretariat of FSCIRE. I am also grateful to the BBS Bologna Business School and its Dean professor Max Bergami who welcomed us in the beautiful grotto of Villa Guastavillani. To the *Rector Magnificus* Francesco Ubertini and to his executive assistant Elisabetta Zanette goes the gratitude of all of us. I am also glad to acknowledge the main donors of FSCIRE and the authorities monitoring its financial resources – Fondazione CARIPLO,

Fondazione CARISBO, Ministero dell'istruzione università e ricerca, Regione Emilia Romagna.

The conference in Bologna took place on 24-25 January 2018 in conjunction with the meeting on 23 January 2018 of the ESFRI Strategy Working Group on Social and Cultural Innovation. My special gratitude goes to the ESFRI, to its President Giorgio Rossi, to the chair of the Strategy Working Group Jacques Dubucs and to the Conference Programme Committee chair Bente Maegaard. The meeting was honoured by the presence of Professor Romano Prodi, former President of the European Commission, Professor at the Bologna University and since the times of Giuseppe Dossetti very generous in his advice to the via san Vitale 114 research team. To all the participants a warm *benvenuti a Bologna, arrivederci a Bologna*.

Patrizio Bianchi

Minister for Research and Innovation of the Regione Emilia Romagna

A rich and heterogeneous literature defines the current phase as the fourth industrial revolution. Most of this literature, however, reduces this great social transformation to technological change. History teaches us that the same technology can have different social impacts in different social contexts.

On the other hand, the great English industrial revolution described by Adam Smith in 1776 has its roots in the political, scientific and cultural revolution of a hundred years earlier. With the Glorious Revolution, with Newton's *Principia Mathematica*, with Locke's *Two Treatises of Government*, a new vision of world and society was affirmed and this transformation in social relations allowed those technological innovations to become tools for the development of the country.

Today, we cannot understand the new industrial revolution based on internet, on robots, on artificial intelligence, if we do not explore the great social, scientific and cultural transformations that are reshaping societies in the age of economic globalisation without political globalisation.

We cannot even evaluate the impact of these technologies on society if we do not have the tools to analyse the transformation of society in the long run, if we do not have the tools to deeply analyse the transformations of the sense that men have of their own humanity.

For these reasons, the Regione Emilia Romagna is investing heavily in two pillars of development: on the one hand the Bologna Big Data Technopole, in order to have a world-class centre for the development of tools that tackle sustainable development goals, from climate change to the transformation of production systems; on the other hand the Fondazione Scienze Religiose (FSCIRE), as a hub for the European network of universities that investigate the great movements of societies that mark collective identities in today's world.

Europe must invest in large research infrastructures in the human and social sciences not only to strongly mark our own identity, so as to reduce the fears linked to global openness, but also to increase our social resilience to the global changes. Europe must make these investments in hu-

man and social research infrastructures to be able to face global challenges that require powerful scientific and technological tools with a vision of the future that has at its centre the real life of people, both individuals and the community – a vision built with all the intellectual tools that our culture has developed over the centuries behind us but, which live in our current research.

Massimo Inguscio

President of the National Research Council of Italy (CNR)

At the National Research Council, the Department of Human Sciences (DSU-CNR) has a twofold mission. First, it coordinates and promotes a network of cross-disciplinary researchers in the domain. Second, it functions as centre of gravity for discussions on Social Sciences and Humanities within the Italian system of research. It caters to the communities of cognitive science, social sciences, humanities and cultural heritage. Finally, it provides data-driven research in the domains of Neuroscience, Computational Social Science, Big Data Humanities and Heritage Science.

Under this perspective, the DSU-CNR gives a perfect fit with the ESFRI Roadmap 2018. No wonder, the Italian Ministry of Education, University and Research has entrusted the National Research Council with the stewardship of a number of RIs and particularly with the ones that serve the «Strategy Working Group on Social and Cultural Innovation», which has promoted this conference.

Last but not least, let me point out that the Italian node of DARIAH ERIC was started in 2013 at the Institute for the European Intellectual Lexicon and History of Ideas (ILIESI-CNR) and is currently run at the Opera del Vocabolario Italiano (OVI-CNR). The Italian node of CLARIN ERIC is being hosted since 2016 at the Institute of Computational Linguistics (ILC-CNR), while the seat of the infrastructure E-RIHS as well as of its Italian node have been run at the National Institute of Optics (INO-CNR) since its inception in 2014.

Giorgio Rossi

President of the European Strategy Forum on Research Infrastructures (ESFRI)

First of all, I would like to thank very much the organisers of this meeting, which I believe is important and timely. Social and cultural innovation research infrastructures have grown to become powerful tools for culture and society engaged in research and innovation. I think they are a substantial achievement of the whole European research and innovation community, for they are having impact and bear a huge potential.

Today, we are facing momentous changes in connection with the changes in our labour organisation due to artificial intelligence, which is fundamentally based on the so-called big data. Changes bring fears, uncertainty, confusion and worries as some outlooks indicate that maybe up to 50% of the labour force might be replaced by artificial intelligence.

Artificial intelligence, however, requires algorithms and high-quality data to operate. The big data paradigm today is that big data are collected through the observation of common behaviours of many individuals typically defined as customers and classified as customers. We have data about our list of purchases in a supermarket; we have data about our preference in airlines or hotel services, etc. The paradigm is that these data are given by the individuals for free in exchange of low-quality data services, such as games, invasive social networks, unreliable weather forecasts, etc.

It happens, then, that the economy makes it possible to earn profit from low-quality data given for free to the advantage of very few concentrators of wealth such as Amazon, Microsoft, Google, Apple and Alibaba. In return, customers receive low-quality services that induce a very low-quality usage of the data infrastructure that stimulates, say, online gambling, cyber bullying and social behaviours that are not for the improvement of society.

Today, research infrastructures are the producers of research data. They have built in the knowledge and the capability to quality-check the data and to decide which high-quality datasets are worth to be put in the open. This is a very important function that research and research infrastructures have at this time if we want to reshape the big data society.

The data capital is now concentrated in very few operators, which ex-

ploit the information spontaneously given by individuals, for a business has a labour content smaller than one-hundredth with respect to any other productive model.

It means that today's big data economy might eventually lead to poverty and that we should worry about the usage of the high-quality data that are collected through public research infrastructures in such an economy. Research products are all labour-intensive: a lot of knowledge and a lot of work go into producing high-quality data that can be curated and documented to be put in the open.

The research community already operates high-quality data services, and more needs to be developed to reach a broader audience. The research infrastructures can contribute to steering towards a new paradigm in which data as labour replace data as capital, thus leading to a more equal labour-based society and to a corresponding perception of the value of the data.

In this sense, the infrastructures for social and cultural innovation provide a quite direct interface to the public, and can also help to transfer the knowledge generated by the fundamental observations and experiments of the natural sciences.

The ESFRI analyses how research infrastructures in different fields do impact more and more diverse fields of knowledge. There is evidence that high-quality data are the key for high-quality services and for a more effective and positive development of the data-based economy. For this reason, the ESFRI is contributing to the very important initiative of the European Open Science Cloud (EOSC), a very important initiative of the European Commission that opens the way towards many positive developments at social and economic level, but very high attention needs to be paid in avoiding that low-quality data are introduced into the EOSC, because this could jeopardize the credibility of the whole system.

In this context, research infrastructures have an important role to play.

Having said that, I repeat that it is very important that this meeting dedicated to infrastructures for social and cultural innovation is taking place, for they may take the lead in orienting correctly towards a good data economy and I am looking forward to hearing the contributions.

Jacques Dubucs

Chair of the Strategy Working Group on Social and Cultural Innovation (ESFRI SWG SCI)

The very notion of the impact of research (infrastructures) is still dominated by the paradigm of technological innovation and patent taking which characterises manufacturing industry. We need today a broader notion of impact, suitable to service industry, knowledge societies and Human and Social Sciences (HSS). To achieve this objective, one should firstly take into account the economic value of large sets of data as linguistic and iconic corpora or collections of information dealing with the social, sanitary and ideological situations of citizens, but one has also to appreciate and, if possible, to measure the value of such data for inclusiveness and resilience of societies.

In the Strategy Working Group for Social and Cultural Innovation we started a long time ago a reflection about the impact of research infrastructures, and this reflection was of course related to research infrastructures for social science and humanities (SSH). We felt that the usual notion of impact dealing with technological innovation, patents, etc. which is *prima facie* appropriate for big science as physics and for manufacturing industries, was not to appropriate for the domain of SSH and for service industries, and we reflected internally on notions of impact that would be more suitable to what we do in social science and humanities, and in fact this led us to a threefold interrogation:

First of all: what would be a better and more inclusive notion of impact, taking into account social and cultural impact of SSH research? Secondly, what could be considered an acceptable metric for that new notion of impact? And thirdly: what could we do to increase this impact, i.e., to make SSH research and SSH research infrastructures more useful, for instance for policy making for societies and for citizens?

At that point, we realised that in fact our problematics was not specific to us, and that it would be a valuable attempt to open the game and to associate our colleagues from other departments and other sectors of science.

Hence this conference, which associates societal and cultural innovations to all other groups, and I would like to thank all the participants here and in particular Professor Alberto Melloni, of FSCIRE, who has made this event possible.

Bente Maegaard

Chair of the Conference Programme Committee

There is a growing consensus that it is important to be able to assess the value of research infrastructures, not only for research, but also for the society at large. But currently there is no unified framework for the impact assessment of investment in research infrastructures. Various conceptual frameworks exist in parallel comprising a range of observable direct and indirect effects and longer-term impacts, in particular economic impacts. However, most of these studies and frameworks do not concentrate on Social Sciences and Humanities. SSH Research Infrastructures are very well suited to take into account the future of society. Their experiences and variety stress the impact of SSH RIs beyond research: it affects the vision of decision makers and social actors.

Furthermore, core aspects of RI benefits, such as their impact on human and social capital formation and innovation, are not sufficiently explored. In this conference we want to focus on the societal impact of RIs for SSH, i.e., we want to discuss the broad scale of types of impact and methodologies for their assessment. On this background we invite discussion about ways to increase impact, in SSH and beyond.

So, how did we implement these ideas into the programme? Let me just briefly take you through the thinking behind it. First of all we have three keynote speakers: these are distinguished high-level individuals, and we simply asked them to give their best views of what the difficulties are and how they can be tackled – the keynote speakers have been asked to present to us any ideas that they have.

The rest of the programme follows a structured approach, where we start out with the concept of impact: how can impact be defined and what are the various aspects. Following the conceptualisation we get to measurement: How can you actually measure impact in certain projects and infrastructures, i.e. that is a more specific and more concrete way of looking at it. In the next session we have asked various countries to tell us why they think they need research infrastructures as a basis for research in social science and humanities and maybe beyond.

In the next session we move on to the five ERICs that we have in so-

cial science and humanities (CESSDA, CLARIN, DARIAH, ESS, SHARE), and we have asked each of them to tell how they go about impact – what kind of impact they have and how they can show it. And finally we have asked all the ESFRI strategy working groups to come together in the session tomorrow because we do think that by crossing boundaries between domains we could maybe have an even larger impact, and we would like to inspire and explore this.

The programme ends with a final discussion, which we hope will show ways into better understanding impact and better being able to collaborate across borders.

Before stopping I would like to mention that we will be making proceedings for this conference, so that there will also be a more tangible result and you can go back and have a look at those ideas that were created here and were spread here.

The Conference Programme Committee was composed by Jacques Dubucs, István Kenesei, Georg Lutz, Alberto Melloni, Riccardo Pozzo, Sonia Stefanizzi and Matthew Woollard. I want to warmly thank each of them for their efforts.

Ales Fiala
European Commission

Good afternoon. It is a pleasure to participate in the opening of this conference on the impact of RI.

The topic of impact is very important in any human endeavour, and the RIs are not the exception.

It is also timely to organise such an event in order to feed into a debate with Member States on establishing the European Action Plan on the long-term sustainability of RIs, as well as into a debate on the post-H2020 Framework Programme.

In this context, I want to recall the so-called Lamy report *Investing in the European Future We Want*, which was published by the EC the last year. This report is focused on how to maximise the impact of a post-H2020 European research and innovation programme.

It is always good to start with appreciation of what has been achieved.

And indeed, a lot of work has already been carried out in the field of RI in Europe. Over the last 15 years, the EC has been working in close collaboration with the European Strategy Forum for Research Infrastructures, the ESFRI. Together, we have been very successful in developing and implementing a strategic, coordinated and life-cycle approach to the planning, funding and implementation of new pan-European RIs in various fields of science.

Europe has built a worldwide reputation in the development of new legal and financial frameworks for organising RIs. The ESFRI Roadmaps together with the European Research Infrastructure Consortium Regulation represent important policy developments.

The European RI policy has generated clear added value.

Examples include the standardisation of procedures for setting up of political priorities across Europe. This is happening through the development of national roadmaps that are gradually aligning with the European Roadmap.

Another example is to enable and leverage synergies between different funding sources; such as H2020, the European Structural and Investment

Funds, the European Regional Development Funds and the European Investment Bank.

Still another example is the development of a common approach to access procedures to RIs.

A lot has been achieved but there is still a lot to do.

Most of the ESFRI RIs generate and handle huge data volumes, and one of our policy priorities is to ensure connection of RIs to the European Open Science Cloud.

Another policy focus is on a pan-European vision for the Long-Term Sustainability of RIs. The increasing number of RIs require billions of euros of investment every year, and policy makers face important funding decisions. They must consider priorities of different scientific communities and of the society in general, but also the international context. Understanding and measuring of all kinds of impact of RIs is essential in order to take the right decisions at both national and European levels.

Over recent years, the European Commission has been working in close collaboration with the ESFRI and the Organisation for Economic Co-operation and Development, in order to support the development of a standardised reference framework of robust and reliable methods for assessing the impact and the socio-economic relevance of RIs. Presentations in this conference will provide the excellent opportunity to discuss this work.

There is a need for interaction across all scientific domains to reach consensus on the standardised reference framework for assessing the impact of RIs. The presence and contributions of the Chairs of all ESFRI Strategy Working Groups to this conference is an important step in this direction.

It is not easy to compare investments in RIs across Europe due to the diversity of funding instruments, national and European. In view of the next FP, the Lamy report invites to reflect upon developing a common approach to the impact assessment methodology at national and European levels.

We need a definition of impact that captures all important elements such as the impact on science; on skills and competences; on competitiveness of the European industry; on innovation practices; on performance of Member States and policy-making. We need to increase the visibility of RIs, to communicate better the impact and added value of RIs to society at large, and to exchange the best practices.

Those are just some elements which I wanted to share with you.

I am confident that this conference will make a major contribution to the current debate on the search of new ways to assess the impact of RIs.

Let me conclude by wishing you fruitful discussions!

INTRODUCTION

Bente Maegaard, Riccardo Pozzo
Editors

Almost all presentations which were given at the conference held at the seat of the Fondazione Scienze Religiose Giovanni XXIII (FSCIRE) in Bologna on 24-25 January 2018 have found their way to this volume. Appropriate funding was provided by the Regione Emilia Romagna and the Alma Mater Studiorum University of Bologna.

The editors wish to thank István Kenesei, Georg Lutz, Alberto Melloni, Sonia Stefanizzi and Matthew Woollard for their careful reviews of all papers, Matthew Woollard also for his support in editorial matters. They also express their gratitude to Antonio Lamarra, the director of the Institute for the European Intellectual Lexicon and History of Ideas of the National Research Council of Italy (ILIESI-CNR), and to its Scientific Committee for having accepted this volume in its flagship series «Lessico Intellettuale Europeo». Our gratitude and a special appreciation go to Maria Cristina Dalfino for her impeccable editorial work at ILIESI-CNR. Let it be reminded that with its lexical approach to a database embracing one-hundred great books in the history of philosophy and science published between 1600 and 1800 ILIESI-CNR has played a pioneering role in opening up digital humanities by providing access to one of the first digital libraries, which was started in 1964 and became operative in 1967.

Its researchers [of ILIESI-CNR] investigate several epochs under the assumption that at the root of the history of philosophy and of the sciences and more generally of the history of ideas lie textual *corpora* that have been developed in the context of each discipline over the centuries. Historical semantic tools consider technical uses and ambiguities, synchronic and diachronic inter-relations, translations and transpositions across lexical fields. The specificity of their methodology requires keeping close to texts, individual terms and lexical families. Hence the publication of lexica, indices and concordances, the setting-up of data-bases and scientific data processing applied to technical terminology in the humanities.[1]

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[1] See <http://www.iliesi.cnr.it/EN/> accessed 10 October 2018.

Dedicated to twentieth-first-century occurrences of the notion of impact, this volume contributes to the growth of a series that was started after the establishment, in 1964, of one of the first research infrastructures for electronic text processing, the «Lessico Intellettuale Europeo».

One can see, then, that ILIESI-CNR can be considered as one of the seeds from which decades later research infrastructures such as CLARIN ERIC and DARIAH-ERIC were born.

The volume starts with the two momentous «Conference keynotes» delivered by Milena Žic Fuchs, who puts into context the impact of SSH RIs within the ESFRI 2016 and 2018 roadmaps, and Yves Gingras, who warns about taking into account the specificity of SSH research as regards evaluating its impact.

The remaining part of the proceedings presents a number of papers divided in five parts.

Part one is concerned with the «Conceptualisation of impact», with Elena Esposito looking into the spread of Big Data for assessing the impact of infrastructures in different areas and specifically the forms and methods of prediction, and Jelena Angelis, Elina Griniece, Silvia Vignetti and Alasdair Reid charting investments pathways from the perspective of funding institutions.

Part two considers ways of providing «Measurement of impact» with Matthew Woollard and Victoria Moody framing impact into a mechanism that funders can use to continue their investments into data service infrastructure, Riccardo Pozzo and Vania Virgili proposing inclusion and reflection as the most effective items for measuring SSH impact, and Jean Moulin looking into quantitative and qualitative indicators of direct and indirect impact for the needs of science policy makers, funders, hosting organisations.

Part three focuses on the «Demand for SSH research». Matthias Reiter-Pazmandy and Thorsten D. Barth present a comprehensive rendering of Austrian demand-offer interaction; Alberto Melloni insists on the fertility of overcoming cultural and religious illiteracy; while David Pérez Fernández, Doaa Samy, Jerónimo Arenas-García and Juan de Dios Llorens González show how language technologies may help science policy-makers to design better informed policies, thus improving their economic, social, environmental and cultural impact.

Part four presents all five «SSH ERICs». Ron Dekker explains what the impact of CESSDA ERIC is about, Franciska de Jong informs on how to demonstrate the impact of CLARIN ERIC, Rory Fitzgerald and Stefan Swift reconstruct the waves of ESS ERIC, while Axel Börsch-Supan gives current data on SHARE ERIC users. Finally, Laurent Romary and Jennifer Edmond inform on the most recent elaborations as regards the impact of DARIAH ERIC.

Part five considers the «The increase of impact through interaction of domains», with Minh-Quang Tran expanding on the importance of Social Sciences and Humanities for Energy development and acceptance of such development, especially for new technologies, and Ana Proykova proposing a pragmatic view in the development of SSH RIs in the direction of shared services that focus on enhancing and improving the services offered locally, European Open Science Cloud (EOSC) integration for the development of metadata and machine-readable content, together with global services for certification, resource discovery and multi-party collaboration.

As Ales Fiala has suggested, we need a comprehensive definition of impact that connects the dimensions of scientific research, skills, competences with the dimension of economic competitiveness and that of social inclusion and security, without neglecting the dimensions of policy-making in a self-reflective society. Last but not least, impact is about visibility, dissemination and communication. As all discussions showed, the issue of impact is still in its early stages in all domains, and the term *impact* does not have one clear definition yet. On the other hand, there is no obvious difference in the discussion of the concept of impact across domains, and the work done in the area of conceptualisation of impact can therefore take all domains into account.

The forward look is nonetheless heartening: we believe the conference has made it clear that Research Infrastructures have already gone a long way in catalysing joint research projects that are having a substantial impact in both society and culture. The landscape is taking a favourable shape for open innovation processes that make the most of open science contents.

CONFERENCE KEYNOTES

Milena Žic Fuchs

ESFRI IN FUTURE CONTEXTS OF IMPACT: RESEARCH INFRASTRUCTURES IN SSH

Abstract

The envisaged topics and breadth of the conference dedicated to the «Impact of Research Infrastructures on SSH and Beyond» cover the most important issues needed to streamline the concept of 'impact', and possibly achieve a deeper understanding of what it is, and what its implications are. One of the issues that, to my mind, is of exceptional importance and which needs further elaboration and development, refers to the concept of 'scientific excellence', or more precisely, how scientific excellence is measured in the context of research infrastructures. More specifically, the question arises as to how to adequately integrate efforts, activities and work done within RIs into the still very much bibliometrically oriented evaluation of 'scientific excellence'. Secondly, what we see emerging within the ESFRI landscape are infrastructures that are in their nature 'multidisciplinary' (often with SSH disciplines) and which still have to find their rightful place, especially seen from the point of view of the possible impact that they may have in the sphere of research, but also in the sphere of social and cultural innovation.

Introduction

The ESFRI (European Strategy Forum on Research Infrastructures), founded in 2002, has over the years become a key player in policy making on research infrastructures in Europe. Its strategy Roadmap identifies new vital research infrastructures, and as in the 2016 Roadmap it presents in detail twenty-one ESFRI projects including six new ones. It also features those research infrastructures that have attained the implementation phase (by the end of 2015). Among these so-called Landmarks we find those that belong to the domains of Social Sciences and Humanities (SSH).

On the basis of thorough evaluations after the years,[1] the ESFRI process

[1] For instance, an in-depth analysis of the ESFRI projects was performed during 2012/2013, and in August 2013 the European Commission published a report entitled *Assessing the projects*

has been refined considerably, and thus it is not surprising that the ESFRI has attained a high level of international recognition. This recognition mirrors one of the main aims of the ESFRI, namely that the EU remains at the forefront of science and technology, and that it be competitive in a knowledge-based global environment.

The above mentioned assessment, dating back to 2013, was mainly focused on financial and stakeholder support, governance, human resource and project management, users and risks, seen as the crucial foundations for developing a successful research infrastructure. However, over the last few years new issues have been brought to the forefront, notably 'sustainability', 'impact' and more recently 'innovation', used in the widest sense of the word. These 'new' issues reflect developments in research agendas in general, or more precisely, the move towards further enhancing and validating investments in research as well as research infrastructures.

1. *'Excellence'*

The major topics embedded in the notion of 'impact' are well covered by the session topics of the conference *Stay tuned to the Future: An International Conference on the Impact of Research Infrastructures for Social Sciences and Humanities* held in Bologna, January 2018.

The topics covered were:

- conceptualisation of impact
- measurement of impact of research infrastructures
- the demand for SSH research
- the five Social Science and Humanities ERICs and their impact
- increase of impact through interaction of domains

Two aspects that I see as possibilities through which further steps in contributing to the concept of 'impact' are 'excellence' and 'multidisciplinarity'. Thus, for instance, in a relatively recent document *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Horizon 2020 interim evaluation: maximising the impact of EU research and innovation*[2] excellence is seen as:

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on the ESFRI Roadmaps. The evaluation was performed by a high level expert group: https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/esfri.pdf.

[2] The document came out in January 2018: https://ec.europa.eu/transparency/regdoc/rep/1/2018/EN/COM-2018-2-F1-EN-MAIN-PART-1.PDF.

Excellence as the core underlying principle ensures quality. Having excellence as the main criterion for allocating funding has helped the first scientific publications of Horizon 2020 to be cited already at twice the world average rate. Patents produced through the programme are of higher quality and likely commercial value than similar patents produced elsewhere. Horizon 2020 already has supported some seventeen Nobel Prize Winners.

The factsheet document, which follows the Communication from the Commission, includes a selection of quotes from the *High Level Group on maximising impact of EU Research and Innovation Programmes* (known as the Lamy Group). My contribution on the notion of 'excellence' in the original (partially transmitted to the official document) reads as follows:

[…] (scientific publications) […] these results are to be commended, however as far as publications are concerned, the question arises whether they should be seen as the only major criteria for determining excellence? Namely, under the 3 O's agenda, of which one is Open Science, the establishment of databases in the widest sense of the word, work invested in Research Infrastructures, ESFRI, should also be a part of the criteria in evaluating excellence. Namely, a more 'holistic' kind of evaluation should evolve over time.

Basically, the main question that arises is how to increase 'visibility' and showcase 'impact', especially in the domains of Social Sciences and Humanities. More precisely, how can the path to a more 'holistic' approach to measuring 'excellence' as an indicator of impact be achieved, and move away from the 'traditional' view of seeing Research Infrastructures as contributing to academic impact only? [3]

A brief historical overview of documents that speak for the necessity of including 'non-article' and 'non-book' indicators of excellence is worth mentioning. They are significant in the sense of underpinning the changing landscape of evaluation and the necessity of conceptualising excellence in broader terms.

In 2013, young researchers in the Digital Humanities launched a *Manifesto* [4] in which they state:

The Humanities and Social Sciences are a vital component of human culture and offer an essential insight into the world in which we live. The Digital Humanities

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[3] See also: M. Žic Fuchs, *Research infrastructures in the humanities: The challenges of 'visibility' and 'impact'*, in *Facing the Future: European research infrastructures for the humanities and social sciences*, edited by A. Duşa, D. Nelle, G. Stock and G. Wagner, Berlin, Scivero, 2014, pp. 121-133.

[4] See https://dhdhi.hypotheses.org/1855.

reflect the transition of the Humanities to the digital age. However, they do not only bring with them new technical means, but also new forms of knowledge creation and dissemination within, across and outside academic disciplines.

Thus, apart from traditional research outputs, contributing to the establishment or development of a research infrastructure should also become an integral part of evaluation processes for promotions and job applications. Needless to say, contributions to an RI should also be scrutinised and assessed, for the roles of researches in the establishment and/or development of an RI may vary greatly in both quantity and quality. But individual cases notwithstanding, a wider perspective on especially early career researchers' endeavours would help validate serious and often quantitatively impressive contributions. What is more, such an approach would also showcase the RIs themselves, which is still necessary within the realm of Social Sciences and Humanities, despite the fact that the ones known as Landmarks on the ESFRI Roadmap have played a crucial role in the recognition of the role of SSH in general.

This line of rethinking 'evaluation' and 'assessment' for research outputs was also stressed in the *San Francisco Declaration on Research Assessment – DORA* (December 2012)[5] which focused mainly on the use and misuse of impact factors in the so-called hard sciences. In this document the following is stressed: «For the purposes of research assessment, consider the value and impact of all research outputs (including datasets and software) …».

Although the *Leiden Manifesto for Research Metrics*[6] does not specifically mention RIs, it however does emphasise that the abuse of research metrics has become too widespread to ignore. But what is even more important is what has developed out of the *Manifesto* itself, especially, to my mind, a very important EC document, *Next-generation Metrics: Responsible Metrics and Evaluation for Open Science*.[7] Namely, as the title itself indicates, the necessity for a different kind of metrics is already evident, especially from the point of view of 'open science'. As the authors of this report state: «For some, the ideal result might seem to be the development of a

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[5] See http://www.ascb.org/files/SFDeclarationFINAL.pdf.

[6] D. Hicks *et al*., *Bibliometrics: The Leiden Manifesto for research metrics*, *Comment*. *Nature* 250 (2015), n. 7548. See https://www.nature.com/news/bibliometrics-the-leiden-manifesto-for-research-metrics-1.17351.

[7] *Next-generation metrics: Responsible metrics and evaluation for open science: Report of the European Commission Expert Group on Altmetrics*, https://ec.europa.eu/research/openscience/pdf/report.pdf.

single metric through which to measure open science. We view this as impossible and undesirable».[8]

The changing landscape of evaluation, in the widest sense of the word, with special emphasis on 'open science' means that barriers for 'open science' should be removed, and that special stress should be put on developing an 'open science' cloud[9] as well as streamlining 'open science' into a socio-economic driver.

It is impossible here to go into the many topics and details that this Report opens (for instance, alt-metrics, etc.), however, the spirit and the main directions for future evaluation are evident.[10] They certainly include that research assessment should also encompass research data and software. I think it is safe to say that all the variations of research assessment that have now been evidenced and discussed have yet to be fully approved and accepted by the scientific community. However, research infrastructures, whether they be physical or distributed, that is the work and knowledge necessary for their establishment and development, has to gain recognition and prestige within the scientific community. Or, more precisely, it is the academic community that has to award the 'prestige' to these endeavours.

Apart from the general acceptance of a much wider concept of research assessment, the SSH community has for decades been faced with attempts to adapt their assessment parameters according to the ones in the so-called hard sciences, despite obvious differences in outputs that the various domains produce.[11]

The Metric Wars, as they are sometimes called, are by no means over. However, steps in the right direction do appear, and one worth mentioning in the context of RIs, is that in the UK REF (the way universities are assessed on their research) databases are explicitly mentioned and listed as research outputs, thus making them an integral part of the assessment process.[12]

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[8] *Ibid*., p. 5.

[9] *Ibid*., p. 16. In recommendation #7, the aforementioned report mentions the need for «Realising the vision for the European Open Science Cloud (EOCS) will rely on linked metadata that can become the basis for open, publicly available data infrastructures».

[10] *Ibid*., pp. 15-17, see especially the ten recommendations for fostering open science with particular reference to «3.2.3 Developing research infrastructures for open science».

[11] M. Žic Fuchs, *Bibliometrics: use and abuse in the humanities*, in *Bibliometrics: Use and abuse in the Review of Research Performance*, edited by W. Blockmans, L. Engwall and D. Weaire, London, Portland Press, 2014. http://www.portlandpress.com/pp/books/online/wg87/087/0107/0870107.pdf.

[12] I would like to thank Rory Fitzgerald of the ESS (European Social Survey) for sending me the following impact case study: http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=44389. Studies such as these clearly reflect not only the objectives of the various RIs but elaborate their socio-economic impact thus ensuring their continuous update of their scientific and strategic relevance.

More well-articulated efforts are still necessary for firmly placing the efforts and contributions in establishing and developing RIs within the notion of 'excellence', whether these RIs be of Pan-European or of national relevance. The inclusion of work and knowledge necessary for 'setting up' RIs is a step in the direction of attaining a 'holistic approach' in research assessment, thus expanding the notion of 'excellence'.

2. *'Multidisciplinarity'*

In 2014, that is four years ago, in a plenary I presented at the conference of the Research Data Alliance (RDA) entitled «Research Infrastructures in the Humanities: the Past, the Present and the Future», the main point I stressed was not just the importance of RIs in the Humanities (and Social Sciences) *per se*, but also their, at the time, potential and significance in inter/multi/transdisciplinary research. A logical sequence or outcome was the development of 'multidisciplinary' RIs. I saw SSH as crucial in the context of 'multidisciplinarity', and even more importantly, the basis for understanding and achieving innovation, as stated in the presentation itself:

> The Humanities and Social Sciences not only address global issues inherent in the Grand Challenges, but also identify and research cultural (national) differences or 'different cultures of knowledge': All Grand Challenges are by their nature societal and often global in nature, but inherently anchored in specific cultural domains.[13]

During the work of the so-called Lamy Group (*High Level Group on maximising impact of EU Research and Innovation Programmes*), innovation was one of the central topics addressed, if nothing else because of the fact that Europe is, in global terms, at the forefront of research (both in quantity and quality) but lags behind other major world players in the sphere of innovation. The group[14] had meetings with quite a few stakeholders and researchers from the 'innovation world', and when they were asked what the most important component of innovation was – almost unanimously the

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[13] The idea of the necessity and the centrality of the SSH in 'multidisciplinarity' research as well as in university settings is elaborated in M. Žic Fuchs, *'Science' and 'culture' in university settings. Areas of overlap? Areas of tension? Or, areas of mutual complementarity?*, «European Review» 26 (2018), n. 2, pp. 319-329. See https://www.cambridge.org/core/journals/european-review/article/science-and-culture-in-university-settings-areas-of-overlap-areas-of-tension-or-areas-of-mutual-complementarity/6125AE02324CEFD7F5228271CF414401.

[14] See especially Annex 2 «Consultation with Stakeholders» in the Lamy Report: *High Level Group on maximising impact of EU Research and Innovation Programmes*, http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf.

answer was 'multidisciplinarity'. And it is not just 'innovation' that is leaning more and more towards 'multidisciplinarity', but the reshaping of research itself in the sense of 'research questions' becoming the central pivotal point in the sense that these questions by their nature bring together different disciplines from different domains.

In keeping with the briefly sketched changes that are occurring within the last decade or so, multidisciplinary RIs have started to appear within the ESFRI context.

Briefly, I will outline two such RIs.

DANUBIUS-RI The International Centre for Advanced Studies on River-Sea Systems

DANUBIUS-RI is included in the 2016 ESFRI Roadmap and is an EUSDR Flagship Project (EU Strategy for the Danube Region).The RI is developing as a pan-European distributed research infrastructure dedicated to interdisciplinary studies of large river-sea systems. It will enable and support research addressing the conflicts between society's demands, environmental change and environmental protection in river-sea systems worldwide.[15] DANUBIUS-RI also serves as an excellent example of a regional concept developed into a pan-European RI, but what is more, it spans the environmental, social and economic sciences and brings together research on different environmental sectors. It is also a platform for interdisciplinary research, education and training, and is moving towards global outreach.

[15] DANUBIUS-RI is being developed by partners in eleven European countries, with expressions of interest and support from the scientific community in many others in Europe and worldwide. It aims to become operational by 2022 (description from http://danubius-pp.eu/www/wp-content/uploads/2017/02/Roll-up-A-1.pdf).

Apart from European political support, DANUBIUS-RI is also counting on participation with countries in Africa, Asia, and North America. DANUBIUS-RI is an excellent example of combining and engaging with national funding bodies as well as applying for structural funds with the aim of achieving ERIC status by 2022.

The second example is:

E-RIHS (European Research Infrastructure for Heritage Science)

Heritage is considered to be a central component of national identities, but what is more it is a key component of European identity. The study and preservation of cultural and natural heritage is a global challenge for science and the European society at large. This RI is developing state-of-the-art tools and services which will be provided by cross-disciplinary groups of researchers to cross-disciplinary users and scientific communities working to advance knowledge about heritage and to devise innovative strategies for its preservation. E-RIHS connects researchers in the humanities and natural sciences, and fosters a transdisciplinary culture of exchange and cooperation.[16]

Research infrastructures, whether regional or pan-European (or development from regional to pan-European), can be seen as a breeding ground

[16] Description from http://www.e-rihs.eu/about/about/.

for research across institutions, borders and disciplines. Through this tight inter-relatedness between research, institutions and especially education of users RIs can be seen as a major source of societal impact.

The complexity implied by 'multidisciplinary' research challenges research itself within all research domains. The complex nature of crossing boundaries and integrating different lines of thought brings to the forefront a reconceptualisation of research itself as well as the education necessary for it. However, what we are witnessing at the moment is the emergence of 'multidisciplinary' RIs growing out of such efforts. It should be stressed that we can expect the appearance of more of them in the coming years since they will present in many cases a necessary foundation for achieving 'multdisciplinary' aims.

3. *Conclusion*

Systematic monitoring and impact assessment of RIs is without a doubt a necessity. However, a methodology, which would also include the factors mentioned in this paper, would be very welcome in order to evaluate the RIs' scientific as well as strategic relevance.

'Multidisciplinarity' should be seen as a possible important driver of excellence, as well as an opportunity for broadening the user base and maximising impact. It is a development which has significant potential and opens up the way for the establishment of the RIs relating to specific research-related topics. What follows from this is that RIs should also be viewed as having potential in fostering breakthrough innovation. All in all, the need arises for re-evaluating the various components that comprise 'impact', and this conference, through its wide framework, is undoubtedly a step in the right direction.

Yves Gingras

THE SPECIFICITY OF THE SOCIAL SCIENCES AND HUMANITIES AND ITS RELATION TO RESEARCH EVALUATION

Abstract

Any attempt at measuring the 'impact' of research in Social and Human Sciences must start with the recognition of the specificity of these fields compared to the natural sciences. We will analyse the perverse effects on research in SHS generated by the use of impact indicators designed for the natural sciences and which are not consistent with the nature of SHS research.

In order to provide a credible analysis of the impact of the bibliometric evaluation of research in the social sciences and humanities (SSH), one must first distinguish *performative* discourses, which aim at making things happen, from *descriptive* ones that simply express how things are. In the first case, we hear, for example, that we want research to be more interdisciplinary, excellent, innovative, international, inter-sectorial and so on. But those are wishes that do not always translate into reality. So, we have to check what in fact happens in practice. And here, since the theme is the 'impact' of research, I thought the best would be first to look at those practices, and show that there are, in fact, fundamental differences between the natural sciences and the social sciences, and also, important ones between the social sciences and the humanities. And my point is that the word 'impact', and all the discourses about 'impact factors' and 'h index', are most often ill-defined and that these indicators are inadequate and do not measure what they pretend to measure.[1]

First, it is important to distinguish *bibliometrics* from *evaluation*. Bibliometrics as a quantitative research method has been in use in sociology of science since at least the 1960s. It is a fundamental tool that can provide a global view of scientific research. If you want to understand the trends in international collaboration across the world and identify who is collaborat-

[1] For more technical details, see Y. Gingras, *Bibliometrics and Research evaluation: uses and abuses*, Cambridge, Mass., MIT Press, 2016.

ing with whom in which field, bibliometrics offer a unique way to measure these trends over time. The objective is then not to say that more collaboration is good or to evaluate researchers on the basis of their level of collaboration but, more simply, to know what the trends are in different countries in their practices of international collaborations.

1. *Disciplinary differences in publication practices*

Bibliometric data also help to better understand the important differences between the natural sciences, the social sciences and the humanities in terms of, for example, the percentage of papers with more than one author. As shown in Figure 1, in the natural sciences, 90% of all the papers, now have more than one author. It means that the old ideology and mythology of the lone scientist isolated in his or her laboratory may have been true in 1900 but is no longer the case as the natural sciences are now a fundamentally collective enterprise. In the social sciences, the percentage of publications with more than one author was much lower in 1980 but has since rised rapidly to reach about 80%. That means that disciplines like sociology, psychology and economics are now more of a collective enterprise than they used to be, though single authored papers are still frequent. In the humanities, however the individual researcher is still the norm with only about 10% of papers having more than one author, though we observe a recent growth since 2005 in multi-authored papers. This first set of data thus already shows important differences between the natural sciences and the social sciences and humanities.

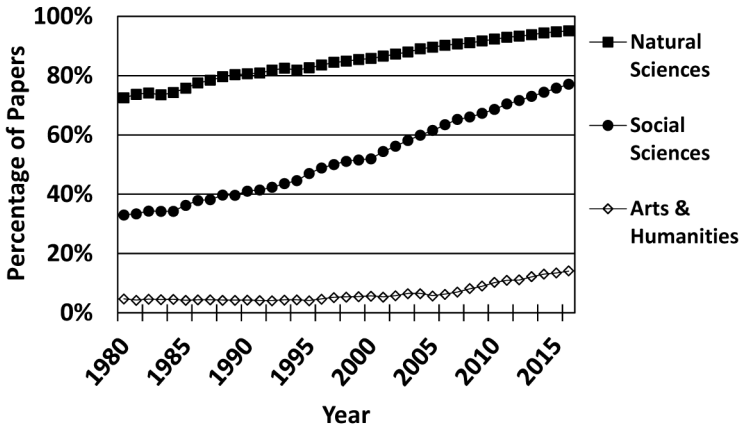

Figure 1. - Proportion of papers with more than one author in the natural sciences, social Sciences and Humanities. Source: Web of Science.

Figure 2 shows the level of international collaboration by disciplines. Here also we see major differences. The natural sciences have the highest level of internationalisation, closely followed by the social sciences, while the humanities have the lowest proportion of internationally co-authored papers, despite a recent growth since 2005. The case of humanities is interesting as it shows the danger of misinterpreting a given indicator, here the proportion of internationally co-authored papers. Of course, implicit in this indicator is the fact that the paper must have at least two authors to count as an international collaboration. But most papers in the humanities have only one author (Figure 1), so that such an indicator of international collaboration is not a good measure of collaboration in those disciplines. For these fields, a better measure would be, for example, looking at the acknowledgements mentioned in the papers or at the participation in international conferences where people meet, learn and exchange ideas though they do not sign a collective paper, but can contribute to a collective book in addition to a conference.[2]

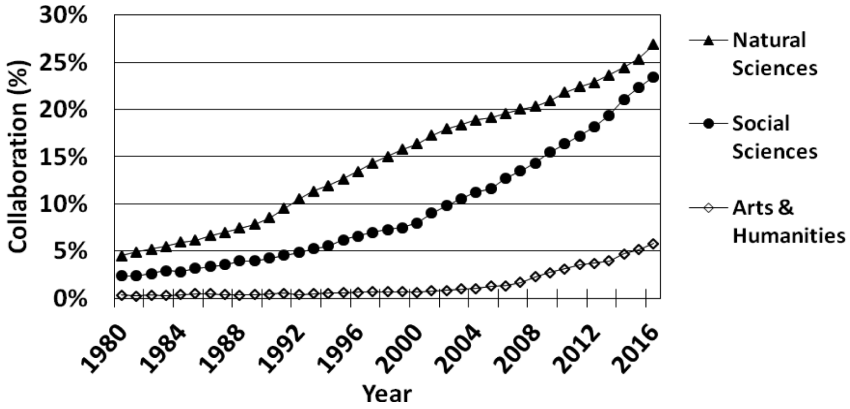

Figure 2. - Proportion papers written in International collaboration at the world level in the natural sciences and the social Sciences and Humanities (1980-2016). Source: Web of Science.

This example shows once more the specificity of disciplines and the danger of mechanically transferring an indicator valid for one field to another one for which it would not be adequate. So, not only are indica-

[2] See A. Paul-Hus, P. Mongeon, M. Sainte-Marie, V. Larivière, *The sum of it all: revealing collaboration patterns by combining authorship and acknowledgements*, «Journal of Informetrics», 11 (2017), n. 1, pp. 80-87.

tors devised for the natural sciences not necessarily valid for the social sciences, but even those valid for some disciplines of the social sciences should not be automatically transferred to the humanities without validating them.

The level of international collaboration varies with the characteristics of the country. Figure 3 shows the trends for Canada, USA and China. In the seventies, the density of international collaboration between countries was much lower than in the nineties, and now nearly every country is collaborating with every other one. For example, Canadian scientists, in all disciplines, collaborated with colleagues from about 100 different countries in 1980 and now, in 2015 this network extends to about 190 countries. Of course, international collaboration depends on the nature and history of each country. Quebec for example has stronger ties with France than Ontario, a province more connected to Great Britain.[3] Also, a dominant scientific country like the USA has a much smaller proportion of its papers written in international collaboration than Canada, France or Germany, countries that have, more than the USA, to go beyond their borders to find all the expertise needs for a given research project.

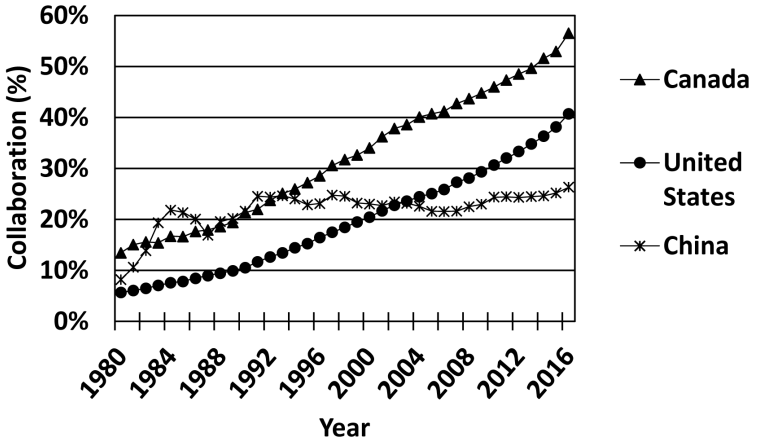

Figure 3. - Proportion of international papers written in collaboration for Canada, United States and China (1980-2016). Source: Web of Science.

[3] Y. Gingras, *L'évolution des collaborations scientifiques entre le Québec, le Canada et l'union européenne (1980-2009)*, «Globe. Revue internationale d'études québécoises», 14 (2011), n. 2, pp. 185-197.

But the fact that we observe a clear growth in international collaboration does not imply that we should do more. That would be taking the means for the ends. We should do more collaboration if the object or question we are looking at necessitates it. The same is true with interdisciplinarity: it is reversing the logic of things to begin with interdisplinarity before asking «what is the problem to be solved?» and then identifying the kind of people and expertise needed to solve it. In health, for example, the questions raised are obviously more open to interdisciplinarity than when confronted with a purely technical problem of laser optics or solid-state physics. Thus, it is not surprising that the level of interdisciplinarity greatly varies according to disciplines.[4] In other words, we should think of international and interdisciplinary collaborations in relation to the question or problem to be analysed and not as something 'good in itself' in all occasions.

Other important differences between disciplines can be identified by analysing the kinds of cited references we find in the published papers. As shown in Figure 4, we observe that in the natural sciences, 80% to 90% of the references are to other scientific papers, because in these disciplines, since at least the end of the eighteenth century, you don't publish anymore big books like Galileo or Newton did, but short scientific papers in specialised journals. This means that all you can cite are indeed essentially scientific papers and some reference books. By contrast, in the social sciences and even more in the humanities, books remain important and have the most impact on the career of scholars. As a consequence, papers in social sciences, more often refer to books than to other papers. That is a very important practice that we have to take into account when evaluating researchers. Thus books don't have an 'impact factor' like journals have. So should researchers publish papers instead of books in order to have an impact factor to facilitate their evaluation? That would be turning the world upside down: one must respect the role of books in the social sciences and humanities and not undervalue them because they do not conform to an indicator imported from the natural sciences.

There are also national traditions in the way people refer to books or papers. For example, the tendency to cite papers is different in Germany, in the United States and in France. For instance, in 2000, 47% of the cited references in papers by American sociologists were to articles, where-

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[4] V. Larivière, Y. Gingras, *Measuring Interdisciplinarity*, in *Beyond bibliometrics: Harnessing multidimensional indicators of scholarly impact*, edited by C. Cronin and C. Sugimoto, Cambridge, Mass., MIT Press, 2014, pp. 187-200.

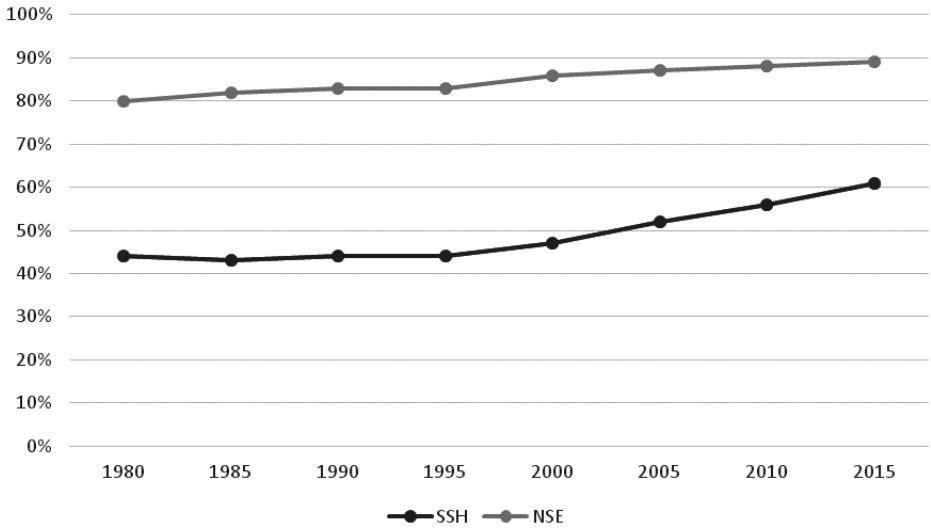

Figure 4. - Proportion of references to journals in the natural sciences and engineering (NSE) and in the social sciences and humanities (SSH). Source: Web of Science.

as it was only 30% for French articles in sociology, which mean that they cited books in 70% of their references. And Germany is right in between, with about one third of the papers citing articles, two third citing books. So, even between sociologists from different countries, the way they look at the role of papers and books as a source of knowledge is different. Again, we have to take these traditions into account instead of thinking that there is one 'universal' way of publishing research results and thus one universal way to measure and evaluate research. Measures based on impact factors of journals devaluate books as well as book chapters simply because they cannot be measured and the focus on papers leads to artificial questions like «is a book equivalent to four or five papers?» instead of simply taking the book for what it is and see if it is good or not. These simplistic approaches to evaluation are not mere theoretical possibilities and are in fact applied in some countries. In Italy for example, the national agency define the threshold of the numbers of papers that are needed to have the right to participate in the habilitation procedure.[5] One could also re-

[5] A. Baccini, *Napoléon et l'évaluation bibliométrique de la recherche: Considérations sur la réforme de l'université et sur l'action de l'agence national d'évaluation en Italie*, «Canadian Journal of Information and Library Science/Revue Canadienne des Sciences de l'Information et de Bibliothéconomie», 40 (2016), n. 1, pp 37-57.

call Australia and Flanders where the number of papers published was also used to evaluate researchers.[6]

2. *The effects of 'globalisation' on citation practices*

Most people tend to say that 'globalisation' can only be good for researchers from less developed countries who should work more with Europe or with the USA, and publish in their more visible journals, perceived as the 'best' international journals. That would make their work more visible. That is a nice hypothesis, but it is not confirmed by the facts. What we observe is a big asymmetry in knowledge exchange and recognition through citation between the North and the South. As Table 1 shows, the proportion of citations to the Global South is negligible in papers from the Global North. For example, North American papers refer to themselves in more than 75% of their cited references and cite European papers in only 20%, though it has risen a bit (6%) between 1985 and 2005. Europe is more open than the USA and cites itself only in about 50% of its cited references. The most striking effect of the so-called 'globalisation' of research is that the more African countries collaborate with the North, the less they cite their own local papers! Hence, African papers mentioned their own local papers in 20% of their cited references in 1985 and only in 11% in 2005. We see the same decline in all developing countries. Such a trend can be explained by the fact that the urge to publish in so-called 'best journals', which are written in English and published essentially in Europe and North America, push the authors to cite only papers by those countries to show that their contribution is worthwhile. Thus, there is a reduction in the citation of 'local' papers even when they are relevant/pertinent to the research in hand. Note that this decline is not at all compensated by a growth in citations coming from the Global North.[7]

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[6] L. Butler, *Explaining Australia's increased share of ISI publications: The effects of a funding formula based on publication counts*, «Research Policy», 31 (2003), pp. 143-155; see also Ead., *Assessing university research: a plea for a balanced approach*, «Science and Public Policy», 34 (2007), pp. 565-574; for Flanders, see K. Debackere and W. Glänzel, *Using a bibliometric approach to support research policy making: the case of the Flemish BOF-key*, «Scientometrics», 59 (2004), pp. 253-276.

[7] For details, see S. Mosbah-Natanson and Y. Gingras, *The globalisation of social sciences? Evidence from a quantitative analysis of 30 years of production, collaboration and citations in the social sciences (1980-2009)*, «Current Sociology», 62 (2014), n. 5, pp. 626-646.

Citing Region	North America			Europe			Asia			Oceania		
Cited journals	**1983-85**	**1993-95**	**2003-05**	**1983-85**	**1993-95**	**2003-05**	**1983-85**	**1993-95**	**2003-05**	**1983-85**	**1993-95**	**2003-05**
Africa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Asia	0%	0%	0%	0,4%	0,4%	0,2%	9,7%	5,4%	1,3%	1,2%	0%	0,3%
CIS	0%	0%	0%	0,2%	0%	0%	0%	0%	0%	0%	0%	0%
Europe	15,8%	18,3%	21,9%	54,4%	52,1%	50,0%	24,7%	32,4%	41,0%	34,1%	37,1%	42,8%
International	1,4%	1,5%	1,4%	1,2%	1,6%	1,3%	3,0%	3,5%	2,2%	1,7%	2,1%	1,7%
Latin America	0%	0%	0%	0%	0%	0%	0,3%	0%	0%	0%	0%	0%
North America	82,9%	80,2%	76,7%	43,1%	45,3%	48,1%	61,9%	58,7%	55,5%	47,7%	47,9%	47,8%
Oceania	0%	0%	0%	0,8%	0,5%	0,4%	0,5%	0%	0%	15,4%	12,8%	7,4%

Citing Region	Latin America			Africa			CIS		
Cited journals	**1983-85**	**1993-95**	**2003-05**	**1983-85**	**1993-95**	**2003-05**	**1983-85**	**1993-95**	**2003-05**
Africa	0%	0%	0,7%	20,9%	19,4%	11,3%	0%	0,2%	0,2%
Asia	0%	0,6%	0,3%	0,7%	0,9%	0,9%	0%	1,2%	1,2%
CIS	0,5%	0%	0%	0%	0%	0%	55,3%	38,2%	16,8%
Europe	24,5%	30,5%	34,4%	44,1%	46,7%	53,1%	28,3%	27,6%	31,2%
International	4,2%	3,7%	2,3%	1,8%	5,0%	3,2%	0,6%	0,5%	0,2%
Latin America	23,1%	13,3%	5,9%	0%	0%	0%	0%	0%	0%
North America	47,7%	51,7%	56,4%	31,7%	27,6%	31,4%	15,8%	32,3%	50,4%
Oceania	0%	0,2%	0%	0,9%	0,5%	0,2%	0%	0%	0%

Table 1. - Changing geographic origin of references from the 1980s to the 2000s. Source: Web of Science.

Also very interesting is the fact that different countries have different research topics in SSH. We can define topics by analysing the most frequent words used in the titles of papers and aggregating them by regions. Table 2 shows the correlation between the research topics and world regions. It could be done with countries of course but that would produce an even more complicated Table. Each region is thus defined by a vector of the most frequent words in the titles of the papers coming from that region and the correlation measures the similarity of the vectors. The diagonal is of course one and a negative measure indicates a negative correlation, that is an opposition in research themes between two regions. As we can see, North American countries have a strong affinity with Europe, but

a weak one with the former Soviet Union (CIS here) in the period 1980-1990. We also observe that Africa and Asia have more topics in common in the 1990s than in the 1980s. This makes sense if we recall that research topics in the social sciences and humanities are more related to the local context.[8] So, if one wants to collaborate more with the United States, for example, one will have to adopt a topic that fits with their interest and abandon local problems. Thus, a policy that simply promotes having more collaboration with USA in the SSH can in fact generate the perverse effect of a decline in local topics for the sake of being more attractive to American researchers and their journals.

89-90	Africa	Asia	CIS	Europe	Latin_Am.	North_Am.	Oceania
Africa	1	0,184	0,017	0,121	0,243	0,183	0,072
Asia	0,184	1	0,007	0,370	0,099	0,277	0,320
CIS	0,017	0,007	1	0,055	–0,024	0,083	–0,021
Europe	0,121	0,370	0,055	1	0,205	0,575	0,366
Latin_America	0,243	0,099	–0,024	0,205	1	0,172	0,011
North_America	0,183	0,277	0,083	0,575	0,172	1	0,412
Oceania	0,072	0,320	–0,021	0,366	0,011	0,412	1

90-2000	Africa	Asia	CIS	Europe	Latin_Am.	North_Am.	Oceania
Africa	1	0,361	–0,049	0,166	0,058	0,153	0,098
Asia	0,361	1	–0,015	0,431	0,228	0,308	0,203
CIS	–0,049	–0,015	1	0,043	–0,163	0,030	0,005
Europe	0,166	0,431	0,043	1	0,163	0,451	0,402
Latin_America	0,058	0,228	–0,163	0,163	1	0,036	–0,034
North_America	0,153	0,308	0,030	0,451	0,036	1	0,440
Oceania	0,098	0,203	0,005	0,402	–0,034	0,440	1

Table 2. - Correlation between research themes and regions (1980-1990 and 1990-2000). Source: Web of Science.

[8] Of course, we have to remember that there are limitations to existing bibliometric database like the Web of Science (that I use here) or Scopus, which have a very strong overrepresentation of Anglo-Saxon journals. But given that recent policies push scholars toward publishing even more in these dominant journals, these results can only be reinforced if researchers conform themselves to these policies. For an analysis of the limitations of bibliometric databases see, Y. Gingras and M. Khelfaoui, *Assessing the effect of the United States' 'citation advantage' on the other countries' scientific impact as measured in the Web of Science (WoS) database*, «Scientometrics», 114 (2018), n. 2, pp. 517-532.

Another kind of perverse effect comes from the pressure to publish in so-called 'international journals'. But what exactly makes a journal 'international'? For example, is it an American journal? Many academics tend to say yes. But to provide a real measure of internationality we need to better define the term. If words make sense, an international journal should be one in which ones finds authors from many different countries. So, the proportion of different countries in a journal is a good first measure of a journal being 'international'. Let us look at the *American Journal of Sociology (AJS)*. Between 2000 and 2012, 81% of the papers published in that journal were written by American authors. By comparison, the *British Journal of Sociology* had only 61% of its papers by UK scholars, which mean that, curiously, the *British Journal of Sociology* (or even the *Canadian Journal of Sociology)* is more international than the *AJS*. It is thus important to distinguish between being *visible* at the international level, as *AJS* obviously is in sociology, and being an international journal. *AJS* maybe more visible that *BJS* or *CJS*, but it is not more international. Like any other sociology journal, *AJS* is first of all a local American journal talking about American problems. So, if you want to publish there, you will abandon your local objects, as has been shown empirically for the case of Canadian economics.[9] Most economists think that there are only 'five top journals' and they want to publish there and ask young researchers to publish there if they want a job. But those are essentially American journals. Do they want a lot of papers on the dynamic of the Canadian economy or the policies of the Bank of Canada? Not really, and it's normal since they are American journals that care about the United States of America. For example, a brief full-text search in the *Journal of Economic Literature* shows that the term «United States» generates 420 documents, while «France» produces only 165 and «monetary union» only 11, which suggests that all economic objects are not born equal in the so-called top journals. Of course the so-called 'top five' journals will also accept delocalised objects like a theorem showing the existence of an equilibrium in a twelve dimension space filled with 'rational' agents that do not exist on Earth – but most economists do not care about this. In practice, focusing evaluation on these supposedly 'best' journals has the effect of diminishing interest in local objects that are important for a given country.

In short if you absolutely want to be international, stop studying the north of France, stop studying the south of Italy. Study something delocalised and abstract, like (in sociology) the comparison between Habermas and

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[9] W. Simpson and J. C. H. Emery, *Canadian economics in decline: Implications for Canada's economics journals*, «Canadian Public Policy», 38 (2012), pp. 445-470.

Bourdieu or Luhmann, a theoretical question that travels more easily than empirical, local but important questions about a given city or country.

Another perverse effect of the evaluation fever based on inadequate and even invalid indicators, is a decline of national journals in social sciences and humanities. The new craze for rankings of journals, 'A' for the best, 'B' for the national, and 'C' for the regional contribute to that decline. These, not Theses classifications are done by committees (on which authority?) and it is curious to note that they seem to be biased such that 'A' journals tend to be Anglo-American, 'B' national and 'C' regional. Such classifications are dangerous and hide a form of colonised thinking as they are based on a false notion of 'international' in the social sciences and humanities.

All these trends are important and strongly suggest that it is not a good idea to try to apply to humanities an approach imported from the natural sciences. Psychology is not history, neither linguistics nor sociology, and each of these disciplines has its own specificities that have to be taken into account when defining a research policy.

3. *Conclusion: the fundamental indexicality of the social sciences and humanities*

The major reason behind all these disciplinary differences in the way research is done and reported is, I think, *ontological*, that is, related to the *nature of the objects* studied. Put simply: there are no Chinese electrons or Italian galaxies! There is however an Italian society and Italian culture as well as a Quebec culture, worth studying. Most social sciences and humanities thus look at local objects whereas natural scientists look at universal objects with no national characteristics. Thus, astrophysics or solid-state physics can easily be studied by an international team of scientists working in the US, Canada and China. It is less obvious and much more difficult to ask American historians or sociologists to systematically study the Canadian society, or the French society, instead of their own country. No one expects to see more foreigners than nationals to study a given society, as all have local characteristics that are important to understand in order to define local policies. For these reasons, we see that the level of international collaboration is much lower in the humanities and social sciences than in the natural sciences.

If we want to correctly (and I would even say ethically) evaluate research, we have to use indicators that are shown to be valid for the discipline concerned. The mechanical an unreflexive use of any indicator is dangerous for the future and diversity of research, particularly in the social

sciences and humanities, as their objects are more local than those in the natural sciences, disciples for which most bibliometric indicators have been defined. Neglecting the fundamental indexicality and specific ontology of the social sciences and humanities could only lead to a decline in the quality of the research done in these disciplines to the detriment of the various societies and local cultures that make up the world.

PART I

Conceptualisation of Impact

Elena Esposito

THE IMPACT OF BIG DATA

Abstract

The spread of Big Data involves a transformation in the use and meaning of data for sciences and for society as a whole, and in particular for social sciences and humanities. Referring to a theory of society and to performativity studies, the paper shows how the problem of assessing the impact of infrastructures in different areas of society is changing, and specifically how the forms and methods of prediction are changing. Assessment tends to be understood as a learning tool.

In the current situation of the social sciences and humanities, the impact of research infrastructures certainly requires careful and innovative conceptualisation and assessment. Even at a first glance, however, the issue appears quite intricate: should we focus on the «impact of research infrastructures» on social sciences and humanities, or about the impact of «research infrastructures for social sciences and humanities»? On the impact of infrastructures on the social sciences or on the social impact of infrastructures? Or maybe on the impact of the assessment of infrastructures?

To clarify the different dimensions involved, I will quickly sketch a theoretical framework referring to the theory of society and raise some general issues, and then approach more specifically the assessment of impact – or of impacts.

Sometimes the emphasis is exaggerated, but we apparently are facing a crucial moment for infrastructures in all sciences, and in particular in the social sciences and humanities. I am referring to the current hype about Big Data, which gives rise to various imaginative interpretations but also has a very concrete basis, which is a challenge for our topic in all disciplines.[1] In the social sciences and humanities, however, infrastructures are essentially data infrastructures: databases, archives, datasets, software packages, compu-

[1] V. Mayer-Schönberger and K. Cukier, *Big Data: A revolution that will transform how we live, work, and think*, London, Murray, 2013; R. Kitchin, *Big Data, new epistemologies and paradigm shifts*, «Big Data and Society», April-June: 1-12 2014.

tational models – possibly in the cloud. And it is to these infrastructures that Big Data pose the most direct challenges. I mention only two aspects.

Big Data do not mean just more data, but above all different data, which become so incredibly numerous because they are not information, but data obtained in refined ways from information and producing further information. Traditional archives and databases in the social sciences collect information: texts, documents, numbers on the population, personal, medical, political, educational details etc. Big Data, instead, only includes data: certainly all data related to information, but also much more: a myriad of metadata (secondary data related to format, time, location, author, purpose and other features) and also unstructured data like those generated by GPS localisations, JPEG images, MP3 audio files and in general by the Internet of Things. These data are usually produced in an unconscious way but become a very important source of information.

The second aspect is that these data, which in themselves are produced without any meaning, are processed by algorithms with complex and often non-transparent machine learning techniques, to produce patterns and correlations from which new information can be obtained.[2] The interpretation of the outcome of this kind of digital processing, that cannot refer to the perspective of the interpreter or the producer, raises unprecedented puzzling issues.[3] The transformation in the use and meaning of data affects all sciences, but social sciences and humanities must face a particular challenge. In all disciplines data by themselves are only data, and to become meaningful (to become information) they must be interpreted.[4] Here the role of the social sciences and humanities becomes central, because they are the ones dealing with interpretation and its dilemmas, with biases and contextual dependence (local, temporal, economic, political, educational or other).

What does this mean for infrastructures? And for our topic?

The classic problem of assessment, and in particular the assessment of the impact of infrastructures for social sciences, is sharpened and changes connotation. Which impact do we have to assess, and on whom? Scientific impact? Impact on society? What aspect of society?

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[2] J. Burrell, *How the machine 'thinks': Understanding opacity in machine learning algorithms*, «Big Data and Society», 1 (2016), pp. 1-12.

[3] D. Weinberger, *Machines now have knowledge we'll never understand*, «Wired», 18 (2017), n. 4; F. Moretti, *Patterns and interpretation: Literary Lab Pamphlet 15*, <https://litlab.stanford.edu/LiteraryLabPamphlet15.pdf> (accessed 27 December 2017).

[4] L. Gitelman, ed., *'Raw Data' is an oxymoron*, Cambridge, Mass., MIT Press, 2013; D. Boyd and K. Crawford, *Critical questions for Big Data*, «Information, Communication and Society», 15 (2012), n. 5, pp. 662-679.

We already have various techniques for assessing scientific impact, such as rankings and benchmarkings, that are established even if very controversial.[5] But now that collection and use of data are so widespread and pervasive, these are not the tools we need, or at least they are not enough – as the scientific debate amply confirms. What we want to assess is rather the social impact of the availability of infrastructures, understood as the impact of social sciences' outcomes on other disciplines and (above all) on different non-scientific stakeholders. These are the traditional goals of applied scientific research. We then look at other parameters, like number of accesses, international visibility, uniqueness of the service, possible multidisciplinarity. But these parameters are not homogeneous and coordinated, and again we have to choose between different recipients of applied research: politics, the economy, education?

The theory of society has shown that criteria and references are different in each of these fields and cannot be traced back to a single standard: they remain and must remain different – this is one of the conditions for the complexity of modern society.[6] It would be naive to think that better scientific research is by itself more useful. High quality of scientific research does not in itself mean economic efficacy or media visibility or political or pedagogical success or otherwise. Many fundamental scientific discoveries are economically irrelevant (not only in the social sciences) and in any case economic effectiveness does not mean by itself scientific excellence. Obviously high scientific quality must be pursued anyway and application must be taken into account, but for research the reference to applicability is a constraint and must be seen as such. Constraints can be very useful, but they are external conditions for scientific research.

Not only: today Big Data question the main category that until now worked as intermediation between different areas: *causality.* In the various fields of the sciences and also in external fields that use their results (economics, politics, education, mass media, etc.) knowing that a certain effect follows a given cause often serves as on orientation (despite all epistemological doubts on the interpretation of causality). Big Data, however, are moving away from the reference to causal relationships. Algorithms do not work with causality but with correlations and patterns,[7] whose interpreta-

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[5] E. Esposito and D. Stark, *What's Observed in a Rating? Rankings as Orientation in the Face of Uncertainty*, «Theory, Culture & Society» (2019).

[6] N. Luhmann, *Die Gesellschaft der Gesellschaft*, Frankfurt, Suhrkamp, 1997.

[7] D. Hand, *Data mining: Statistics and more?*, «The American Statistician», 52 (1988) n. 2, pp. 112-118.

tion is much more difficult and controversial. And here we find again the central role of the humanities for interpretation.[8]

What do we do then? What should be assessed? As the title of the conference in Bologna (January 2018) «Stay Tuned to the Future» testifies, the tendency is often to shift the assessment of infrastructures from the past to the future, addressing the impact on future developments rather than the impact on past performance. This approach also corresponds to a recent shift in data management technologies. The main use of Big Data today is prediction rather than data analysis. Predictive Analytics promises to use the patterns identified by algorithms to foresee what will happen in the future[9] – and to get prepared to it. In the medical field we should know the risk of getting ill before the disease occurs, in the economic field we should know what a specific user wants to buy before he or she is aware of it, crime prevention should be activated before criminal acts are committed. This approach, of course, is still very controversial, but signals a kind of prediction very different from the probabilistic forecast we are familiar with since the eighteenth century, oriented towards present uncertainty and its management.[10] Algorithmic forecast claims to intervene on the future it foresees.[11]

In these conditions the assessment, if it must address future impact, can only be performative: flexible, differentiated and able to learn from its own results. And this is a challenge. Understanding assessment as a learning tool, as many observers (rightly) propose, implies allowing the assessment to learn from the impact of the assessment. It is already difficult to assess the impact of infrastructures for science in general (data are inaccurate, incomplete and inconsistent) – but if we want to assess social change, also the assessment must change and try to include this reflexivity as an asset and not as an obstacle. Theory of society and performativity studies have a lot to say about it.[12] The results will inevitably be local, situated and provisional, but this must not necessarily be a liability.

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[8] S. Ramsay, *Reading machines: Toward an algorithmic criticism*, Champaign, Ill., University of Illinois Press, 2011.

[9] E. Siegel, *Predictive analytics: The power to predict who will click, buy, lie or die*, Hoboken, N. J., Wiley, 2011.

[10] L. Daston, *Classical Probability in the Enlightenment*, Princeton, N. J., Princeton University Press, 1988; I. Hacking, *The emergence of probability*, Cambridge, Cambridge University Press, 1975.

[11] D. Cardon, *À quoi rêvent les algorithmes*, Paris, Seuil, 2015.

[12] D. MacKenzie, *An engine, not a camera: How financial models shape markets*, Cambridge, Mass., MIT Press, 2006; D. MacKenzie, F. Muniesa and L. Siu, *Do economists make markets?*, Princeton, N. J., Princeton University Press, 2007; E. Esposito, *The structures of uncertainty: Performativity and unpredictability in economic operations*, «Economy and Society», 42 (2013), pp. 102-129.

This approach can be very productive to face the current challenges of the assessment of infrastructures' impact with the appropriate openness and flexibility. For some observers, however, the obstacle can be that it requires to give up the claim (or the hope) to find a common ground for different areas and different stakeholders. This is not the meaning of multidisciplinarity. The goal cannot be a common language between science, politics, economics and their concrete consequences, nor a translation from one area to another, but a methodology that makes it possible to reformulate the results in different ways in different areas, keeping the possibility to learn – that is, keeping difference as a resource.

Jelena Angelis, Elina Griniece, Silvia Vignetti, Alasdair Reid

CHARTING IMPACT PATHWAYS OF INVESTMENTS IN RESEARCH INFRASTRUCTURES

Abstract

The topic of the socio-economic impacts of investments into the Research Infrastructures is hot on the international and national agendas at various levels: the funders, operators of RIs, users and society at large. Although several impact assessment approaches exist, a question remains if it is possible and sensible to have a more systemic view on the relationships between the impacts, accounting for the time-scale of impact diffusion and their cumulative effects. The ambition of the H2020 project RI Impact Pathways is to develop a logical model in a participatory co-design manner engaging RIs and other stakeholders in making explicit their assumptions and elaborating the logical chains in how they see various socio-economic impacts emerge and diffuse over time and across boundaries.

Introduction – A growing role of research infrastructures

As science and innovation are increasingly seen as essential engines of growth, research infrastructures (RIs) are becoming a strategic component of publicly supported policies boosting technological and scientific progress.[1] The question about the socio-economic impact arises given the increasing amount of public money spent for research facilities in an unparalleled context of strict budget constraints.[2]

While there is vast theoretical and empirical literature on the return for society of aggregate expenditures on research, development and innovation

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[1] E. Autio, *Innovation from big science: Enhancing big science impact agenda*, London, Imperial College Business School 2014; B. Hall, J. Mairesse and P. Mohnen, *Measuring the returns to R&D*. In *Handbook of the Economics of Innovation*, edited by B. Hall and N. Rosenberg, Amsterdam, Elsevier, 2010.

[2] M. Turner, *Big science is hard but worth it*, «Science», 348, 2015 (Issue 6233), pp. 375; B. Martin and P. Tang, *The benefits from publicly funded research*, «SPRU Electronic Working Paper Series», n. 161, Brighton, University of Sussex, 2007).

(RDI),[3] the same does not fully hold for individual projects.[4] From a policy perspective, if there are good reasons to invest in RI, there might also be arguments for *not* engaging into such costly investments. For example, RI would be 'self-perpetuating' investments, often requiring more investment, sunk costs and often characterised by excess capacity. They may also pose a problem in terms of excessive geographical concentration of resources at the expense of territorial cohesion.[5] RIs are increasingly expected to be subject to standard public policy practices, especially as far as their selection, appraisal and evaluation is concerned to correctly assess their performance and take the right decisions in terms of establishment of new RI, and continuation or discontinuation of existing ones.[6]

The fact that RIs can demonstrate that they contribute to socio-economic development beyond the primary objective of producing cutting-edge science is becoming crucial.[7] The Europe 2020 strategy includes the Innovation Union flagship initiative, aimed at transforming Europe into a world-class science performer, by, among other actions, completing or launching the construction of priority European RIs. Other countries, including China, Japan, South Africa, Canada and Australia, are planning large-scale scientific investments for the next decades. There is an increasing international competition in hosting facilities at the frontier of scientific and technological knowledge to promote economic competitiveness. The last ESFRI roadmap strategy report recognises the importance of promoting EU RIs to foster innovation and socio-economic impact. The strategy highlights that, when deciding the location and distribution of RIs in Europe, importance should be given to the relation between the higher education system in a specific region or territory and the industrial landscape, reflecting the local innovation-based economic vocation.[8]

The importance of promoting RIs with a view of their role within a wid-

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[3] B. Hall, J. Mairesse and P. Mohnen, *ibid*.; A. J. Salter and B. Martin, *The economic benefits of publicly funded basic research: A critical review*, «Research Policy», 30 (2001), n. 3, pp. 509-532.

[4] C. Del Bo, *The rate of return to investment in R&D: The case of research infrastructures*, «Technological Forecasting & Social Change», 2016, pp. 112.

[5] European Commission, *High Level Panel on the socio-economic benefits of the European Research Area*, Final Report, 2012.

[6] OECD, *Report on roadmapping of large research infrastructures*, Paris, OECD, 2008.

[7] L. Scaringella and J.-J. Chanaron, *Grenoble-GIANT territorial innovation models: are investments in research infrastructures worthwhile?*, «Technological Forecasting and Social Change», 12 (2016), n. 112, pp. 92-101; C. Macilwain, *Science economics: What science is really worth*, «Nature», 465 (2010), pp. 682-684.

[8] European Strategy Forum on Research Infrastructures, *Strategy report on research infrastructures: Roadmap 2016*, 2016.

er ecosystem with a relevant territorial dimension is fully embraced by the EU Cohesion Policy programmes, providing a significant share of the European structural and investment funds for RIs. During the 2007-2013 period 32 major RDI projects were co-financed by the Cohesion Policy for a total cost of € 4 billion and with an economic rate of return reported in a range of 7-45%. The scale of investment may increase in the current period. According to regulatory provisions, however, an ex-ante condition for investing in RIs is to have a multi-annual strategy in place for budgeting and prioritisation of investments in line with territorial specificities.

Attempts to assess socio-economic impact

Currently there is no unified framework for the socio-economic impact assessment (IA) of investment in RI. Various conceptual frameworks exist in parallel comprising a range of observable direct and indirect effects and longer-term impacts and reflecting different information needs of funding institutions, policy decision-makers and RI managers. A heterogeneous set of methods is applied to capture these effects of RI. Most of them address standard economic impacts (direct effects) and to some extent economic multipliers. To fill this gap there have been several attempts to carry out systematic exercises to map the information needs by stakeholders and capacity of RIs to provide relevant data and key performance indicators.

The challenging traits of assessing the socio-economic impact of RI – and of science in a broader sense – are related to several aspects. These are the intangible nature of benefits, their long timespan, their high uncertainty (especially in relation to the probability of breakthrough scientific discoveries) and related risks as well as the high occurrence of externalities and spillover effects. Not only do such features distinguish RI from investments in traditional infrastructure or in the RDI sector, but they are also highly idiosyncratic. This has led to the proliferation of *ad hoc* modelling and forecasting exercises. Such exercises as case studies on individual RIs are of course necessary. They allow for tailoring the approach to the uniqueness of the unit of analysis and focusing on types of impacts specific to that RI. However, they also take lots of effort to conduct either by the RI managers or funders themselves or with the help of external consultants.

There have been several attempts to reflect on the intrinsic advantages and limits of specific tools, and to put forward practical recommendations about how to accurately select these tool(s) and possibly combine them in the most appropriate way. In 2016 the OECD Global Science Forum's

(GSF) Expert Group initiated a project to develop «A reference framework to assess socio-economic impact of research infrastructures». The framework provides a common set of indicators and will be finalised in the autumn 2018. The ESFRI working groups have been addressing the topic as well, and there are some conceptual models in development, especially reflecting on list of relevant indicators and different dimensions of impacts. First attempts to look at the impact assessment of RI from a more systemic impact pathway perspective have also been recently undertaken.

Another relevant experience is the significant work undertaken by the FP7 project «Research Infrastructures: Foresight and Impact» (RIFI). A Foresight Enriched Research Infrastructure Impact Assessment Methodology (FenRIAM) was developed during the project, which significantly contributed to the understanding of the impact of RI on learning and capacity of RI operators, suppliers and users and providing procedures, instructions, recommendations and instruments. The FenRIAM guide provides step-by-step instructions on how to proceed with research and development impact assessment and questionnaires to help collecting data aimed at investigating different themes. It also reviews the main methods used to analyse data. However, the decision about the suitable appraisal model to adopt is still open for discussion.

A new approach offered by RI-PATHS

A Horizon 2020 funded project «Research Infrastructure imPact Assessment paTHwayS» (RI-PATHS) that is being implemented from January 2018 until June 2020 suggests a new approach to the impact assessment topic addressing particularity of research infrastructures. The main objective of RI-PATHS is to develop a theoretical model describing the socio-economic impact of RIs and their related financial investments. It has three specific objectives:

- Carry out a comprehensive stocktaking exercise on the existing approaches for impact assessment of research infrastructures and map policy-maker expectations of impact and current and future data gathering needs of the key stakeholder groups;
- Develop a modular impact assessment model employing systems thinking approach and representing all major impact pathways of distinct types of research infrastructures;
- Operationalise the IA model by defining a set of reference indicators, providing guidance on the most appropriate monitoring and evaluation approaches and testing its feasibility with pilot research infrastructures.

The model will be developed in a modular manner adapting it to a broad range of scientific domains and types of infrastructures. Through continuous interaction with other global initiatives in this area, RI-PATHS is also expected to contribute to a more streamlined approach to impact assessment of research infrastructures at international level. The work will also take into account and build upon the list of indicators developed by the OECD GSF's Expert Group.

A solid IA model, however, cannot be an *ad hoc* set of propositions and procedures, neither a long-list of performance indicators. The task of pinning down socio-economic impact of research infrastructures involves examination of very complex and dynamic systems. An overly linear/structured understanding of impact misses important aspects of research-society interaction and can lead to a myopic focus on limited goals and objectives. The ambition of RI-PATHS is not just to list the relevant socio-economic impact areas, but to develop a systemic view on the relationships between the impacts, accounting for the time-scale of impact diffusion and their cumulative effects. To enable the elaboration of such a comprehensive perspective, the project employs impact pathway approaches.

The key building blocks of an impact pathway method to evaluations is to describe causal mechanisms that explain why and how an investment in RI does contribute to a specific impact. Interventions are only one of the forces that contribute to observable effects. The causal claims may be based on attribution of outputs and outcomes to a public intervention or, where causal mechanisms are more complex, on the contribution of this public intervention to longer-term outcomes and wider impacts. Attributing wider socio-economic impacts must consider complex relationships and processes that can be non-linear, iterative and cumulative. They cover long periods of time and diffuse differently in geographical space. Hence, causal mechanisms depend on the context in which they take place. Context can be conceptualised by determinants that influence the timeframes, scale and dynamics and drivers and barriers that influence the effects of a public intervention.

Therefore, in its initial steps the thinking behind RI-PATHS presents a dedicated attempt to build an impact theory for such complex systems as research infrastructures.

Theory building in a complex environment

Waltz has famously coined that a theory is «a picture mentally formed». A theory «always remains distinct from [the real] world»; in essence, there

is always a creative element in theory development.[9] Reflecting on Waltz's contribution, Wæver summarises: «The word 'theory' should not be used as a synonym with 'law', not even for collection or set of laws. Theory should be reserved for something that explains – explains laws, and explains in general».[10]

The main driver for the application of theory-based approaches to impact assessment is the increasing need not only to estimate and measure net effects of a policy intervention, but to provide explanations why and how impacts occur. In other words, the approaches do not focus on measuring the scale of effects, but rather on identifying the impact mechanism behind the change paying particular attention to the process of how causality is established. RI-PATHS aims to draw upon the conceptual contribution of theory-based evaluation approaches in charting key pathways of how investment in research infrastructures lead to a broad range of socio-economic impacts.

It is recognised that the task of pinning down socio-economic impact of research infrastructures involves examination of very complex and dynamic systems, including technical, societal, environmental and cultural aspects. Bach *et al.* concludes:

> The systemic nature of the interactions 'around' the RIs is hardly addressable with too linear a causality reasoning […] RI can be considered as a complex system […] It is also an open system in interaction with its environment. Furthermore, networking RIs can be seen as systems of systems.[11]

This understanding calls for exploring the potential of systemic inquiries to tackle the variety and heterogeneity of RI impacts.

While the application of theory-based approaches in their full methodological rigour may prove very difficult, especially in a field such as IA of RI where data collection routines are not well-established, there is an intrinsic value to starting with a good narrative or a timeline that lists the sequence of effects. Careful descriptions are fundamental for causal inference and this narrative is still underdeveloped when it comes to scoping the impact of RIs.

A fine-grained process description relies on both qualitative and quantitative data, thus the boundary between them should not be rigid. Process

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[9] K. Waltz, *Theory of international politics*, Reading, Mass., Addison-Wesley, 1979.

[10] O. Wæver, *Waltz's theory of theory*, «International Relations», 23 (2009), n. 2, pp. 201-222.

[11] L. Bach *et. al.* (2011) *Core study: Adapting the BETA method to the case of the evaluation of the impact of Research Infrastructures. Deliverable 1.1-Report on BETA evaluation approach for RIs-of FP7 funded project EvaRIO.*

tracing requires finding 'diagnostic evidence' that forms the basis for elaboration of causalities. The identification of evidence that can be interpreted as 'diagnostic' depends on 'prior knowledge',[12] thus it is important to connect findings from the process tracing with their actual theoretical starting point. Collier extends Waltz distinctions between the types of prior knowledge into the following four categories: (1) conceptual frameworks: sets of interrelated concepts that are identified as meriting analytic attention; (2) recurring empirical regularities: established patterns in the relationships among phenomena; (3) Theory-I: more tightly connected recurring regularities that allow to build theory «by collecting carefully verified, interconnected hypotheses»;[13] and (4) Theory-II: includes not only interconnected empirical regularities (Theory-I), but also explanatory statements; «Theory-II may also be called an explanatory model».[14]

Reflecting on this categorisation, it can be concluded that current advances in the field of impact assessment of RI have tackled the establishment of partial conceptual frameworks and highlighted some recurring empirical regularities regarding specific types of impacts. RI-PATHS project aims to gather this knowledge and build on the existing advances, extending the conceptual frameworks towards a broader set of social impacts. The ambition is to aggregate evidence on the relationships among phenomena that are observed in similar types of research infrastructures to consolidate verified and interconnected hypotheses on impact diffusion (Theory-I) and consequently arrive at explanatory statements on IA of RI (Theory-II).

Turning theory into practice

The usefulness of applying participatory impact pathway approach to IA of RI can be seen primarily through the lens of information it provides to policy-makers and RI managers. Impact pathways based on strong causal inference can help to reconstruct mechanisms how investment in RI leads to specific impacts. This information can help not only to appraise the effects of RIs from policy-maker and funder perspective, but also meaningfully support RI managers in the design of operational strategies for enhancing impacts. Thus, there is an inherent formative value.

The relevance and applicability of these initial IA pathways to specif-

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[12] D. Collier, *Understanding Process Tracing*, «Political Science and Politics», 44 (2011), n. 4, pp. 823-830.

[13] K. Waltz, *Theory of international politics*, *ibid*.

[14] D. Collier, *Understanding Process Tracing*, *ibid*.

ic types of RIs is being scrutinised and elaborated through a range of dedicated participatory workshops. RI-PATHS is engaging with RIs and other stakeholders, especially policy-makers, in making explicit their assumptions and building the logical chains of how they see various socio-economic impacts emerge and diffuse over time and across boundaries. Using these approaches more in-depth knowledge is being gathered in a structured way on the time lags, cumulative effects, drivers and barriers for specific impacts to emerge. This effort helps improve the understanding of the socio-economic effects in the identified gap areas and serve as a basis for elaborating the logical impact pathway system for each distinct type of RI.

Applying these various efforts emphasis is put on the pertinence, validity and feasibility of the developed model; thus, ensuring its wide applicability. The more applicable the model, the larger the benefits it brings to the RI managers, funders, policy-makers and the wider society.

For the participating research infrastructures (partners), the activities should have an impact in terms of improved understanding of the socio-economic impact of RIs, as well as increased collaboration and partnerships with other RIs and relevant stakeholders. Moreover, its usability should foster the uptake of the proposed IA model and the creation of an interest group beyond the project life that sustains and updates the model and its framework. For the potential communities of users, the RI-PATHS project will seek to reach out to and present the proposed IA model to a broad range of potential users in a uniform/consistent way and in a language that is adapted to each user group. Engagement of communities, that have been critical in the development of socio-economic IA models, at all stages of the development of the model will guarantee further utilisation of the model. For research infrastructure stakeholders, including funding agencies, policy makers (local, national, regional authorities) and RI administrators, RI-PATHS brings an open, transparent and evidence-based dialogue on the socio-economic impact of RIs. The proposed model should facilitate more informed future investment decisions on RIs and create a community of practice around it.

The knowledge accumulated through the RI-PATHS project would help to move from simple ex-post detection of intended and unintended impacts of research infrastructures to a better understanding of various socio-economic impacts brought by RIs and planning of future investments. The project, by adopting a participatory action research method, contributes to this debate by building on existing practices and developing a comprehensive yet flexible model reflecting the needs and capacity of different stakeholders.

PART II

Measurement of Impact of Research Infrastructures

Matthew Woollard, Victoria Moody

UK DATA SERVICE: IMPACT-DRIVEN APPROACH TO SERVICE DELIVERY

Abstract

This paper has two key aims. First, to explain, promote and communicate methods of measuring impact (defined below) in European Research Infrastructures. Second, to examine some of the commonalities of approach in using impact measures as a factor in funding, and refunding (sustainability) RIs. By implication we shall promote the maturity of the SCI community in this area and also by implication we want to try and turn the impact of a service into a mechanism which funders can use to continue their investments into data service infrastructure.

Introduction

This paper has two main aims. Firstly, we explain, promote and communicate methods of measuring impact (defined below) in European Research Infrastructures (RIs). Secondly, we examine some of the commonalities of approach in using impact measures as a factor in funding, managing the sustainability of RIs. By implication we want to promote the maturity of the Social and Cultural Innovation (SCI) community in this area. We've been capturing and using impact for our service delivery for some time and it's possible that others can learn. By implication we aim to try and turn the way in which we identify and understand the impact of our service into a mechanism by which our funders can use to continue their investment in the UK Data Service. This is not a one-sided approach: our funders have to justify to their funders and our host organisations have to see the value of our work. But the two principal rationales are for accountability – to demonstrate the wider value of our Research Infrastructure and secondly, for understanding – to understand the methods and routes by which our

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This paper is an expanded and re-written version of a presentation given by Matthew Woollard at the workshop, «Stay tuned to the future, an international conference on the impact of research infrastructures for social sciences and humanities», Bologna, 24-25 January 2018.

RI leads to impact, and also develop better ways of delivering and communicating impact.[1]

From our long experience, we also believe that it is near to impossible to construct a broad set of impact measures which can be used across multiple RIs, since the specific missions and objectives obviate easy comparison. Below we show in detail some of the specific measures and outcomes which we can use to understand our impact, but we are clear that these are not all universally applicable.

The UK Data Service (the Service) acquires data from a wide range of data creators; national governments, researchers and international governmental and non-governmental organisations, third sector, local government and commercial organisations. We benefit researchers and data providers by curating their data and making them available to eligible researchers – broadly defined – not just in higher education. All that these organisations need to do is to provide the Service with data and sort out the legal side with us and we make it available for reuse – there's no real cost to the data owner. We ingest data into our preservation systems, ensuring that it can be used in the future. For some data we provide online interfaces for access, some data can just be downloaded, and some data must be used in a secure room or environment. We tailor the access mechanisms to suit the needs of the researchers and the owners of the data. Researchers access data freely – there's no cost to them and with more than 7,000 data collections we invest in metadata for discovery and harmonisation. Our question bank provides access to the full text of over 700,000 questions asked in surveys over the last 40 years or so. We version DOIs for all of our datasets, providing easy to use citations. Having more than 7,000 high quality data collections in one place, means serious researchers don't have to search for long. We're also one of the pioneers of secure access for data which has a risk of disclosure, data which can't be made open and which we hold in secure environments. We train researchers to use these systems and we manually check their outputs. We provide comprehensive user support and training for users of the data. All of our activities occur in order for researchers to do better research – thus our primary impact is to facilitate the impact of others.

The Service has been supporting researchers through its existence as an RI in its various forms for over 50 years and can be considered as 'impact-

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[1] T. Penfield, M. J. Baker, R. Scoble, M. C. Wykes, *Assessment, evaluations, and definitions of research impact: A review*, «Research Evaluation», 23 (2014), n. 1, pp. 21-32, DOI: 10.1093/reseval/rvt021. See also: European Strategy Forum on Research Infrastructures Long-Term Sustainability Working Group, *Long-Term Sustainability of Research Infrastructures: ESFRI Scripta. Vol. 2*, Milan, Dipartimento di Fisica, Università degli Studi di Milano, 2017.

ful' throughout that period. We've had a formal focus on impact since receiving dedicated funding (in various forms) for this focus by the primary funder of the Service, the Economic and Social Research Council (ESRC), over the last six years.

Impact is a fairly recent mode for describing and understanding benefit in the context of funded research. We acknowledge methodological uncertainties about impact, noting that impact does not offer a fixed methodology or universal accord as to what it can measure or claim for itself. Here we begin however, to understand how the Service as an RI might align with current discourses of impact and also how those discourses may be deployed to help understand the specific beneficial effect of the Service and the use of the data and resources it makes available.

An overriding basis for understanding our impact is through, the Service's relative disinterest in and independence from the research process, predicated upon our mission (of the curation and archiving of economic and/or social data, broadly defined, for research and teaching):

> To provide an easy to use, trusted and innovative 'one-stop-shop' for suppliers and users of the extraordinary economic and social data resources available in the UK, following the highest standards for data management, access and training and support, across the data life-cycle.

Such positioning perhaps makes impact *measurement* more difficult, including efforts to identify the direct link between an underpinning research output, and the impact, where – as we are focused on – the data we make available were used in that output. We possibly have a more difficult task: we are unlikely to be able to claim impact from simply assuring a particular data collection is available for a piece of research which uses the data and goes on to have that impact. Linear concepts of impact don't perhaps work here. We imply a more embedded effect of the RI where «knowledge provides the concepts, data and tools that underpin our knowledge of social and policy problems».[2] Research processes and RIs may in this definition, be perceived as mutually constitutive to some degree. RIs in this case are implicit in both supporting others in knowledge production (providing data for research) but also in the production of knowledge (curation of *these* data) and any assertions of impact in this context are potentially performative as well as constructivist; so we are careful what we claim as impact and how. We discuss here the opportunity to consider and contribute to methodologies of impact in a particular context, that of data impact and of being an RI which provides those

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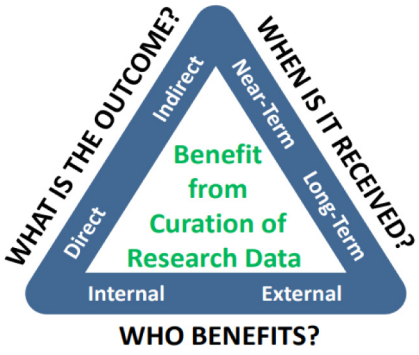
[2] C. Boswell and K. Smith, *Rethinking policy 'impact': Four models of research-policy relations*, «Palgrave Communications», 3 (2017), n. 44, DOI: 10.1057/s41599-017-0042-z.

data; we assess the possibility of identifying ways of understanding and claiming a specific beneficial effect from where and what we are as an RI.

We are starting with a reasonably conventional definition of the impact of the Service which makes sense from the point of view of the Service which we are involved in because it takes account of the dual benefits of costs avoided, and increased productivity and knowledge transfer in the research process. This leads to the construction of a definition of impact which focuses on the cumulative effect of the existence of RIs:

> Impact may be defined as a benefit accrued for the greater good (whether political, economic, socio-cultural, environmental, etc.), within any sphere, but most usually *beyond* the research community, in any way (direct and indirect) and at any time (the past, now, but mostly in the future).

The environment is essentially that which the well-known PESTLE analysis covers, with temporality and effect-type as additional factors.[3] This definition accords well with an earlier 'anatomy of a benefit' used in the Jisc[4] – funded Keeping Research Data Safe project.[5]



Anatomy of a benefit

Source: Introduction to the KRDS Benefits Analysis Toolkit[6]

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[3] P for Political, E for Economic; S for Social; T for Technological; L for Legal and E for Environmental. The UK's Chartered Institute of Personnel and Development's website contains a helpful introduction to the PEST/PESTLE methodology. See: https://www.cipd.co.uk/knowledge/strategy/organisational-development/pestle-analysis-factsheet.

[4] Jisc is the UK's National Research and Education Network.

[5] N. Beagrie, B. Lavoie and M. Woollard, «Keeping Research Data Safe 2» (2010) [Available from http://repository.essex.ac.uk/2147/1/keepingresearchdatasafe2.pdf].

[6] Introduction to the KRDS Benefits Analysis Toolkit (2011). Available at: https://beagrie.com/static/resource/intro_benefits%20analysis%20toolkit_0711.pdf.

Thus we can construct a generic impact statement with these three elements as follows, adding in the various actors as well.

By acting as the licensee for data, researchers benefit from not having to negotiate licences with data owners and thus save time, cost and effort.

Impact as expressed here is direct and persistent. One form, perhaps the overriding form of impact is economic because it means researchers are not spending time and effort in negotiation, nor in data curation, management and infrastructure for these data when it could be more profitably spent in research: a longer term cultural benefit, since it places researchers in a position whereby they become reliant on a service/archive doing this for them. (Such reliance may have a corresponding long-term impact which is not positive.) If the Service were to close tomorrow, then each and every use made of data in our holdings would have to be renegotiated between the researcher and the data owner. Moreover, data owners would incur costs in separately managing not only data access infrastructure for researchers but also user support, training and output checking for data security. The strength of this negative impact could be reduced if all researchers were better aware of what their (now thankfully distant) predecessors had to do in order separately to access the data from the whole range of data creators: companies, government departments, other academics, etc.

Direct impact of the archive/service stems from our actions which *offer this benefit* to researchers and an indirect impact of our funders. They have the foresight to fund us, and make the decision that it is better to fund us to do *this*, rather than fund the researcher.

The impact statement is defined in such a way therefore, as it could act as a template for RIs to use more widely.

- The first part is the action carried out by the RI: 'by acting as the licensee for data'.
- The second is the beneficiary: 'researchers'.
- The third is the benefit: from not having to negotiate…
- And the fourth is the *impact type* in this case economic.

This is all very straightforward. But, it doesn't help us quantify any of this impact. We could say that we spend £x thousand per year on our negotiation activities, and that that is the amount saved; but this is of course the lowest end of any estimation. In this case let us imagine that our negotiation for *all researchers* has the same cost as a single researcher negotiating for their use of the data. If the data are used 200 times by researchers, then having us doing the negotiation is 200 times cheaper. Unfortunately, we

cannot test in any real way whether this is anything close to the real benefit. We can't assume that demand would remain the same if we hadn't negotiated for the data in the first place. Perhaps half of the 200 users would not have bothered to negotiate for the data; or put another way perhaps half of the 200 users are only inquisitive and don't actually want to use the data.

In this case, our ability to measure economic impact is hugely hampered, because the counter-factual makes the real demand for the data uncertain. Are researchers taking the data from us because we exist or because they really need to use it in their research? The big challenge from this simple question is different. It makes us wonder about the value of one of our Key Performance Indicators which is the number of registered users. Our funders assume that we are doing better if the number of our registered users increases. Unfortunately, this takes no account of data which has been downloaded, and it also takes no account of the use of the data. (And, by the way, we have something in the region of 26k registered users of the UK Data Service.) The theory is that if we increase the number of registered users, there is a likelihood that we are increasing the amount of good science which is being done, and (more speculatively) that there must be an increase (not concomitant) of the benefit of that research. However, because we have thought this through, the UK Data Service, no longer actively promotes itself to increase the number of registered users. All our promotion is focussing on keeping existing users registered, and maintaining and increasing our data holdings. At present, we are reasonably complacent in terms of numbers of registered users. There is a small upward trend over the last decade, but net increase is less than 10%. What our funders see every six months are two numbers, representing at two fixed points in time, the number of registered users. If the difference between these two numbers is an increase, then there's a pat on the back; if the difference is negative, then there's a reproachful comment – but that is it.

Part of our income is allocated to demonstrating the impact of our funder's investment, both in [applied] research (which we do not carry out) but supply part of the raw materials for and in our infrastructure itself. We recognise first and foremost that ascribing direct benefits of a data service is complicated by the primarily indirect nature of its impact. In the current scene and specifically for the economic and social sciences, the impact of research on policy is generally considered the 'purest' form of impact. And of course, economic and social science data archives can only *indirectly* affect the work of researchers.

Approach

Accepting that the Service operates to bring data to researchers, saves them cost, time and supports them to use the data, we now consider how to structure a framework for data impact which aims to understand that usage from its appearance in research, to methodologies for demonstrating (and 'claiming') this impact. As we are interested in the impact of the data underpinning research (as opposed to the research itself); in mechanisms for understanding the effect, rather than simply that data were used in an output, that is – as it *appears* in research, policy, debate or the evidential process (although important), our focus is on where (ideally) cited data can be tracked through the specific beneficial outcome and on to an evidenced effect, corroborated by the end user. This is not easy.

In ideal terms, if a social or economic benefit is realised or if one person's life is changed for the better as a result of the use of Service data, resources, expertise, or from the policies and activities of the Service as a data infrastructure, it is important for the Service to aim to understand how, jointly with partners to share that benefit and use it to strengthen and expand its impact.

The Service takes an approach of 'with, not for' to supporting data impact, ensuring impact activity is focused on data user, partner, funder and policy-maker defined concepts of impact.

In addition to the definition of impact of particular relevance to the Service and RIs discussed above (p. 45), the Service's focus on impact is aligned with that of our primary funder, the ESRC (Economic and Social Research Council), which defines impact as:

> the demonstrable contribution that excellent research makes to society and the economy and can involve academic impact, economic and societal impact or both:
>
> – Economic and societal impact is the demonstrable contribution that excellent social and economic research makes to society and the economy, and its benefits to individuals, organisations and/or nations;
>
> – Academic impact is the demonstrable contribution that excellent social and economic research makes in expanding understanding and advancing scientific, method, theory and application across and within disciplines.[7]

The ESRC considers that academic, economic and social research impact can form:

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[7] What is impact? <https://esrc.ukri.org/research/impact-toolkit/what-is-impact/> accessed 21 June 2018.

Instrumental impact	Influencing the development of policy, practice or service provision, shaping legislation, altering behaviour
Conceptual impact	Contributing to the understanding of policy issues, reframing debates
Capacity building	Through technical and personal skill development

For the Service impact is conceptualised as supporting the impact of others using Service-curated and hosted data as well as the impact of the Service as an RI. Our focus is on coordinating data impact activity through the concept of data impact by:

- Expanding methodologies of data impact
- Capitalising on the role of the Service as a critical part of the UK's research infrastructure, internationally
- Contributing to processes of developing social benefit through supporting the re-use of Service data, where (ideally) cited data can be tracked through the specific beneficial outcome and on to an evidenced effect, corroborated by the end user; and
- Demonstrating data impact leadership.

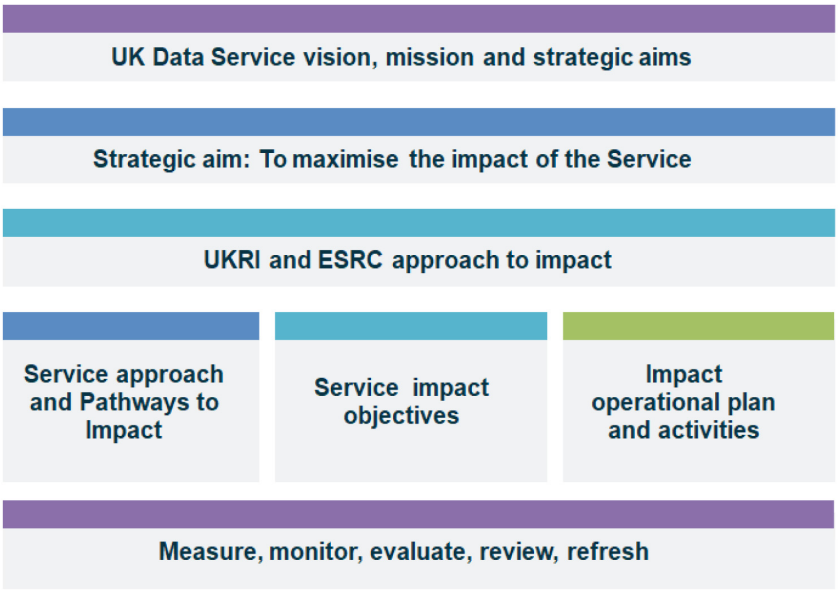
Our focus is therefore on the demonstrable contribution the Service and its data and resources make to the economy, society, culture, public policy and services, health, the environment and quality of life. Our emphasis is on drawing together evidence about the reach and significance of the impact of the use of the data and resources, of the Service as a whole. We frame impact in terms of the Service's strategic approach so that it can be understood in terms of the Service's strategic aims and support the Service in the achievement of its vision:

To support high quality social and economic research, teaching and learning through assuring long-term access to quality economic and social data, supporting and promoting their use, value and impact.

What this means in effect it that our impact measurements are mostly non-quantitative and almost all directly related to our overall strategy. The figure below shows how we frame impact in terms of our overall strategy.

Our Pathways to Impact, a requirement of UK research funding, were developed as part of the impact strategy in the funding period 2012-2017. The Pathways are the prospective approach to impact, designed at the bidding stage, the impact objectives are designed to structure how it is proposed to achieve and demonstrate impact at various stages throughout the grant, in fulfilment of the Pathways. The objectives present detail and context to guide

activity and may change over the phase of the grant as they are achieved; as the impact develops; or as impact priorities and opportunities change.



Thus our Pathways were to:

- Support development of impact derived from research which uses our data
- Engage more non-academic organisations and communities in using our data and services
- Articulate the role of the Service in terms of its contribution to societal benefit, developing the impact of the Service as a whole in the context of that benefit and having an impact on other data services and data infrastructure internationally
- Establish methods for expanding innovation and collaboration in using our data, resources and expertise
- Formalise the evidencing and corroboration of our impact
- Promote our impact through targeted communications activities in an engagement, collaboration and co-creation framework
- Promote impact capacity building

We have developed impact objectives to structure how we achieve and demonstrate the achievement of the Pathways to Impact, and against which we plan annual activities and initiatives. The objectives are to:

1. Derive impact from the Service as a research infrastructure, its assets, resources and expertise, and embed impact across activity

2. Demonstrate data impact leadership and innovation, expanding methodologies of data impact
3. Maximise the use of Service data, resources and expertise by new and non-academic users
4. Increase collaboration between the research community and non-academic organisations and communities, acting as a 'data facilitator'
5. Align Service data and resources to supporting partner priorities focused on addressing societal challenges
6. Engage researchers in ensuring that and understanding how their research using Service data and resources has impact
7. Expand upon and remain creative in how the Service develops, celebrates and promotes its own and others' impact
8. Understand and identify the potential for inter/multidisciplinary approaches to contributing to data impact
9. Increase data impact through increased data citation
10. Develop systems and processes for tracking and evidencing the impact of the Service as a whole
11. Generate more, and more authentic, corroboration
12. Maximise income to the Service from its impact activities.

How to collect information efficiently

Our focus is on understanding and leveraging data sources which already exist and can be repurposed for impact evaluation. We collect information about our impact from the perspective of the role of the Service as a critical part of the UK's research infrastructure, structuring how we conceptualise that impact, through researching and collating external (and internal) activity we are able to demonstrate the impact the Service has through both usage of the data by others and through the categories which define our area of operation as follows:

RI impact
Offering trusted digital repository status
Setting standards in data infrastructure
Providing a unified collection once, for all
Offering efficiency and value for money
Promoting data reuse
Enhancing research capacity
Promoting research data ethics and integrity

Leading data management/policy consultancy, nationally and internationally
Assuring long-range access
Offering support and training in data use, a skills focus
Offering expertise in data management
Stable, enduring and innovative, a Service approach

Examples include:

– *Leading data management/policy consultancy, nationally and internationally*: Matthew Woollard, Director and Louise Corti, Functional Director for Collections Development and Producer Relations at the UK Data Service provide an update on how the UK Data Service has supported the development of the new Indian Council for Social Science Research (ICSSR) Data Service:
http://blog.ukdataservice.ac.uk/welcoming-progress-on-the-new-indian-councl-for-social-science-research-iccsr-data-service/

– *Enhancing research capacity*: Rob Dymond-Green, Technical Manager for the UK Data Service Census Support Service, describes the creation and processing of the 2011 UK Census dataset:
http://blog.ukdataservice.ac.uk/creating-a-unified-2011-census-dataset-for-the-four-nations-of-the-uk/

We plan to establish Service impact champions from among our staff where we 'triage' activities identified by Service colleagues and the external organisations they engage offering potential impact through the categories. Some activities identified by the impact champions will assist in our communication and marketing activities, some will indicate the need for a more impact-focused approach.

We have created a range of dedicated impact channels to develop and enhance our impact activity and its profile. These channels also enable us to promote the Service's and others' impact in a range of ways, helping achieve our impact objectives in the areas of communicating, promoting and building impact capacity through sharing its outputs widely. The channels themselves could also be considered as constitutive of impact because they provide a series of outlets for the development and consideration of methodologies for it:

Impact web pages	We have developed dedicated impact web pages where we bring together the elements of the impact activity which endure over the period of the strategy, such as Impact Case Studies, the #DataImpactFellows, Blog, Lab and #DataImpact events.
Impact case studies	Our *c.* 200 case studies focus on users of the data, including an opportunity for them to describe their impact or findings for policy. The case studies also cover use of the data in teaching. At present we are also focussing on developing case studies with a focus on early career researchers and the Ph.D journey.
Data Impact Blog	The blog is a hub for researchers, students, communities, policy-makers, government and anyone interested in maximising the impact of economic, social and population and data in teaching, research and policy. The blog is where we encourage debate about data impact, • share best practice in data impact; and • keep the data impact community up to date with news, events and the latest data-driven impactful research and policy making.
Impact and Innovation Lab	Through the development of the lab we enhance our impact through working more closely with innovators developing inspiring data solutions to social challenges. The lab focuses on methods and technology.
#DataImpactFellows	The #DataImpactFellows programmes aims to establish additional ways to support the long-range use of its data and resources by new generations of scholars, extending this usage through the research partnerships they develop and by the students they teach – from the earliest stages of, and throughout their career. The programme aims to provide career development opportunities for scholars at a relatively early stage of their academic careers with a proven record of research which has a dedicated focus on impact and includes engagement beyond academia.
#DataImpact events	Annual/biennial event where panels comprising leading data innovators explore data re-use in policy and research, sharing their experiences of demonstrating data enhanced impact and focusing on defining collectively what the data solvable policy challenges are across the higher education, public, commercial and civil society sectors.

ScoopIt	Our ScoopIt enables us to curate data use as it appears across the media. The ScoopIt is an important mechanism for gaining broad insight into the 'appearance' of the collection in terms of its indication of the concerns of the time as both research and media focus, as well as demonstrating evidence of reach and significance through the data's visibility in media outlets. Our analysis of ScoopIt shows over 3,000 articles about research which uses the data in the collection, at around 1,000 per year (and is only indicative).
Impact focused Twitter	Here we promote elements of the impact programme and involve ourselves in impact as an emerging empirical approach.
Our youtube channel	Here we include videos of the data impact events and initiatives such as depositor stories where data creators corroborate the impact of the Service from their perspective.
Wakelet	Our Wakelet is where we curate social media from conferences and events from across the Service, promoting our impact.
Google Analytics	Which we use for demonstrating reach in terms of international coverage and also for giving a sense of how impact channels are performing.

How do we support impact development more directly?

Objectives 4 and 5 of our impact strategy offer us the opportunity to facilitate impact development in partnership with others:

- Increase collaboration between the research community and non-academic organisations and communities, acting as a 'data facilitator'
- Align Service data and resources to supporting partner priorities focused on addressing societal challenges

Our dual role of acting as a data facilitator and supporting partner priorities focused on addressing societal challenges has enabled us to co-ordinate specifically impact focused activities.

Examples include:

- We have held two open data dives, attended by academic, government, and commercial research professionals, where we built impactful applications from open data in the collection together with external open data. The data dives took the form of competitions with the prises being 3-D prints of the winning dives. One was of UK house prices using the Service's Census data and the other was themed as a SWOT analysis of Greater Manchester and the Region

– internationally as a gift for the new mayor of Greater Manchester with the winning teams creating maps of deprivation and community resilience, prescriptions and income inequality.
– We have proposed an additional emphasis on moving the impact continuum forwards, to include a greater focus on orienting our impact practice towards addressing intractable social challenges from the perspective of those organisations and agencies charged with addressing them. We have identified a need for ensuring that impact practice is targeted towards removing organisational barriers to developing social benefit. To that end we have established an impact ambassadors programme where we support public, commercial, voluntary and community sector representatives and data users from among the academic community jointly to understand and support their data needs, and coordinate a programme of activity focused on deriving impact through identifying and 'data solvable' social challenges defined by partners and supported by a range of academic data experts.

How we understand impact where data in the collection are used by others

We are in a good position to collect and demonstrate information about the impact of research which uses the data we make available. We understand usage of much of the data in the collection through our user registrations and are able to trace publications post usage. Moreover, we have recently required citation as a qualification for releasing outputs after disclosure checking and can follow up to ascertain the impact which we then can work with the researcher to create a case study.

The metric tide a report on the independent review of the role of metrics in research assessment and management, chaired by Professor James Wilsdon recommends that:

> The use of digital object identifiers (DOIs) should be extended to cover all research outputs. This should include all outputs submitted to a future REF[8] for which DOIs are suitable, and DOIs should also be more widely adopted in internal HEI and research funder processes. DOIs already predominate in the journal publishing sphere – they should be extended to cover other outputs where no identifier system exists, such as book chapters and datasets.[9]

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[8] The REF is the UK's Research Excellence Framework which is the mechanism where the UK government assesses the quality and impact of research doing by Higher Education Institutions and distributes funding to those institutions. See http:www.ref.ac.uk.

[9] J. Wilsdon *et al.*, *The metric tide: Report of the independent review of the role of metrics in research assessment and measurement* (2015), DOI: 10.13140/RG.2.1.4929.1363.

The citation of research data (and metadata) can support the understanding and promotion of research impact through the tracking of the use of data in research and on into policy and product development, influencing decisions about public and commercial spending and service provision.

Citing research data isn't new; the Service and other data repositories around the world have been requiring it as part of their standard user agreement for many years. Citing data using persistent identifiers (such as DOIs) supporting verification and attribution or research, helps people to understand the impact of the research and offers the realisation and demonstration of efficiencies through re-use. A DOI is automatically assigned to any data collection deposited into the UK Data Service.

We have developed a #CiteTheData campaign which we are proposing to widen through engagement with data providers and journal publishers. We also have the opportunity to support data citation through researcher profile platforms such as ORCID.[10]

Mining publicly-available case-studies

We pilot data-mined the API (Application Programming Interface) that the Higher Education Funding Council of England (Research England) made available on its Research Excellence Frameworks (REF) Impact Case Study website.[11] Citation of data, even the appearance of data, was not mandated in impact case studies for the 2014 REF, so to understand the usage of data in the collection in REF impact case studies we needed to pre-define a set of scripts for mining; we started with high usage terms such as «Labour Force Survey», «Crime Survey for England and Wales». The pilot, focusing on data named in the case study database found 60 or so impact case studies which clearly used data in the UK Data Service collection (from the search terms we used) to support their development (or the underpinning research).

As previously considered however, we are careful what we claim as impact and how. The table below shows some of the ways in which data were a feature in research across a range of institutions and Units of Assessment in the REF. Further work includes reviewing specifically how the data were used in the case studies. Initial indications are that use of the data provid-

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[10] http://blog.ukdataservice.ac.uk/citethedata-impact-tracking-and-the-metrics-debate/.

[11] http://impact.ref.ac.uk/CaseStudies/.

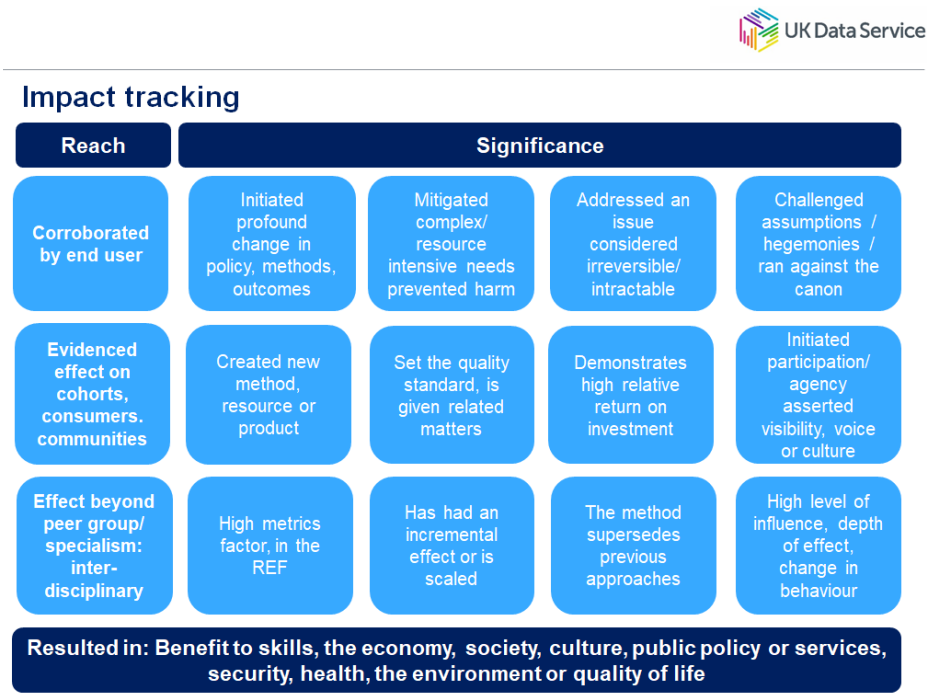
ed evidence of improvement or detriment to people's lives, supporting research processes with the evidence of change.

Assessment Unit	Institution	Case Study Title	Data
Business/ Management	University of York	Employee ownership plans: individual behaviour and company outcomes	Wealth and Assets Survey
Business/ Management	City University London	A fairer approach to compensation for personal injury and fatal accident cases	Labour Force Survey
Social Work/ Social Policy	Nottingham Trent University	Crime drop, security and victimisation	Crime Survey, Census
Economics/ Econometrics	University of Kent	Improving the Economic Role of State Education in Britain: Lessons from the Independent Education Sector	Labour Force Survey
Sociology	University of Surrey	Improving the quality of life for citizens in the UK through shaping the organisation and practice of policing	Crime Survey for England and Wales
Economics/ Econometrics	University College London	Setting national minimum wages	Labour Force Survey
Public Health, Health Services and Primary Care	The University of Oxford	Shaping international and UK tobacco policy and practice	General Lifestyle Survey
Geography, Environmental Studies and Archaeology	University of Portsmouth	The Smoking Epidemic in England and Scotland: Shaping Public Health Policy and Planning	Census & Health Survey for England
Law	Birkbeck, University of London	Trust in justice: mapping public attitudes towards the police and other legal institutions and how these findings have changed EU and UK policy	Crime Survey for England and Wales (European Social Survey)
Education	Institute of Education	University fees and social mobility: a difficult balancing act	Labour Force Survey

Mandating data citation in future REF impact case studies – as part of a broader programme to raise the value imperative of quality, cited data as output – in the wider REF would be a further step towards understanding the impact of the Service and of value for research assessment frameworks for other RIs.

How do we turn a measurement on service activity into an impact description?

Our aim is to structure a framework for data impact which aims to develop methodologies for demonstrating (and 'claiming') impact for RIs. And given as discussed, that we are interested mechanisms for understanding the effect, rather than simply that data were used in an output and where (ideally) cited data can be tracked through the specific beneficial outcome and on to an evidenced effect, corroborated by the end user, we have developed a mechanism for understanding the specific beneficial outcome. From analysis of impact case studies developed as part of the UK's REF exercise in 2014 the following figure offers ways of understanding impact by type – that is through that specific beneficial effect:



Once it is possible to be fairly satisfied that the data were instrumental in the research process from which the impact is identified, we assess typologies of impact as described in order better to understand the reach and significance of the data in the impact. (The figure distils elements of what were concluded to be in that exercise 4* impact from the REF pilot impact case studies exercise designed by (then) HEFCE to structure impact in the exercise.)

We review the impact of the use of data and map it against the elements of the table. Similarly; not easy. Indeed, corroboration; the 'gold standard' of impact evidence and the most elusive, may be understood as further removed from linking data to impact. Other methodologies are proposed here, including a focus on elucidating the importance of data in supporting the understanding of lived experience over time with a focus on the pressures and changes in people's lives. Of benefit, may be the coordination of the development of aggregated, anonymised personas in association with partners, so that it is possible better to understand data impact from the perspective of the data subject. Such an approach may offer a more 'Uber' demonstration of the impact of the data as a consolidated asset of some significance to the social landscape and what it offers as a whole to policy and economics focused initiatives focused on social benefit. Indeed, impact from that perspective offers a focus on methods for understanding the way in which the available data frames the available hypotheses or even structures them, and that without which, much of the research which depends on the data may not be possible.

In this paper we have presented the ways in which we measure our impact both as an RI and through the use of the data and resources we make available. We hope that the paper makes a contribution to emerging frameworks for data impact and will continue to develop and enhance the activity towards understanding the impact of RIs as described here through our broad methodology of:

- Demonstrating data impact leadership
- Expanding methodologies of data impact
- Capitalising on the role of the Service as a critical part of the UK's research infrastructure, internationally; and
- Contributing to processes of developing societal benefit through supporting the re-use of Service data, where (ideally) cited data can be tracked through the specific beneficial outcome and on to an evidenced effect, corroborated by the end user.

What we have not presented here are easy to digest indicators for impact. The reason is that we do not believe that many proposed impact measures

are relevant to RIs like ours and we do not believe that there is a broad set of impact measures which can be used across multiple RIs, since the specific missions and objectives obviate easy comparison. If RIs are asked to report on impact measures which are meaningless or irrelevant, then funders must be expected to receive irrelevant or meaningless information for the subject. Consequently, we have concentrated on trying to identify impact and tracking back to understand our involvement. This is not a perfect methodology, but it is one from which we can get some idea of the real benefits the UK Data Service provides, and it is not based on spurious and unreliable metrics which are constructed from pertinent and reliable performance indicators.

We believe, like the authors of the recent draft *Reference framework for assessing the socio-economic impact of research infrastructures* that it is harder for RIs to assess impact because much of that impact is indirect. We also believe that the uniqueness of RIs means that comparing the socio-economic impact of different RIs is not recommended.[12] On the other hand we know that funding organisations need to make decisions on continued funding for RIs, and that impact is a major feature of this assessment process. Therefore, the Service has opted to maximise the opportunity for our funders to see for themselves through reporting as well as a variety of communication channels how we have had an impact.

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[12] OECD Global Science Forum. Expert Group meeting on: «Reference framework for assessing the socio-economic impact of research infrastructures». *Draft Assessment Framework. Initial Consensus Indicators*. Paper dated 13 March 2018. [Available at: https://www.innovationpolicyplatform.org/system/files/Draft%20OECD%20GSF%20SEIRI%20framework%20v16.pdf].

Riccardo Pozzo, Vania Virgili

INNOVATION FOR INCLUSION AND REFLECTION

Abstract

'Cultural innovation' sounds like an oxymoron, no doubt. It is not, though. It is something real that tops up social and technological innovation. Cultural innovation requires spaces of exchange in which citizens engage in the process of sharing their experiences while appropriating common goods content. We are talking of public spaces such as libraries, museums, science centres, but also of any place in which co-creation activities may occur e.g., research infrastructures such as DARIAH-EU, which has a long list of working groups. At this level, social innovation becomes reflective and generates cultural innovation. Insisting on reflexivity helps to raise awareness for the importance of framing issues around engaging with science and society, identifying problems and defining solutions. How can we measure 'cultural innovation'? The answer is, as a result of co-creation.

1. *Introduction*

'Social and Cultural Innovation' is a syntagma that has been receiving increased usage since 2016, when it was chosen by the European Strategy Forum Research Infrastructures for the name of the working group that deals with research infrastructures primarily connected with the Social Sciences and Humanities.[1] Innovation refers to the creation of new products and services by bringing a new idea to the market. Economic growth turns on infrastructures, which provide access to services and knowledge, e.g., by overcoming the digital divide. Globalisation has made it clear that a most urgent objective is to work out policies of social and cultural innovation to the advantage of citizens – policies that aim at achieving changes in the regulatory environment that make societies both inclusive and reflective.[2] The

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[1] European Strategy Forum Research Infrastructures, *Strategy report research infrastructures: Roadmap 2016*, Brussels, Science and Technology Facilities Council, 2016.

[2] D. Archibugi and A. Filippetti (eds.), *The handbook of global science, technology and innovation*, London, Wiley, 2015.

«Faro framework convention on the value of cultural heritage for society» of UNESCO encourages reflection on the role of citizens in the process of defining, creating, and managing a cultural environment in which communities evolve.[3] The notions of inclusion and reflection are inspired by philosophical ideas referring to the role of deliberative communication of citizens in a modern public sphere aiming at mutual understanding. Jürgen Habermas has applied to society[4] what G. W. F. Hegel had elaborated as the passage from the surface of being to the ground of essence, a passage that takes place, literally, by «reflecting into the thing»[5] – like reflected light that illuminates something previously invisible, or creates a pattern not previously existing. It is now time to examine the implications of innovation for redefining the ways in which culture has been envisioned, particularly to visualise the various ways in which users engage with cultural processes in the past, present, and future.

'Social innovation' aims to directly address unmet social needs in new ways by developing or enhancing new products and services through the direct engagement of the people who need and use them, typically through a bottom-up process. It takes place when a new product or service answers positively to the following three questions: (1) Does it solve the problem? (2) Does it have a fair cost? (3) Is it universally accepted? An example of social innovation is the regional healthcare card of the Lombardy Region in Italy. It was introduced in 1999 as a pioneer endeavour. It solved the problem of providing access to data; not only did it cost right, but it enabled substantial savings; and it was accepted without any opposition.

'Cultural innovation', no doubt, might sound like an oxymoron. It is something real, however, that tops up social and technological innovation.[6] Cultural innovation requires spaces of exchange in which citizens engage in the process of sharing their experiences while appropriating common goods content. We are talking of public spaces such as libraries, museums, science centres, but also of any place in which co-creation activities may occur e.g.,

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[3] Unesco, *Faro framework convention on the value of cultural heritage for society*, Paris, Unesco, 2007.

[4] J. Habermas, *Wahrheitstheorien*, in *Wirklichkeit und Reflexion: Walter Schulz zum 60. Geburtstag*, edited by H. Fahrenbach, Pfüllingen, Neske, 1973, pp. 211-265.

[5] See http://www.zeno.org/Philosophie/M/Hegel,+Georg+Wilhelm+Friedrich/Wissenschaft+der+Logik> accessed 15 July 2018. G. W. F. Hegel, *Wissenschaft der Logik*, vol. 2: «Die Logik des Wesens», section I: *Erster Abschnitt: Das Wesen als Reflexion in ihm selbst*, chapter 2: «Die Wesenheiten oder die Reflexionsbestimmungen».

[6] R. Pozzo and V. Virgili, *Social and cultural innovation: Research infrastructures tackling migration*, «Diogenes: International Journal of Human Sciences», 64/4 (2017), DOI: 10.1177/0392192117739822.

research infrastructures such as DARIAH-EU, which has a long list of working groups. At this level, social innovation becomes reflective and generates cultural innovation. Insisting on reflexivity helps to raise awareness for the importance of framing issues around engaging with science and society, identifying problems and defining solutions.

2. *Inclusion*

«Reduced inequality» has been declared the tenth goal of the Sustainable Development Agenda of the United Nations.[7] Inequalities and exclusion are major concerns in Europe and are being extensively researched in Horizon 2020:

> Reducing inequalities and social exclusion in Europe are crucial challenges for the future of Europe. At the same time, there is great potential for Europe through opportunities provided, for example, by new forms of innovation and by the engagement of citizens. Supporting inclusive, innovative and reflective societies is a prerequisite for a sustainable European integration.[8]

Theories, events, doctrines, facts and real life are an essential part of today's world: if their knowledge were not to be explored with new educational instruments and transferred in a participated and constructive way, national narratives and identitarian ideologies would attract the minorities and affect the majorities as well, which is a drift the world should be aware of, bearing in mind, e.g., the dreadful experience of the Holocaust. Innovative education and training policies can enhance labour productivity, social equality and eventually democratic participatory process.

Basic research is often funded by public investment. However, due to a lack of successful communication strategies to the general public, its importance is rarely fully understood by citizens who do not grasp its actual usefulness. Co-creation as part of knowledge and technology transfer assumes a social relevance, in that it makes basic science widely accepted by the society and among taxpayers by giving space to societal actors that follow the whole research and innovation process.[9] For these reasons, measuring the

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[7] See <https://www.un.org/sustainabledevelopment/development-agenda> accessed 3 September 2018.

[8] See <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/europe-changing-world-inclusive-innovative-and-reflective-societies> accessed 3 September 2018.

[9] C. K. Prahalad and V. Ramaswamy, *Co-opting customer competence*, «Harvard Business Review», 78/1 (2000), pp. 79-87.

impact is fundamental to improve societal acceptance of public investment in basic research because it provides a basis for aligning research and innovation with the values, needs and expectations of society.[10] The methodology relies on composite indicators that have reliable characteristics when complex and multidimensional phenomena need to be measured. It looks for integrations and complementarities. It takes into account the effects of engaging stakeholders and the civil society in the dynamics of science-based innovation. Finally, the methodology considers the measure of benefits for the private sector as it invests in curiosity-driven research.

Innovation is the main concern of research councils, agencies that began to be established about a century ago, at the time of World War I. They differ significantly from universities and academies. University faculties are mostly free to investigate topics of their interest, they are largely devoted to teaching; freedom of research and teaching is a constitutive right of their profession. European academies were founded by monarchs so that they could obtain answers to their inquiries from live-in scholars. Research councils, on the contrary, were founded by governments in order to achieve results of strategic relevance for the country. Directly related are research infrastructures, which foster economic growth by providing access to services and knowledge. In this view, it is up to national governments to help build competencies that generate complexity.[11]

European research infrastructures today are of different kinds. They range from large-scale facilities with advanced instrumentation (e.g., the CERN Laboratories in Geneva, the European Synchrotron Laboratory, etc.) to resources for knowledge storage, such as archives and databanks. The latter are no longer mono-locational; they are instead the result of an integration of resources and laboratories that are distributed all over Europe. Their governance and legal status are structured as a European Research Infrastructure Consortium (ERIC).

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[10] European Science Foundation, *Research infrastructures in digital humanities: Science policy briefing 42*, Strasbourg, ESF, 2011; M. Kaase, *Research infrastructures in the social sciences: The long and winding road*, in *Understanding Research Infrastructures in the Social Sciences*, edited by B. Kleiner, I. Renschler, B. Wernli, P. Farago and D. Joye, Berlin, Seismo, 2013, pp. 19-30; Q. Lauer, *Die Vermessung der Kultur: Geisteswissenschaften als Digital Humanities*, in *Big Data: Das neue Versprechen der Allwissenheit*, edited by H. Geiselberger and T. Moorstedt, Berlin, Seismo, 2013, pp. 99-116; M. Žic Fuchs, *Research infrastructures in the humanities: The challenges of 'visibility' and 'impact'*, in *Facing the Future: European research infrastructures for the humanities and social sciences*, edited by A. Duşa, D. Nelle, G. Stock and G. Wagner, Berlin, Scivero, 2014, pp. 121-133.

[11] C. Hidalgo and R. Hausmann, *The Building Blocks of Economic Complexity, «Proceedings of the National Academy of Sciences of the United States of America»*, 106 (2009), n. 26, pp. 10570-10575.

Research infrastructures are «common goods».[12] They are planned, built and managed for serving vast research communities, which operate in diversified sectors on the principles of open access and competition. The 2018 ESFRI roadmap considers six groups of research infrastructures: DAT-Data, Computing and Digital Research Infrastructures, ENE-Energy, ENV-Environment, H&F-Health and Food, PSE-Physical Sciences and Engineering, and eventually SCI-Social and Cultural Innovation, whose strategy working group:

> proposes possible solutions (related to RIs) that are able to help tackle the Grand Challenges facing society, such as health or demographic change, or the SC6-«inclusive, innovative and reflective societies» challenge from the third pillar of Horizon 2020 called «Tackling societal challenges». It establishes possible methods through which social sciences and humanities could be used as an evaluation criterion for the activity of other RIs in the ESFRI roadmap (e.g., social impact, etc.). It also explores how RIs can contribute to social innovation or better knowledge transfer towards society.[13]

3. *Reflection*

The Horizon 2020 topic «Reflective Society» introduces another syntagma that covers a vast array of the social sciences and humanities dealing with the past and the present, from history to geopolitics through cultural heritage studies and up to practically all fields of the humanities. The current migrant crisis has made it clear with extraordinary force that a most urgent objective is to work towards Euro-Mediterranean societies that are inclusive, reflective, and attentive to the impact that migration is having on social and cultural innovation, security and health, environment and biodiversity.

It is now time to examine the role of reflection for rethinking the ways in which culture has been envisioned, particularly to visualise the various ways in which users engage with cultural processes in the past, present, and future. Let us propose a case study. Imagine a second-generation diaspora child (*huaqiao* 华桥) who attends a human sciences high school in Italy. At a certain point, s/he might be asked to read a text by Plato, possi-

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[12] R. Pozzo and V. Virgili, *Governing cultural diversity: Common goods, shared experiences, spaces for exchange*, «Economia della cultura», 26/1 (2016), pp. 41-47, DOI: 10.1446/84035; Id. and Ead., *Social and Cultural Innovation*, *ibid*.

[13] See <http://www.esfri.eu/working-groups/social-and-cultural-innovation> accessed 15 July 2018.

bly the *Apology of Socrates* (*Apologia Sokratous* Ἀπολογία Σωκράτους), first in Italian, then perhaps in the Greek original or in the classic Latin rendering of Marsilius Ficinus. Students today delve easily into multi-layered, multilingual hypertexts, and they do so on the basis of the reciprocal guidance made possible by social reading tools.[14] Our student ought to read the same text in modern unified Chinese as well, so that s/he might be able to start a discussion on Socrates in its Chinese-speaking family. Inversely, schoolmates might appropriate, say, the *Analects* (*Lunyu* 伦语) of Confucius through the conceptual references indicated by our student. Together they may start thinking on movement (*dong* 动), rest (*jing* 静), human being (*renji* 人际), humaneness (*ren* 仁), and eventually come to grasp key tenets of Neo-Confucianism,[15] such as the dictum that represents the unity of heaven and human or supernal heaven and humanity (*tianrenheyi* 天人合一), which amounts to «restoring the Heavenly Principle and diminishing human desires».[16]

Globalisation is not a new experience. It is a long-term historical process that enhances regional, national and local identities.[17] In addressing Europe's need to adapt to historical change, one needs to challenge the anachronistic notion of a European intellectual identity. Europe has evolved beyond its Greco-Roman intellectual roots, and has become much more diverse: «When talking of ancient luminaries such as Aristotle, who profoundly shaped European thought, we can correctly describe them as forming part of Europe's intellectual *basis*. European intellectual *identity*, on the other hand, is now much broader in scope, enriched through historical change, particularly immigration».[18] Cultural identity is a «polysemic, slippery and illusory» syntagma.[19] In fact, «culture cannot be but plural, changing, adaptable, constructed… A culture that does not change and exchange with other cultures is a dead culture».[20] Cultural identity is therefore «what we construct

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[14] G. Roncaglia, *L'età della frammentazione: Cultura del libro e scuola digitale*, Bari, Laterza, 2018.

[15] Ni Peimin, *Understanding the Analects of Confucius: A new Translation of Lunyu with Annotations*, Albany, N.Y.: SUNY Press, 2017.

[16] R. R. Wang, *Zhou Dunyi's diagram of the supreme ultimate explained ('Taijitu shuo'): A construction of the Confucian metaphysics*, «Journal of the History of Ideas», 66/3 (2005), pp. 307-323.

[17] Tu Weiming, *The global significance of concrete humanity: Essays on the Confucian discourse in Cultural China*, New Delhi, Centre for Studies in Civilisations, 2010, p. 331.

[18] European Commission, *Bridge over troubled waters?*, Brussels, DG-R&I, 2015, p. 8.

[19] F. Dervin, *Cultural identity, representation, and other, in: The Routledge handbook of language and intercultural communication*, edited by J. Jackson, London, Routledge, 2012, pp. 181-194, here p. 181.

[20] Id., *ibid*., p. 183.

whenever we are in contact with other human beings – regardless of the fact that they are from the same environment or not».[21]

4. *Conclusion*

Rémi Brague has noted that the Arabic term for dictionary, قاموس (qāmūs), is a translation of the name of the Titan of Greek mythology Ὠκεανός (Okeanós), in the original literal sense of a liquid extension that embraces all emerged lands, permitting navigation and hence communication.[22] Leibniz has used the ocean metaphor for an encyclopaedia, which is the very same idea concerning languages that this paper tries to defend. As Karl Jaspers pointed out, Confucius and Laozi lived and taught in China, the Upanishads were produced in India, where the Buddha lived, alike Zarathustra in Persia, the prophets in Palestine, Homer, Parmenides, Heraclitus, and Plato in Greece. «Everything implied by these names developed almost simultaneously in China, India, and the West».[23] Today, we see the rebirth of the cultural melting pot that Plato spoke about in the *Timaeus* (23c), thus prefiguring «the translation of Greek words, culture and thoughts into the Latin words of Cicero and Boethius, or the dynamics of the great Mediterranean cultural circle made of translation and tradition of philosophical, religious, and medical texts from Greek and Hebrew into Arabic, Latin, and all vernacular languages».[24]

The new 'missions' of the next Framework Programme for Research Innovation of the multiannual financial period 2021-2027 will foster research on the systemic change in the new generations. First and foremost, a change in the mindset, e.g., urban development, urban regeneration; institutional change; i-like culture as way of obtaining ratings. We are talking about common goods.[25] Given that migrants use cell-phones to obtain information – hacktivism, hackathons, we can think of measuring impact which generates trust between capital entrepreneurship, like venture capital, and social innovation, we see improvements. We expect cultural innovation

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[21] *Ibid*.

[22] R. Brague, *Langues et traditions constitutives de la philosophie en Europe*, in *Vocabulaire européen des philosophies: Dictionnaire des intraduisibles*, edited by B. Cassin, Paris, Seuil, 2004, pp. 694-699.

[23] K. Jaspers, *Vom Ursprung und Ziel der Geschichte*, Zürich, Artemis, 1949, p. 2.

[24] T. Gregory, *Translatio studiorum*, in *Translatio studiorum: Ancient, medieval and modern bearers of intellectual history*, edited by M. Sgarbi, Leiden, Brill's, 2012, pp. 1-21, here p. 12.

[25] X. Graeffe, *Cultural heritage as a common good*, «Cartaditalia», 1 (2017), pp. 207-220.

to trigger a change in the mindset as regards locating culture (anthropology of space and place) for inclusion and reflection in education, life-long learning, healthcare, urban development and regeneration. Culture cannot be but plural, changing, adaptable, constructed. Inclusion and reflection are constructed whenever we are in contact with other human beings, regardless where they come from. This we have to learn.

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Jean Moulin

MEASUREMENT OF IMPACT OF RESEARCH INFRASTRUCTURES: USE AND USEFULNESS OF INDICATORS

Abstract

A set of quantitative and qualitative indicators of direct and indirect impact that are currently collected and used by RIs will be reviewed, including the specificities of the SSH RIs and of the e-RIs. The respective needs of science policy makers, funders, hosting organisations and RI managers will be discussed.

Introduction

A set of quantitative and qualitative indicators of direct and indirect impact that are currently collected and used by Research Infrastructures (RIs) are reviewed, including the specificities of the RIs for Social Sciences and Humanities (SSH) and of the e-RIs. The respective needs of science policy makers, funders, hosting organisations and RI managers are discussed.

The «return on investment» is measured primarily with indicators of knowledge production and transfer: advances in scientific knowledge and training of highly skilled people, use of the RI as both a platform for Scientific and Technical (S&T) collaboration and as a service provider to industry and society. Socio-economic impact is also achieved through technology development in collaboration with companies, including high-tech small and medium-sized enterprises.

Content

The presentation is based on recent findings of the Expert Group of the Global Science Forum (GSF) of the OECD on «Establishing a reference framework for assessing the socio-economic impact of Research Infrastructures»,[1] and in particular on the results of a survey of a representative sample of RIs (managers and external stakeholders). The final output from this activity will be a policy report (to be published early 2019) that will provide a generic reference framework and include a set of tools and options that take into account the diversity of RIs and can be adapted to the diverse needs of decision makers, funders, RI managers, local authorities and host organisations.

1. *The diversity of Research Infrastructures*

Research Infrastructures (RIs) constitute a vast and diversified group of organisations and there is also a very broad range of interactions between individual RIs and their surrounding economic, industrial, social and societal environment.

As far as socio-economic impacts are concerned, relevant criteria for a typology of RIs are the following:

- the scientific discipline in which they operate (including social sciences and humanities) and their strategic objectives and missions;
- their geographical distribution: single-sited, distributed through a network of 'nodes' more or less strongly integrated with each other, or even mobile (e.g., research vessels);
- their access mode whether on site(s) or remote/virtual. Access may also be provided on a competitive or non-competitive basis;
- the life cycle phase in which they are: at the preparatory and decision stage, or in the construction and initial implementation phase, later in full operation with possible major or incremental upgrades, and even at the end of a complete cycle (out-phasing/termination); and
- their economic rationale and their business model which include elements such as the level of required investments and annual running costs, the diversity and complementarity of resources, e.g., cost sharing among members, possible in-kind contributions, etc.

The main categories of RIs are: (i) research performing institutions in basic or applied science (experimental facilities and observational plat-

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[1] *Establishing a reference framework for assessing the socio-economic impact of research infrastructures*, an activity of the Global Science Forum of the OECD. See the website of the OECD: https://www.innovationpolicyplatform.org/socio-economic-impact-research-infrastructures/ri-impact-files/oecd-gsf-activity-socio-economic.

forms); (ii) more technology-oriented enabling facilities that provide equipment (technological/instrumental/ICT resources and services) to support R&D and innovation and (iii) providers of access to data and other digital resources and to sample collections. These RIs can be specialised (disciplinary, thematic) or multidisciplinary and multifunctional (e.g., a synchrotron radiation facility providing opportunities for the exploration of materials and living matter in many fields: chemistry, material physics, archaeology and cultural heritage, structural biology and medical applications, environmental sciences, etc.).

2. *The perimeters of impact measurement*

As was underlined by the ESFRI WG on Innovation,[2] the socio-economic and societal RI impact can be measured in several concentric circles:

(i) around the RI's immediate environment: including the residence area of the staff or the site of a partner-university providing the RI with well-trained PhD students;
(ii) at regional level: including R&D partner sites and industrial suppliers of mid-range components or services;
(iii) at national or European/international level: including similar 'competing' facilities and sites where internationally known companies provide unique high-level components all over the world;
(iv) in the whole European society whose quality of life benefits from the scientific and technological feats of the facility.

3. *The RI's main strategic objectives and positioning*

The two types of strategic objectives and missions of the RIs most often mentioned by the RI managers and external stakeholders can be summarised as follows: (i) be a scientific leading RI and an enabling facility to support science and (ii) be an enabling facility to support innovation (driven by industry and innovation-oriented strategies, including the promotion of regional development). They are not mutually exclusive and some large infrastructures may combine them. Both types of objectives each include

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[2] European Strategy Forum on Research Infrastructures, *Innovation-oriented cooperation of Research Infrastructures: Report of the ESFRI WG on Innovation: ESFRI Scripta Vol. 3*, Dipartimento di Fisica, Università degli Studi di Milano (January 2018). See: https://www.esfri.eu/sites/default/files/ESFRI_SCRIPTA_VOL3_INNO_single_page.pdf.

also significant activities of training, skills development, education outreach and knowledge transfer.

More specific missions are also emphasised by various RIs, namely the scientific (and technical) support to public policies (e.g., to face the Grand Societal and Environmental Challenges), the promotion of international S&T cooperation ('science diplomacy') and the promotion of data policies (data collection, data provision and open access). Obviously, these aspects are particularly important in the field of social sciences and humanities.

Strategic positioning is essentially evaluated by periodic (scientific) user surveys on the reasons why to choose the RI, periodic strategic exercises and specific evaluation procedures carried out by Government bodies/agencies and by peers.

The main structuring effects expected and whose achievement is mostly positively assessed by all stakeholders can be divided into two categories:

- scientific networking (attracting collaborations, …), structuring of communities around the RI and sharing of values (science, education, innovation) with a broader community;
- visibility to general public and increasing the visibility and attractiveness of the local scientific communities.

4. *The different dimensions of impact assessment*

On the basis of the general strategic, structural and contextual elements described above six dimensions of impact assessment have to be taken into consideration. They are complementary and used by the different types of RIs, in their respective disciplines and fields of activity, at various levels and with their own specificities:

- scientific output and attractiveness;
- training and education;
- social and societal impact;
- technological output and attractiveness;
- direct economic impact;
- indirect economic impact (medium to long-term effects).

It should be noted that science indicators are included in this multidimensional analysis. RIs' *raison d'être* is to perform cutting edge science and/or deliver services to the scientific community (including where appropriate the economic world and society). It is for this purpose that the policy and funding decisions are first taken. And primary and secondary impact of science produced from RIs (well beyond scientific excellence) should indeed be fully integrated in the 'socio-economic' impact assessment.

5. *Current practices: Collection and use of indicators*

The impact indicators listed below are currently collected and used by a significant number of RIs. They were identified through a survey of a representative sample of RIs (including RI managers and external stakeholders) and are used (or not) according to the specific needs of each RI. The lists are not exhaustive. Most of these indicators can be used by the SSH RIs.

The characteristics and peculiarities of e-infrastructures (data infrastructures) and of distributed RIs (central hub vs. nodes) should of course be properly taken into account for all indicators, in particular for the financial aspects. For example, the exact full contributions/budgets/HR of the nodes (in situ and transferred to the central hub) are sometimes difficult to identify. The effective perimeter of the distributed RI in each node should be precisely defined; the in-kind contributions (material and human resources, delivery of services) of the nodes should be included in the total budget.

A coherent and well-coordinated internal approach is needed; data gathering and reporting are especially complex.

A few indicators (marked in italics) are mainly related to experimental/observational facilities but may nevertheless be relevant for SSH in some cases.

5.1. Scientific output and attractiveness: excellence, collaborative networks, data and knowledge production and transfer, national/international reputation…
- Bibliometric data on scientific output, adapted to the publication pattern of the scientific fields concerned, and including specific data on citations (citation lifetime, database citation, etc.)
- Number of users; collaboration with leading teams worldwide
- Access, use and re-use of research data, digital products and services, informatics resources: various indicators, including web statistics on users, usage and access
- Available digital resources (data, databases, collections and informatics) and services
- *Available experimental/observational instruments, products and services and access (user visits)/use of these facilities*

5.2. Training and education: students, PhDs, postdocs, developing new skills, networking people
- Various categories of HR who have been working with(in) the RI (master students, PhDs, postdocs, technical support); gender and nationality distribution
- Training programmes including the number and type of: events, trainees/students, teacher positions, specific grants for trainees/students

- Number of masters, PhDs or postdocs trained within the RI and employed by other RIs or by industry
- Number of graduates employed by the RI through relevant specific sponsorship programmes
- Use of the RI/RI data for teaching and training

5.3. Social and societal impact: S&T support to public policies and public services (e.g., to address grand societal and environmental challenges), role in social innovation development, large public awareness including schools, cultural tourism. This dimension is obviously very relevant for all SSH RIs.

- Public awareness (in press and other media); *visits and visitors*
- Consultation of web pages (including by the education sector, public administrations and the general public); web statistics
- Staff engaged in RI for educational and outreach activities
- Production and use of open databases, *biobanks*, *experimental/observational data* and expert advice in support of public policies (they can, e.g., provide data and knowledge that contribute to the definition and evaluation of new health or social policies)
- Impact on legislation and regulation
- General profile of support provided to R&D related to a specific public policy
- Impact of data aggregation, integration and open access data sharing on public policies (e.g., integration of biodiversity/environmental/social information and tools across diverse communities or stakeholders, including identifying gaps in that information)
- Gathering 'narratives' – nice stories and use cases that are indicative of this impact – could be useful

5.4. Technological output and attractiveness: technology transfer, new patents, licensing, instrumentation, standardisation

- Patents/licenses/copyrights, etc.: various data including on co-patenting and citations, and background IP used
- Involvement in standardisation bodies
- *Prototypes/innovations, technology transfer, co-development with various partners*
- *Involvement of industry in academic collaborations making use of the facility; proprietary use of the facility by industry*
- Availability of, and access to, technology-oriented platforms
- *Distribution of specific products (animals, plants, software & hardware)*

5.5. Direct economic impact: market spill overs (total turnover, employment), including regional impact (revenues for industry as a supplier/as a user)

- Total budgets; total number of FTE
- Public procurements and contracts (including, where appropriate, in partner countries)
- Industrial suppliers and users (including revenues and regional dimension)

- Collaborative projects with industry
- Dedicated economic impact studies (including central hub/nodes for distributed RIs)
- R&D time spent using RI provided data

5.6. Indirect economic impact (medium to long-term effects): impact on innovation activities that results from the RI, impact on regional development (internationalisation):

- *Innovative projects based on RI outputs;* medium- to long-term collaboration with industry; *number of start-ups around the RI and spin-offs generated by the RI*
- The concept of 'Efficiency gains' could be developed, i.e., cost savings of having integrated data freely available, with all licensing and standards in place
- Time saved in researchers being able to spend more time doing additional research rather than data gathering and cleaning but also data improved with people reporting back data on the effect of R&D and policy programmes
- Impact of data aggregation, integration and open access data sharing on industry

6. *Needs of the RI stakeholders (policy makers, funders, local authorities, host organisations, RI managers)*

Clear definitions of the indicators for the various dimensions of RI activities are needed and guidelines to collect information in a standardised way should be developed. A relatively small number of key standard indicators ('core impact indicators') should be selected: easy to collect, fairly generic, longitudinal, compatible along the RI life cycle and that can be adapted appropriately by each RI according to its strategic objectives. They will cover the various dimensions of impact assessment, including publication output, scientific use, collaboration with industrial partners, human resources, educational and outreach activities, production and use of data in support of public policies, etc.). These indicators will be supplemented by relevant *ad hoc* indicators.

Indicators are defined and used to fulfil three types of functions: internal management and monitoring; strategic evaluation and external communication.

Firstly, the group of indicators (standard and *ad hoc* indicators) used for the internal management and monitoring of the activity of the RI are not supposed to be shared outside of the RI. They should help to answer the following types of questions: is the RI efficient, is it attractive to potential users and staff, is it competitive, is it visible, etc.

Secondly, the indicators that are used for strategic evaluation (by policy decision-makers, funders, local authorities and host organisations) aim to help evaluate the degree of achievement of strategic objectives and to nurture reporting exercises for stakeholders. These indicators are supposed to be stable enough, to be based on longitudinal data and to assess the evolution of the RI. They are related to the RI's specific objectives and missions and should not be used to compare RIs which have different strategic missions.

They should help to answer the following types of questions: is the RI a leading actor in its scientific field; is it an efficient training support facility; is it an enabling facility for technology development; does it provide support to public policies; etc. Moreover policy makers (at national and local/regional level), funders and hosting organisations need to evaluate if the RI is cost efficient, if it is developing the local economy, developing the country/the host attractiveness, promoting international collaboration, etc.

Thirdly, indicators are used for external communication, for example illustrative stories and figures to communicate with the public at large about the activity of the RI and its impact on grand societal challenges.

To conclude, most of the indicators listed in the presentation can be used by the SSH RIs, taking proper account: (i) of the characteristics and peculiarities of e-infrastructures (data infrastructures) and of distributed RIs (central hub vs. nodes) and (ii) of the specificities of the scientific and other user communities concerned, in particular the publication and citation patterns. Appropriate indicators of the direct/indirect impact of the use/reuse of data (the various impact pathways), and more generally, of the impact of data aggregation, integration and open access data sharing on public policies and industry should be developed.

PART III

The Demand for SSH Research

Matthias Reiter-Pázmándy, Thorsten D. Barth

AUSTRIAN INSTITUTIONS AS USERS OF SOCIAL SCIENCES AND HUMANITIES RESEARCH INFRASTRUCTURES

Abstract

The paper will give an overview about the demand for SSH-research infrastructures in Austria indicated by the number of institutions and individual researchers that are using them. The use of SSH-RI in Austria has recently been looked upon by a project of the Austrian Federal Ministry for Education, Science and Research. The aim of the project was an analysis of the use of international research infrastructures by Austrian research organisations between 2013-2018. The research organisations that were looked at were primarily the 22 universities in Austria, the Academy of Sciences, the Institute for Science and Technology (IST) Austria, and other selected non-university research organisations. The analysis should support decision-making in the negotiations on the performance contracts with the Austrian universities and other strategic processes. A preliminary result of the analysis will be presented, including institutional user numbers from research infrastructures from the ESFRI-Scientific Domain of «Social and Cultural Innovation» in Austria.

Introduction

The article gives an overview of institutions using Social Sciences and Humanities research infrastructures in Austria.

Results are reported from two recent projects of the Austrian Federal Ministry of Education, Science and Research (BMBWF). One project counted Austrian research institutions using international large-scale research infrastructure and the other promoted the use of the Austrian Public Database of Research Infrastructures. The use of research infrastructures from the Social Sciences and Humanities is looked at in more detail.

Finally, the article argues for more data and comparability of institutional as well as individual user numbers as pragmatic and widely available proxy indicators for assessing research infrastructures and prerequisite to assess outcomes and impact.

At EU-level the topic of research infrastructures has received increas-

ing recognition over the past two decades. In recent years the European Strategy Forum on Research Infrastructures (ESFRI) has developed a long-term plan for the establishment of European research infrastructures, the ESFRI-Roadmap.[1] During this period, also Social Sciences and Humanities research infrastructures (SSH-RIs) have accomplished a big next step in their development. Five of them came on the Roadmap from early on.[2] In the last decade, organisational questions and governance questions in connection with the legal framework of a European Research Infrastructure Consortium (ERIC) have been at the forefront.[3] SSH-RIs have had specific discussions because they are distributed infrastructures rather than constructions at a certain site. Therefore, these discussions revolved around questions of internal division of labour in distributed research infrastructures, governance questions, the right balance between strong central headquarters and the participation of a large number of members, etc. These five SSH-RIs on the ESFRI-Roadmap have worked hard on achieving the status of ERICs and have had great success in this regard: all five of them are ERICs today.

The quest for collecting and storing data came along with many other challenges. The most prominent issues to tackle have been common standards, interoperability and geographical coverage. In particular, geographical coverage remains a huge challenge for SSH-RIs. Some aspects have been solved, even if most challenges will remain constant companions in the future. These days, in this process of becoming more mature, one can perceive a slow shift of focus. SSH-RIs are more and more pushing the promotion and the use of their data. As governance questions and major operational challenges have been overcome, the actual product of these undertakings is getting ever more attention: data, gold of the twenty-first century.

This shift is partly due to the ever-growing maturity and professionality of the SSH-RIs on the ESFRI-Roadmap and their higher efficiency. Partly it is also the result of the growing interest of funders about the outcome. Funders want to see outcomes. But finally, they do not only want to see the production of datasets, but also analytical outcomes, research results and in the end: impact.

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[1] For more information, see http://www.esfri.eu.

[2] CESSDA, CLARIN, DARIAH, ESS, SHARE.

[3] If one is interested in cherishing even earlier developments and the great accomplishments of the pioneers of research infrastructures in the SSH one can turn for instance to M. Kaase, *Research infrastructures in the social sciences: The long and winding road*, in *Understanding Research Infrastructures in the Social Sciences*, edited by B. Kleiner, I. Renschler, B. Wernli, P. Farago and D. Joye, Berlin, Seismo, 2013, pp. 19-30.

The most basic prerequisite for impact is the actual use of the research infrastructure. «How measuring 'impact' will be defined and implemented in the future remains to be seen» was Žic Fuchs' verdict some years ago.[4] The first step – defining impact and its measurement – has greatly developed.[5] The second step – the implementation – is more complicated as it is attached to many practical issues. For these practical reasons, a very popular indicator is the number of users. Even if this is a very rough indicator, it is still a proxy indicator that is more easily available then others and therefore widely in use.

In most cases, users are understood as individual researchers or persons.[6] However, usage and users can also be looked at on the level of institutions. A thesis that is sometimes voiced in research policy circles about research infrastructures is that they act as points of crystallisation for research communities. The hope of more interdisciplinary collaboration is often attached to this thesis, 'cross-fertilisation' between research communities. The research infrastructure, the activities around it and its data are conceived as a hub for cooperation between researchers and institutions. In some cases, individual researcher group around these research infrastructures and work together on the basis of common data. Eventually, this could even lead to the evolvement of scientific schools around research infrastructures. In other cases, institutions cooperate to run an infrastructure effectively.[7] Therefore, it is interesting to look at research infrastructure use also from the side of institutional users. This is what an analysis of the research infrastructure unit of the Austrian Federal Ministry of Education, Science and Research (BMBWF) did in a recent project.

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[4] M. Žic Fuchs, *Research infrastructures in the humanities: The challenges of 'visibility' and 'impact'*, in *Facing the Future: European research infrastructures for the humanities and social sciences*, edited by A. Duşa, D. Nelle, G. Stock and G. Wagner, Berlin, Scivero, 2014, pp. 121-133. Available at: http://www.allea.org/wp-content/uploads/2015/09/2014_06_04-FACING_THE_FUTURE.pdf.

[5] A good overview about the issue can be found in S. Tanner, *Measuring the impact of digital resources: The balanced value impact model*, London, Arcadia, 2012. Available at: https://www.kdl.kcl.ac.uk/fileadmin/documents/pubs/BalancedValueImpactModel_SimonTanner_October2012.pdf-

[6] For an extensive discussion of this and other indicators compare M. S. Mayernik, D. L. Hart, K. E. Maull, N. M. Weber, *Assessing and tracing the outcomes and impact of research infrastructures*, «Journal of the Association for Information Science and Technology», 68 (2017), n. 6, pp. 1341-1359, DOI: 10.1002/asi.23721.

[7] This is for instance the case with the Austrian Social Science Data Archive (AUSSDA), which is the Service Provider for CESSDA. It is a cooperation between the Universities of Vienna, Graz and Linz. Another example is the Austrian Centre for Digital Humanities (ACDH) that is the Austrian node in CLARIN and DARIAH. The ACDH is a cooperation between the Austrian Academy of Sciences and the Universities of Vienna and Graz.

A project about the use of international research infrastructures by Austrian institutions

In 2010, the Austrian government has decided a «Strategy for Research, Technology and Innovation» (RTI-Strategy).[8] The aim of the strategy is to move Austria ahead from the group of innovation followers into the group of innovation leaders, i.e., the most innovative countries in the EU. Based on the RTI-Strategy the «Austrian Research Infrastructure Action Plan» was elaborated,[9] which focuses on the challenges in the field of basic research-driven and application-oriented research infrastructures.

In 2017 the BMBWF[10] started a project to develop a list of users of international large-scale research infrastructures. The aim of the project was to get an overview of Austrian research infrastructure use by institutions.

From February 2017 to February 2018 the project team collected evidence on the use of research infrastructures by Austrian institutions from 2013 to 2018. Austrian institutions that were looked at in the project were all 22 public universities in Austria and four non-university research organisations with direct institutional links to the BMBWF. Evidence such as the use of infrastructure as described in the performance agreements between the Austrian universities and the Ministry was collected, contracts showing use of RIs, performance reports, university development plans, other reports, websites and publications of international research organisations as well as available data from other Austrian research institutions. For the list and the documentation the research infrastructures (as well as the international research organisations that host them) have been classified into scientific domains according to the ESFRI.[11]

The project found 135 international research infrastructures in use by Austrian research institutions. These research infrastructures are hosted by 70 international research organisations. 68 (of 135) research infrastructures were provided by 24 (of 70) international research organisations in which the BMBWF holds a membership for Austria (Tab. 1). These 24 research

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[8] Own translation («Strategie für Forschung, Technologie und Innovation», «FTI Strategie»). The document is only available in German: https://bmbwf.gv.at/fileadmin/user_upload/forschung/FTI-Strategie.pdf.

[9] Own translation («Österreichischer Forschungsinfrastruktur-Aktionsplan»). The document is only available in German: http://archiv.bka.gv.at/DocView.axd?CobId=54964.

[10] Federal Ministry of Science, Research and Economy (BMWFW) at the time of the project start.

[11] The ESFRI scientific domains are «Health and Food», «Physical Sciences and Engineering», «Social and Cultural Innovation», «Energy», «Environment», «e-RI».

infrastructures have in total 167 institutional users. The most frequently used research infrastructures by Austrian research institutions were ESRF (Physical Sciences and Engineering), EMBL (Health and Food), SHARE and DARIAH (both Social and Cultural Innovation).

Table 1: RIs with Austrian Membership through BMBWF (2013-2018)

ESFRI Scientific Domain	Research Infrastructure	Number of Austrian research institutions using the RIs
Social and Cultural Innovation	CESSDA	9
	CLARIN	9
	DARIAH	11
	ESS (Survey)	7
	SHARE	13
Physical Sciences and Engineering	CERIC	1
	CTAO	2
	ELETTRA	10
	EUROFUSION (ITER)	7
	F4E (ITER)	5
	CERN	5
	ESO	6
	ESRF	17
	ILL	6
Health and Food	EMBL	17
	EuroBioImaging	9
	IARC	7
	BBMRI	7
Environment	EMSC	2
	EZMW	2
	ICDP	8
	IODP	3
	ISC	2
	ORFEUS	2
Total	**24**	**167**

Another 67 (of 135) research infrastructures were provided by 46 (of 70) international research organisations in which the BMBWF does not hold

a membership. In some of them Austria holds observatory status, in others membership is not necessary in a formal sense or membership is held by research institutions directly (because it is not necessary to hold the membership through the BMBWF).

Institutions using ESFRI-SSH-RIs in Austria

The results of the project were used to take a closer look at the use of the five ESFRI-SSH-RIs (in which Austria has a membership) by institution (Table 2). It has to be kept in mind that the project only looked at the 22 Austrian public universities and four non-university research institutions with links to the Ministry. For institutional users that are not within this sample the category «Other institutions» was created.

Table 2: Austrian institutions using ESFRI-SSH-RIs

	ESS	**CESSDA**	**CLARIN**	**DARIAH**	**SHARE**
Academy of Sciences	1	1	1	1	1
Ludwig Boltzmann Society			1	1	1
Vienna University	1	1	1	1	1
Graz University		1	1	1	1
Innsbruck University	1	1	1	1	1
Medical University Vienna					1
Salzburg University		1			1
Technical University Vienna	1		1	1	1
Technical University Graz			1	1	
Vienna University of Economics and Business	1	1			1
Linz University	1	1			1
Klagenfurt University		1		1	1
Danube University Krems					1
University of Applied Arts Vienna			1	1	
University of Music and Performing Arts Graz				1	
Other institutions	1	1	1	1	1
Total	**7**	**9**	**9**	**11**	**13**
The other eleven institutions from the sample did not use any of the five RIs					

Information on use was mainly obtained from the Austrian national coordinators of the respective SSH-RIs as well as in some cases through publicly available strategy documents.

This project focused on academic institutions. For completeness a category for «other institutions» was included that counted whether that infrastructure was used by other institutions at all. If several other institutions were using these research infrastructures they were counted for this table only once and put together in that last category (which therefore in reality includes more than one entry per infrastructure).

A closer look into that last category (going beyond the initial scope of the project) revealed that this category «Other institutions» is full of interesting users. For instance, private universities and universities of applied sciences were not part of the sample of this project and are strong in certain fields of SSH. Medium-sized and small non-university research organisations in various specialised fields are typical for social sciences research in particular. Organisations that apply SSH-knowledge like NGOs, government, museums and companies are also not included.

SSH-RIs users go well beyond that inner-circle of leading public academic institutions in Austria. For instance, SHARE has at least another 30 known institutional users in Austria: among them 20 non-university research organisations, two Ministries, local government, private universities, universities of applied sciences and one NGO. ESS in Austria has also dozens of institutions like NGOs, government and others that use its data. The ESS Impact Study – an extensive report on the impacts of the ESS that was published in 2017 – describes in one impact case study the use of ESS data by the Austrian Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK).[12]

SSH-RIs in the Austrian Public Database of Research Infrastructures

In 2017 the BMBWF published its strategy document «Social Sciences and Humanities-Contribution to strategically develop its framework conditions».[13] It includes a number of measures to improve Research Infra-

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[12] Technopolis, *ESS ERIC impact study: Report annex: Impact case studies*, ###. ###, 2017. Available at: http://www.europeansocialsurvey.org/docs/findings/ESS-Impact-study-ANNEX-Impact-case-studies.pdf.

[13] Own translation («Geisteswissenschaften, Sozialwissenschaften, Kulturwissenschaften – Beitrag zur strategischen Weiterentwicklung der Rahmenbedingungen»). The document is only available in German.

structure in SSH in Austria as well as stronger participation in European SSH-RIs by the BMBWF but also by other Ministries from sectoral policy fields. Other measures aim at supporting the development of services by research infrastructures and better communication about their services and benefits. Data produced through publicly funded research infrastructures that provide data not only at national level, but also data for European and international cooperation should be re-used in the most extensive way.

State-of-the-art research infrastructures and new collaborations in research are the basic principle of innovation and development. For this reason, the BMBWF developed the Austrian Public Database of Research Infrastructures (APDRI)[14] to improve research infrastructures in Austria.[15] The Public Database of Research Infrastructures provides new incentives for collaborations between research institutions of the tertiary sector or research intense companies to strengthen sustainable knowledge sharing and innovation via research infrastructures.

After two years of developing and building the public database it presents more than 95 Austrian research institutions and research-intensive companies with over 1300 public research infrastructures that are open for collaboration in R&D.[16]

It is an open portal that addresses providers of research infrastructures, the management of research infrastructures, policy makers and the management level in politics, business and industry. APDRI has three major objectives:

– To act as an information-sharing platform for establishing future co-operation in science and innovation;
– To promote and represent selected research infrastructures and their role in science and innovation;
– To promote transparency of research and research infrastructures in Austria.

As documented in an OECD publication in 2017, APDRI is an example of best practice.[17]

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[14] See https://forschungsinfrastruktur.bmbwf.gv.at/en.

[15] Based on a measure to implement the Action Plan for a Competitive Research Area (own translation «Aktionsplan für einen wettbewerbsfähigen Forschungsraum») the database was developed and first published in 2016. The document is only available in German: https://bmbwf.gv.at/fileadmin/user_upload/forschung/Strategische_Weiterentwicklung_Geistes-_Kultur-_Sozialwiss/Forschungsaktionsplan-des-BMWFW-2015.pdf.

[16] The project APDRI is supported by the Federal Ministry of Education, Science and Research (BMBWF), the Austrian Federal Economic Chamber (WKÖ) and the Federal Ministry for Digital, Business and Enterprise (BMDW).

[17] See OECD, *Digital platforms for facilitating access to research infrastructures, OECD Science, Technology and Innovation Policy Papers* (2017), n. 49, DOI: 10.1787/8288d208-en, p. 9, 20, 27.

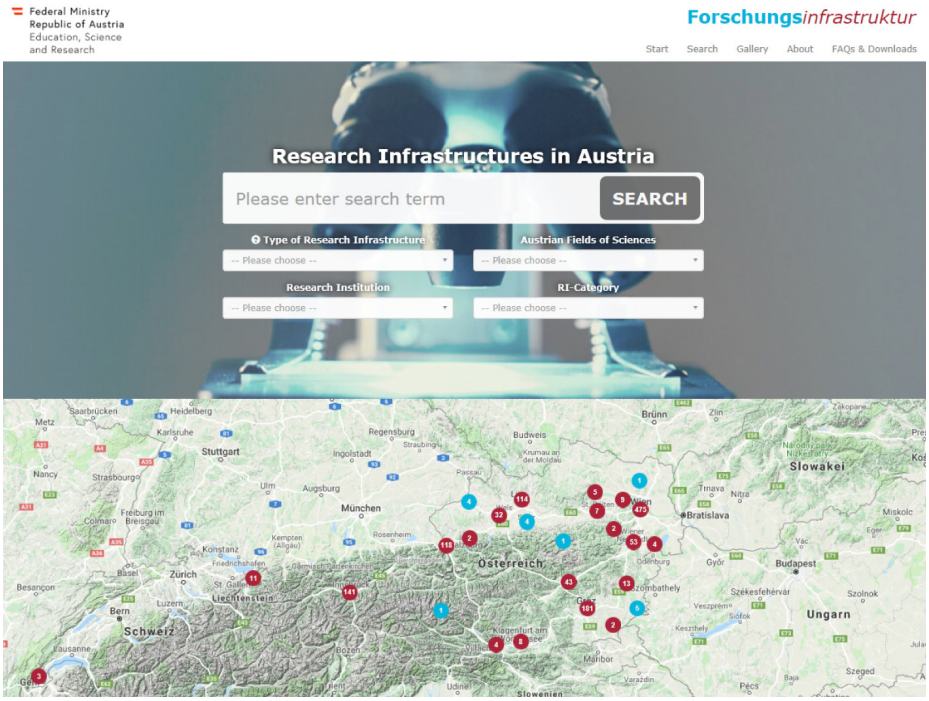

Image 1. - Screenshot of the landing page of the Austrian Public Database for Research Infrastructure.

Up to December 2017 only a relatively low number of SSH-RIs had registered in APDRI (26 research infrastructures). Some of them even had a very low SSH-relevance, like for instance interdisciplinary research infrastructures from psychology (devices to measure brain activity). Therefore, one of the measures of the BMBWF-strategy document for improving SSH research conditions in Austria was to inform host organisations of research infrastructures from the SSH about the public database and its benefits. The aim of the project was to get a better representation of Austrian SSH-RIs within the public database.

We identified 130 research institutions with potential SSH-RIs in Austria and contacted them through the course of the project. Many of them were archives and collections on federal, state or city level. A number of museums with their archives and collections relevant for SSH-research were included as well. The main arguments to include one's research infrastructure into the public database were (1) visibility to the research community, (2) offering access to one's research resources, (3) entering into national

and international collaborations and subsequently, (4) gaining new knowledge about one's resources as well as (5) reputation.[18] As a result of the project, 58 of the 130 research institutions that we contacted are registered in the database as of July 2018. From the 58 registered institutions 28 have so far published one or several research infrastructures in the public database.

Outlook: Counting users ever more precisely and future potential

For SSH-RIs in general more evidence on institutions and individuals using the data is needed. More comparability of user data – at individual as well as at institutional level – and usage data is needed as well. When it comes to assessing and comparing research infrastructures those indicators that are easily available are turned to first. Also those indicators that are more easily comparable are used. Academic discussions often highlight the short-comings of such proxy indicators and in fact they have valid arguments. However, if more precise indicators are hard or impossible to produce, more simple versions will still be widely used. Activities to make key indicators on usage level comparable should be promoted on national and European levels.

In Austria, a general assessment of user data of research infrastructures is still at a preliminary stage. Individual user data is available from some research infrastructures,[19] but not on a broader level. More importantly, most user data are not completely comparable at the moment. Some research infrastructures count registered data users, others count dataset downloads. Registered users are sometimes individual users, in other cases institutional accounts exist and several persons use one account together.

The potential to use data collected by others is high. In 2015 a re-

[18] To include a research infrastructure into the public database it has to be open for collaboration. Research institutions that want to register have to be cleared by the Ministry for their scientific relevance. The modes of access as well as the services that are provided to researchers have to be described in the database entry. So only research infrastructures that have a real interest in collaborating with and providing services to researchers can get registered into the database. Quality management procedures to ensure minimum standards of the registry-entries have been implemented. Our «terms of use» help to avoid misuse as well: The decision and responsibility for the publication of research infrastructure entries eventually rest with the institution creating the entry. This especially includes the indemnification of the necessary rights for the publication and the use, e.g. by means of duplication and distribution of content shared on the platform.

[19] For instance, the *ESS Impact Study* includes data on individual users broken down into several sub-categories.

search group in Austria carried out an Austria-wide survey of researchers and asked them about their data usage habits.[20] They interviewed researchers of twenty-one public universities and three non-university research organisations in Austria.[21]

In this survey 74% of Austrian researchers in the Social Sciences and 70% of researchers in the Humanities stated that they use data they have not collected themselves. In comparison to other disciplines SSH range in the middle.

Use of research data from other researchers	n=3648
Scientific discipline	
Geosciences and Geography	88%
Engineering	81%
Social Sciences	74%
Humanities	70%
Chemistry	70%
Mathematics	70%
Biology	69%
Medicine	67%
Physic	64%
Agricultural, Forestry and Veterinary science	58%
Question: Do you use data from others for your research (not data that you collected)? Aggregation of answers «After no or minor processing» and «After major processing».	

SSH-RIs need to focus further on the shift from producing and archiving to enabling and promoting data use and data re-use. «Scientific data preservation [and production] is pointless unless the data are used now and in the future. To ensure data usability, data managers need to understand

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[20] B. Bauer, A. Ferus, J. Gorraiz, V. Gründhammer, C. Gumpenberger, N. Maly, J. M. Mühlegger, J. L. Preza, B. Sánchez-Solís, N. Schmidt, C. Steineder, *Forschende und ihre Daten: Ergebnisse einer österreichweiten Befragung-Report 2015*, 2015, Version 1.2. DOI: 10.5281/zenodo.32043, Tab. 42, p. 112.

[21] The survey was part of the project «e-Infrastructures Austria».

who needs to use the data».[22] Knowing one's users – individuals and institutions – is necessary to promote use and re-use and this is the first step for more outcomes and more impact.

[22] M. A. Parsons, R. E. Duerr, *Designating user communities for scientific data: Challenges and solutions*, «Data Science Journal», 4 (2015), DOI: 10.2481/dsj.4.31.

Alberto Melloni

IMPACT OR FERTILITY?

Abstract

The demand for SSH research has two origins: on one side, a fertile and stable activity in the many fields of SSH research; on the other, the capability to understand which line of research can play a role in making society more social and more human. My test case comes from the research experience of our institute and our EU/Mena/Russian research community. As it is in the climate change and global warming issues, also in the religious climate change and the religious global warming of the past 40 years scholarship is a key issue. The same triangle – scientists, decision-makers, public opinion – which brought common resolutions on emissions, can be activated to produce fertile and stable activity, open access to resources, and increase the understanding of the EU as a place of rights and freedom coming from a history where one of the most divisive issues – (ir)religiosity and its diversity – through historical research appears like a repository of social and human understanding.

Every jargon has its origins, its story, usefulness and social/intellectual cost. Every jargon has its biography, its prophets and Cassandras. It is impossible to boil them down to a single model or a series of predefined typologies. Every jargon comes with the context that produces it, but above all it has a heavily historical context that consecrates it, sealing it and rendering it a language that can only be learned, or perhaps slightly modified in its use, but may be challenged only by a madman or lunatic such as that of Salvatore in *The Name of the Rose*.

In certain cases, the price of the jargon becomes clear and inordinate only when it is too late to change it: this is the case of the term 'radical' given to jihadi terrorism. This lofty title from nineteenth- and twentieth-century European politics was used in American security jargon to indicate potentially dangerous individuals (we all remember the scene from *Never Say Never Again* where James Bond cloaks his assignment in diet terminology, saying he has to «eliminate all free radicals»). In the midst of rising Salafi violence throughout the world, the civil wars of the Algerian GIA, Al-Qae-

da and the caliphate of Daesh, it has become commonplace to attribute this form of terrorism to the works of 'radical' or 'radicalised' Muslims. The US Department of State under the Obama administration proposed the alternative category of «violent extremism» and instituted its CVE programme (Countering Violent Extremism), despite accepting the term 'deradicalisation'.[1] This proved unsuccessful. Entire political systems (such as those in Europe) had already been seeped in the new jargon of radicalism and radicalisation (in Northern Ireland they never spoke of radical Catholics or radical Orangemen), which was then counterbalanced by the inception of a jargon of 'moderation', understood no longer as a virtue and character of the government à la Montesquieu,[2] but as the prerogative of a cautious and circumspect consumer of the religious.

Much as I proposed at the conference of the ESFRI Strategy Working Group, I would like to advance a reflection on a term that is no less debatable: impact. It, too, has lost any and all awareness of its origins and stages of its metamorphoses. The term entails a 'violent' connotation: the Latin verb from which its past participle comes (*im-pingere*)[3] entails a collision that is undesirable for at least one of the parties, involving considerable consequences. It is no coincidence that the concept of impact has been the province of ballistic science since the dawn of modern artillery, studying the angle of suitable 'impact' to ensure that a projectile encountering its target would have the necessary effects.

The metaphorical use of impact does not require complex or in-depth research – an analysis of the entries in the great encyclopaedias of the eighteenth and nineteenth century would suffice – and such an inquiry could go alongside a study of the shift from scientometrics to what we may now define as policy-metrics.

In scientometrics, impact becomes a 'factor': a mathematically calculable result capable of measurably qualifying the incidence and therefore the 'value' of a scientific product. Eugene Garfield, the founder of the Institute for Scientific Information in 1960, set forth this definition in 1955 at the

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[1] See an example in *Leaving terrorism behind: Disengagement from political violence*, edited by T. Bjorgo and J. Horgan, New York, Routledge, 2009.

[2] G. Benrekassa, *Le langage des Lumières*, Paris, PUF, 1995, in Benrekassa's own words: *'Modéré', 'modération', 'modérantisme'*; C. Spector, *Montesquieu et l'histoire: Théorie et pratique de la modération*, in *Le Sens du devenir et pensée de l'histoire au temps des Lumières*, edited by B. Binoche and F. Tinland, Seyssel, Champ Vallon, 2000, pp. 53-75.

[3] Within the vast literature see A. Beltrami, *M. Minucio Felice Oct. 14, 1*, «Rivista di Filologia e di istruzione classica», 47 (1919), n. 2, p. 271 on the passage: «Tunc Octavius ait: 'Non boni viri est, Marce frater, hominem domi forisque lateri tuo inhaerentem sic in hac imperitiae vulgaris cecitate deserere, ut tam luculento die in lapides eum patiaris impingere […]'».

National Institutes of Health.[4] The measurability of citations would orient research and rated researchers with a system that, following the experimentation with the Genetics Citation Index in 1961 and the Science Citation Index, would lead to the creation of a system. With the help of Irving H. Sher, that system generated its own literature with methods of deliberation, correction, and editing.[5]

Prior to Garfield's idea, we find Vannevar Bush's 1945 report in *Science, the Endless Frontier*.[6] Bush's work was a manifesto that (in the year of Hiroshima…) was based on a theory that the autonomy of research and its self-regulation of value would have led to greater benefits than those guided by political interests.[7]

This invention was highly successful in the collective imagination. A trace of this can be found in the work of the designer Geoffrey Lee, who in 1965 created a new typeface, carried out by the Stephenson Blake foundry, where lower-case letters took up three-fourths the space occupied by the upper-case and carried the name of *Impact*.

The success of that conception brought about the semantic extension of the old category of ballistics (in various languages for the atomic bomb of Hiroshima and Nagasaki and for the experiments carried out for new weapons, we find the term 'impact zone').[8] Analysis led by the Accademia della Crusca on the use of the root and especially the verb derived from the Anglicism 'impact' to replace the Latin *impingere* notes that as early as October 1966 an important Italian education sociologist by the name of Saverio Avveduto had used the verb in citing an anonymous Belgian minister: «In short, to put it in the words of a Belgian minister, the politics of science entails the full impact of science in all economic and social life».

Here we find proof that by then the term had already entered into the jargon of measurement of public policies linked somehow to research: from law to the chemistry of matter, from physics to the climate, and the use of

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[4] E. Garfield, *Citation indexes to science: a new dimension in documentation through association of ideas*, «Science», 122 (1955), pp. 108-111 [now Garfield library.upenn.edu].

[5] E. Garfield, *The history and meaning of the journal impact factor*, «JAMA», 29 (January 4, 2006), n. 1, pp. 90-93.

[6] For the biography of Vannevar Bush, cf. G. Pascal Zachary, *Endless frontier: Vannevar Bush, Engineer of the American Century*, New York, Free Press, 2018.

[7] D. Mowery and N. Rosenberg, *Technology and the pursuit of economic growth*, Cambridge, Cambridge University Press, 1989.

[8] B. Migliorini emphasises this point in his excellent supplement to Alfredo Panzini, *Dizionario moderno delle parole che non si trovano nei dizionari comuni, con un'appendice di ottomila voci nuovamente compilata da Bruno Migliorini*, Milano, Hoepli, 1950.

ballistics in space exploration.[9] There was, however, variation: in the verb form, 'to impact' takes on the meaning of having an influence with rather negative implications. In its noun form, it becomes instead a paradigm of the success of economic actions and of public or private investment.[10]

That being the case, this evolution was accompanied by a progressive trivialisation of the term itself,[11] as clearly shown in detail by documentation from the European Commission up to and including its tautological application in a legislative site of the Barroso Commission: «Impact assessments are carried out on initiatives expected to have significant economic, social or environmental impacts».[12] It is a bit like saying that medicine entails all the things that have significant relevance to medicine.

Formulated as the content of an *ad hoc* organ on the impact constituted by the Commission, the term has also entered into the jargon of research policy: sometimes as a tool that serves critical scrutiny, but in some cases, impact is used as an epistemological superstition to which important decisions are entrusted in general and strategic terms. This 'impact syndrome' has then become not only a jargon, but also a veritable system.

In Italy, where a government agency sets the quantitative criteria of a career on the basis of impact or on rather extrinsic 'non-bibliometric' parameters, many speak ironically about these 'values', not even Ludwig Wittgenstein would have been allowed to progress in a university for the clear insufficiency of his *Tractatus logico-philosophicus*, while crowds of medio-

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[9] NASA uses 'impact' to indicate the contact between the space shuttle and the lunar surface, as reported and explained in a newspaper with a strong pedagogical bent such as «L'Unità», on 4 February 1966.

[10] For an IT perspective, cf. G. G. Gable, D. Sedera and T. Chan, *Re-conceptualizing information system success: The IS-Impact Measurement Model*, «JAIS-Journal of the Association for Information Systems», 9 (2008), n. 7; as well as A. Burton-Jones and M. J. Gallivan, *Toward a deeper understanding of system usage in organisations: a multilevel perspective*, «MIS Quarterly», 31 (2007), n. 4, pp. 657-679; a critical view in A. Diamantopoulos and J. A. Siguaw, *Formative versus reflective indicators in organisational measure development: A comparison and empirical illustration*, «British Journal of Management», 17 (2006), n. 4.

[11] For the amusement of the Italian reader, I cite a satirical text that imagined the response of academics to newspaper articles that predicted the destruction of the Earth by an asteroid: «Even in very recent times we register a certain level of resistance: according to authors of the Lercio magazine, the use of the verb should horrify members of the Accademia della Crusca, as shown by one satirical article entitled *Will the Umberto Smaila asteroid destroy the Planet Earth?* The appeal from the Accademia della Crusca came forthwith: 'If the world has to end, may it do so correctly and with style. Please do not say that «Umberto Smaila will impact». Do not use the verb 'to impact' nor the adjective 'impactful'. We may very well disappear, but we shall do so with our heads held high.»; *Un anno lercio: Il 2014 come non l'avete mai letto*, Milano, Rizzoli, 2014, p. 112.

[12] Cf. https://ec.europa.eu/info/law/law-making-process/planning-and-proposing - law/impact-assessments_en.

cre, unoriginal philosophisers could easily edge him out (but could have been hired as full professor in the countries still adopting older standards of cooptation).

On a global scale, it is more than evident that a focus on impact presumes not only a theory of impact but also a concept of time and a systemic postulate.

In fact, time determines scale (e.g., the active research career of a scholar); it determines the degree (the forecast period of the time in office of a political decision-maker), and it determines the periodisation and the mediatisation of what constitutes failure or success in terms of impact.

It is a systemic postulate that makes the global ecosystem of research seem imperfect but acceptable, and therefore the flow of independent resources appears acceptable along with the content of academic 'consortia', and the action of public authorities and the broad trust of public opinion also become acceptable.

The experience of twentieth-century history would suffice in introducing a dose of methodical doubt into these conceptions and postulates. It would be sufficient, for example, to gauge *ex post* the impact factor of other discoveries and stances from the past in order to understand that within political situations with intense authoritarian control there are entire segments of science that are penalised by public authorities dominated by an authoritarian ideology and marked by propagandistic logic. It does not mean simply understanding what impact factor the writings of Dietrich Bonhöffer would have had in 1930s Nazi Germany or that only a dozen professors in the Italian academic system refused to pledge allegiance to Fascism. It is a question of asking oneself why in such developed academic systems racism was not disavowed, but rather taught, practiced and adulated as a demonstrated and demonstrable truth.

I believe this caveat must also be adopted when we deal with measuring the impact of the research infrastructures that the ESFRI (inasmuch as it is the enactment of a Commission's advisory body like ERAC – European Research Area and Innovation Committee) examines and monitors, accompanying said infrastructures through their development. First, it is important to consider that if we intend to use this category we must apply it as if it were a 'double entry' in bookkeeping.

There is no impact that is solely positive: every impact by definition also has a negative connotation. You acquire knowledge, but at the same time you silence doubts that might question commonplace beliefs; you scientifically build upon an area, but like in urbanisation, you consume a limited resource; you consolidate positions that are not necessarily more advanced than those which lose out and are then excluded.

This is all the truer when it comes to research infrastructure: as service chains financed by member states through national and community budgets, within a scientific community, they produce a hub that can either have a positive value for many or solely for the subsector represented by whoever is in the lead. Research infrastructures can offer leverage for the empowerment of new generations of scholars or be an obstacle to emancipation by closed schools of thought. On this last issue, there is literature that could significantly benefit from studies on diverse impact generated by the policies of racial integration in the academic and non-academic systems in America.[13]

Overall – and for the reasons stated above – I do not pretend to call into question the jargon of impact. Allow me, however, to propose a parallel category that might compensate for its shortcomings. In order to balance the risk that the fetish for impact allows for the insinuation of procedural superstitions, I would recommend the parameter of 'fertility'.[14]

Research in general – the kind that requires great collective efforts on the part of one or more generations so that future generations are endowed with the tools needed to foster the progress of understanding – is not measured solely in (ask Jung if it is phallic…) terms of impact. Moreover, if measured in the long term, impact makes little sense as it returns to the realm of ballistics from the one of metaphor. Research value and, above all, research infrastructures value – as shrine of research freedom – can be better (or solely) understood within a logic of fertility, as something freely consigned to the future.[15] This fertility is not of the 'generative' form, but rather a gratuitous fertility that endows the future with a soil that is ripe for sowing.[16]

In fact, when the language of the ESFRI poses the problem of the long-term sustainability of infrastructures and their global placement, it is posing the problem of fertility without specifically naming it. I presume that this problem concerns – although I say it with an absolute incompetence in

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[13] Cf. J. Arday-Heidi Mizra, *Race in higher education: Dismantling racial inequality within the academy*, London, Palgrave, 2017; cf. also the report *Equality in higher education: Statistical report 2015*, and the report *Experience of black and minority ethnic staff in HE in England* published in 2011 both available in www.ecu.ac.uk.

[14] Cf. D. Nolan, *Is fertility virtuous in its own right?*, «The British Journal for the Philosophy of Science», 50 (1999), n. 2.1, pp. 265-282, DOI: 10.1093/bjps/50.2.265.

[15] I am making a distinction in contrast to the generativity postulated by Erik Erikson in 1950 as «a concern for establishing and guiding the next generation»; for Erikson, the *Gegenbegriff* of generativity is the «stagnation» of the personality. Instead, fertility regards neither an individual nor a pair of individuals, but rather a «territory» of even the intellectual kind.

[16] A. Battistini, *Le risorse conoscitive ed estetiche della metafora*, in *La metafora tra letteratura e scienza. Convegno di studi, Bari 1-2 dicembre 2005*, Bari, Servizio Editoriale Universitario, 2006, p. 29; for the synonymity that links *fertilitas* to both *laetus* and *laetamen*.

the hard sciences, hoping to set a good example – the hard sciences, yet I am sure that it is the deciding issue in the definition of the priorities of the humanities. Furthermore, it is essential in defining the understandings that pass through and are influenced by historical-critical knowledge.

Let me illustrate this with an example familiar to me regarding the historical-religious environment, which aspires to provide itself with a research infrastructure in due time (i.e., before trans-denominational dissemination of the same fundamentalist involution which has affected a minority of Islam, driving it towards internal and external terrorism against other Muslims and non-Muslims, so to incite Islamophobia that has sunk into European consensus, and reigniting the anti-Semitism that has always been its companion since 1095). Historical research in the fields that are crossed by or cross religion – as I expressed my position at the foundation of the European Academy of Religion in 2015 – cannot be founded on a dogmatic approach, assuming that there is an authority (a religious authority or a non-religious authority) capable to avoid the complex debate based on specialist approach: this free debate that does not except exclusion (nor the exclusion of history in the name of a religious truth, nor the exclusion of theology in the name of non-religious dogma) requires specific skills which cannot be omitted: e.g., a critical knowledge and a perfect competence in Persian, Hebrew, Aramaic, Greek, Syriac, Latin in all its nuances, Arabic, Middle Persian, Turkish, Urdu, Hindi, and so on; an in-depth analysis of the philosophical texture of doctrinal evolutions; a capacity to interpret the multipolar interplay between cultures, institutions and religious structures; the capacity to work taking into account the tangle of hermeneutics and the dialectic between doctrines. An infrastructure like the infrastructure on Religious Studies (launched with the INFRAIA programme REIRES, and its follow up *Resilience*) that limits itself to reasoning in terms of impact will be led by an incompetent judgement to value comparatism over specialism and will be unable to consider the need to valorise a broader community where rare and non-fungible skills can be integrated.

So, the 'fertility factor' will tend to measure the other side of the 'impact factor': instead of measuring the use of a work, it will consider the capacity to rediscover far off ideas capable of flourishing and to prepare the ground for other ideas to bloom.

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Juan de Dios Llorens González

COMPUTERS THAT READ AND UNDERSTAND (ALMOST): LANGUAGE TECHNOLOGIES AND SCIENTIFIC INFORMATION MANAGEMENT

Abstract

The purpose of this paper is to show through a real example how language technologies may help science policy-makers to design better informed policies, thus improving their impact (economic, social, environmental, cultural, etc.). Scientometrics and impact evaluation are currently scientific disciplines with a quite long history (Lotka, Bradford, Merton, Price, Garfield, etc.). It is a huge challenge. Our approach is far humbler. We use language technologies (LT). LT are a diverse set of technologies that are paving the way for an ever deeper automatic understanding of human language. This paper will present tool-based LT that allow large collections of texts to be automatically analysed for the purpose of discovering the subjects they deal with and establishing a metric to measure topic distance between texts. These tools have been used to design the new Spanish State Plan for Scientific and Technical Research and Innovation. They are also being used to obtain an overview of the subjects, and their evolution over time, of applications for public aids, and to narrow the scope of application's evaluators' search to similar applications by subject. They have also served to characterise the ICT job offer thematically and to detect companies that carry out e-commerce by taking advantage of the textual information on web pages. The distinctive feature of these tools is that they use text as a source, although they can be combined with structured information (metadata) to refine information retrieval.

1. *Impact evaluation challenge*

Scientometrics, bibliometrics and scientific impact evaluation are already scientific disciplines with a quite long history. Lotka, Bradford, Merton, Price or Garfield made decisive contributions to achieve that level. Nevertheless significant challenges remain. Let us focus on economic impact (indeed social, environmental or cultural impacts are in the end the impor-

tant ones). Our goal is to discover causal relations among knowledge space and economic space. Let us look at one example: In 1998, Sergey Brin and Lawrence Page publish *The anatomy of a large-scale hypertextual web search engine*,[1] the kernel of Google large-scale search engine. Economic impact of this piece of knowledge is almost incalculable. But this piece of knowledge is based on another piece of knowledge: the Perron-Frobenius theorem, published in 1907 and 1912. Somehow someone invested money to allow Oskar Perron and Georg Frobenius develop their researches in linear algebra and a century later this makes Google large-scale search engine possible. How to track these relations among knowledge and economic spaces?

Our approach is far humbler.

2. *Language technologies*

Massive digitisation began in the 1990s and today much of the information raw material is already produced directly in electronic format (whether pictures, movies, music, texts, or measures). But electronic format is, above all, another way of storing information outside our brain, as cuneiform writing was more than 5,000 years ago. This way of information storage (electronic format) has drawbacks, such as ensuring digital preservation, but also great advantages, such as shrinking storage space, plunging replication costs to zero and, thanks to the development of telecommunications, allowing its transmission from one point of the world to another in a very short time. But electronic format does not mean that computers can understand it, in the sense of understand and manage its meaning. Computers only understand a small part of this electronic information (software and databases). We will call structured information the information computers can understand. The rest of the digitised information, although in electronic format, is intended to be understood by humans.

Due to the development of telecommunications networks, Internet and, in general, ICTs (Information and communications technologies) our access to unstructured electronic information has grown so rapidly that is already beyond human reach. We have evolved very quickly from informational malnutrition to obesity. So we are in the post-digitalisation era.

Much of this digital information is of linguistic nature (textual or oral). Language technologies are a diverse set of technologies that are paving the way for an ever deeper automatic comprehension of human language. They

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[1] S. Brin and L. Page, *The anatomy of a large-scale hypertextual web search engine*, «Computer Networks and ISDN Systems», 30 (1998), n. 1-7, pp. 107-117.

allow, among other things, to automatically exploit (structure) this volume of information already intractable.

They are already offering their fruits. We have a lot of everyday examples, like web search engines, conversational interfaces, mobile spell checkers and predictors, mobile speech recognisers, personal assistants, automatic translation, automatic call centres, etc.

3. *Landing in specific problems*

We work in a public administration body that is in charge of ICT sector public policies. It is a very dynamic and highly specialised sector. And it is also a cross-cutting sector, present in very diverse economic and social areas. Therefore, there are gaps in statistical knowledge. It is a poorly classified sector, with scarce granularity and outdated results (a lag of at least 18 months means an outdated picture in such a dynamic sector). Therefore, structured information is not sufficient to design and implement effective public policies. Knowledge of the ICT sector needs to be improved.

There is also a need to improve granting procedures for public funding of ICT R&D&I (Research, Development and Innovation). There is a great volume of grant applications and a great diversity of technologies and projects but evaluation resources are scarce. Also an overview of the whole system for the advancement of R&D&I and comparison among different bodies involved in it are needed.

4. *A tool to help solving them using language technologies*

There are many textual corpora available that enclose a lot of relevant information. They are so huge that there is no way to extract this information with human resources. The drops of this waterfall of documents are words. Our effort is to extract the ore from the seam using language technologies (and other analytical tools).

In a broad sense use cases are in the intersections of analysis techniques, corpora (of public grants, patents, scientific papers, public procurement, even Internet itself) and projections (document versus corpus, corpus versus corpus or evolution of corpora in time).

The system makes use of structured information (metadata) and unstructured information (text). For the latter it makes use of language technologies.

5. *Automatic thematic characterisation (topic modelling)*

There is a language technologies pipeline that performs several tasks such as tokenisation (identification of words and other text elements in the electronic file) or part-of-speech tagging (differentiation of the types of words such as nouns, adjective or verbs), but the key element is the implementation of *Latent Dirichlet Allocation* (LDA).[2] Broadly speaking, this technique makes it possible to characterise a corpus or collection of texts according to a finite set of 'topics' that are automatically detected. Each 'topic' is a vector of numbers (probability distribution) that quantifies the probability in that topic of each of the words in the lexicon or set of words in the corpus. For example, if a topic were to emerge with high frequencies in words such as *gas, emission, atmosphere, pollutant, engine, reduction, particle, greenhouse, diesel*, etc. we could deduce that one of the topics dealt with in the analysed corpus is something related to reduction of pollutant emissions.

Once these vectors that characterise each topic have been obtained, it is possible, in turn, to characterise the corpus, each text and even a new text (which shares lexicon) with another vector (probability distribution) that quantifies the probability that the corpus, corpus text or the new text will address those topics. The interesting thing is that this vector of probabilities (topic vector) becomes, therefore, a sort of fingerprint or signature of the thematic content of the document, which characterises it. This characterisation of the document, apart from being automatic, is much more expressive than classifications, which assign each document a single subject.

6. *Automatic thematic similarity calculation*

Converted into vectors, it is easy to define a thematic metric which allows to calculate thematic distance among texts. The closer they are, the more similar they are thematically.

(a) *What's that all for?*

- Just some examples:
- Find documents by subject matter, that is to say, in a more semantically adjusted way than by words.
- In a collection of documents find documents similar in their thematic con-

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[2] D. M. Blei, A. Y. Ng and M. I. Jordan, *Latent Dirichlet Allocation*, «Journal of Machine Learning Research», 3 (2003), pp. 993-1022.

tent to a given one (it is a matter of searching for vectors of similar numbers, which a computer can do very quickly). This can help evaluators of public grants or patent applications to find documents similar to the application under consideration. This is extremely useful when the collection of documents in which to search for similar documents is very large. This technique also assigns synonyms to the same themes, so that sophisticated plagiarism can be detected.
- Have an overview of the topics covered by large corpora.
- See the time evolution of the subject matters.
- Identify overlaps and synergies in the public aid policies of different departments, analysing the subject matters financed by each of them.

(b) *A step further: visualising thematic similarity*
- A stated earlier, using LDA topic models it is possible to automatically calculate topic distance among proposals. Despite the number of documents computers do that fairly quickly. But a new problem arises: distances arise in a quadratic form. For example, given 18,160 documents there are 164,883,720 pairs of distances. It is easy to find the most similar proposals (sort distances and select the smallest), but how can we have a picture of how proposals relate among them by its thematic content? How to navigate in this matrix of distances? How to see clusters of similar proposals?
- There is a long tradition of cluster analysis methods (k-means, ISODATA, …) that allow us to classify proposals in sets of similar proposals (clusters). These methods have some well-known issues, as guessing the number of clusters that are really there in advance, noise introduced by outliers, computational complexity, etc. Nevertheless the problem of visualising those topic distances remains. In this thematic metric space, proposals are dots in a multi-dimensional space whose dimension is the number of topics discovered with LDA algorithm. This number is greater (far greater) than 2. So it is impossible to represent it in 2 dimensions without distortion. There are algorithms to minimise this distortion (Principal component analysis (PCA), Multi-dimensional scaling, …) but given the huge number of documents and the number of topics the distortion will be so great that it becomes useless.
- Having explored those paths, finally we took a different approach: graphs.

(c) *Graphs*
- Graphs are mathematical structures composed by nodes and lines that unite pairs of nodes. The idea is that under some threshold (a parameter we can choose) of thematic similarity (or, inversely, over some threshold of topic distance) we can consider that two proposals are unrelated, and over this threshold that they are related. So we have a graph of proposal (nodes) where those pairs of proposals that are thematically related are connected.
- This way we discard a lot of irrelevant and noisy information, but it is still equivalent to replacing in the similarity matrix the values of similarities under

a threshold by zero (or distances over a threshold by infinite). But graphs go further and are useful at least for the following functionalities:

– It is possible to have a visual representation of the thematic relations of proposals since the condition distance preservation is lifted and only relation have to be represented.
– This representation also helps navigation in the constellations of proposals.
– The Louvain [3] method for community detection gives a promising alternative to clustering methods to automatically identify sets of similar documents.

(d) *Summarising*

– Of course up to today there is no doubt that a human brain understands a text far better than a computer, but a computer can deal with thousands of texts in far less time.
– When the number of documents overwhelms human capacity to read and understand them we can rely on some automatic tools to help us.
– These tools (language technologies) can automatically do things like:
– Discover the topics dealt with in by a corpus.
– Have a global vision of these topics.
– Track the evolution of these topics.
– Aggregate documents by their thematic content.
– Find documents similar in their content to a given one.
– Compare corpora by their thematic content.

7. *Conclusion*

We are far from answering questions as the impact of scientific work, but just reconnoitring knowledge space with the help of language technologies may raise a lot of relevant information.

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[3] V. D. Blondel, J.-L. Guillaume, R. Lambiotte and E. Lefebvre, *Fast unfolding of communities in large networks*, «Journal of Statistical Mechanics: Theory and Experiment», 9 October 2008.

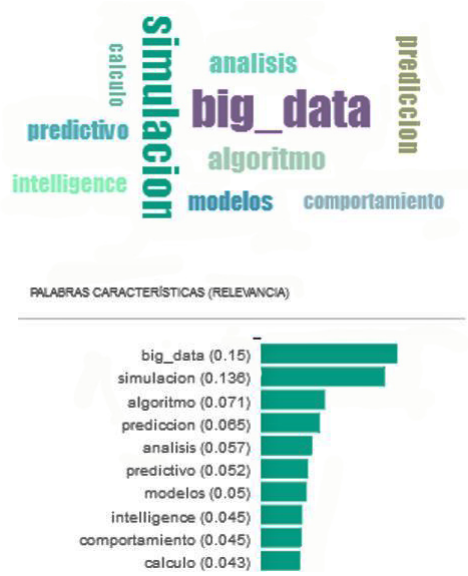

Figure 1. - A Topic: A topic is a probability distribution of words. Here the most frequent words in a given topic.

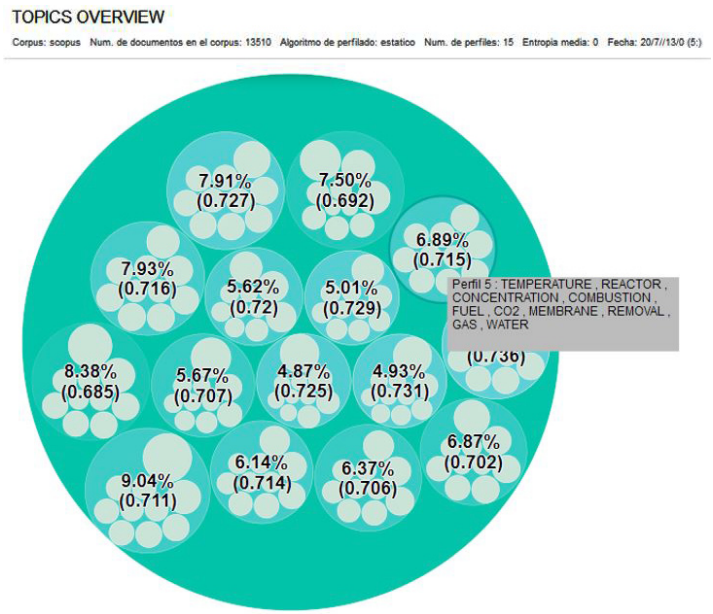

Figure 2. - Topic overview: A representation of the topic distribution in a given corpus (a model of 15 topics).

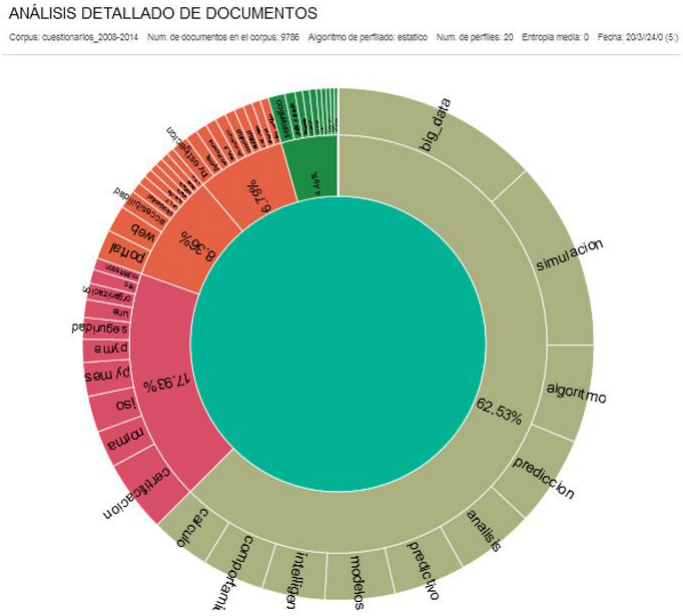

Figure 3. - Topic composition of a text: In turn, a text can be characterized as probability distribution of topics. A representation of the relative topic composition of a given text.

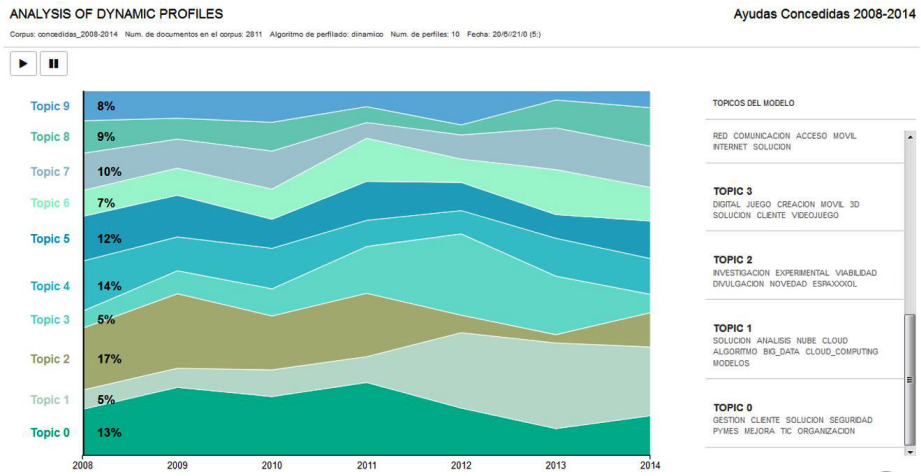

Figure 4. - Topic evolution: Evolution over time of relative topic composition of a given corpus.

PART IV

Social Science and Humanities Erics and their Impact

Ron Dekker

IMPACT OF SOCIAL SCIENCE DATA SERVICES

Abstract

The Consortium of European Social Science Data Archives (CESSDA) is a distributed social science data infrastructure with currently 17 members (www.cessda.eu). We work on FAIR data and are developing a social science data platform as part of the EOSC. CESSDA is an ESFRI Landmark, and in June 2017 it became a European Research Infrastructure Consortium (ERIC). CESSDA's goal is to bring together the expertise of the CESSDA Service Providers and realise an infrastructure that enables researchers to perform high quality research. It has a small Main Office in Bergen and each Member assigned a Service Provider that functions as a national social data archive and data services organisation. Via CESSDA these Service Providers join resources and expertise to realise this top data infrastructure for social science data, and the national Members discuss and create an overarching CESSDA strategy. A key challenge is to realise the EOSC – using the FAIR principles, taking into account the distributive character of infrastructures within social sciences, and the sensitivity of many social science data – requiring safe & secure access. At CESSDA we follow a stepping stone strategy in realising the social science data cloud. We are using the FAIR principles and have realised the 'F'. The CESSDA Data Catalogue currently contains 10.000+ studies. We have pathfinder projects on the other principles and on secure access. Our stepping stone strategy is to work out the other FAIR principles: especially legal aspects of Accessibility, development of data clusters to improve Interoperability, and tools to increase the Reuse of data – including reuse of sensitive data. We also stress the importance of Skills and elaborate on Training activities – taking the data life cycle as starting point. This means providing tools for data owners, but also focus on users, e.g., by creating user communities around data clusters, and how to share expertise in a distributed data infrastructure. To realise the Social Data Cloud, CESSDA will cooperate with the other SSH ERICS and international infrastructures.

Introduction

Impact can refer to scientific, environmental, social and economic impacts. It can relate to different audiences: researchers, citizens, governments – either on local, national or global scale.

Leonie van Drooge stresses the long chain between activities and impact. To measure impact, we should investigate the processes that lead to results and deliver outcomes. Moreover, she stresses that impacts should relate to goals – starting even before the inputs: Hence, according to Van Drooge, impact is what Research Infrastructures statutory need to achieve, what is agreed upon with funders, and what stakeholders expect.[1]

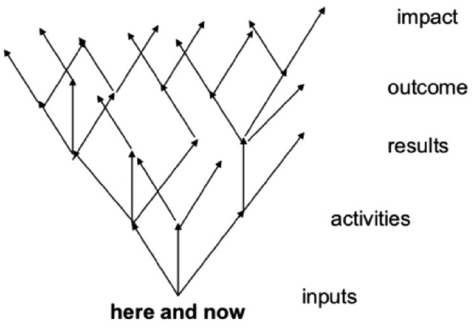

Figure 1. - The impact of research (infrastructures) starts at the end by Leonie van Drooge.

This figure reveals the long distance between (original) goals and impact. In-between a lot of unintended and unexpected side-effects could take place and they may blur the direct effects between goals, actions and impact.

From Van Drooge's presentation we conclude that we need to start with the statutory goals to describe impact of a research infrastructure. This will be our outline for this chapter: describe goals, activities, benefits (results and outcomes) and then impact.

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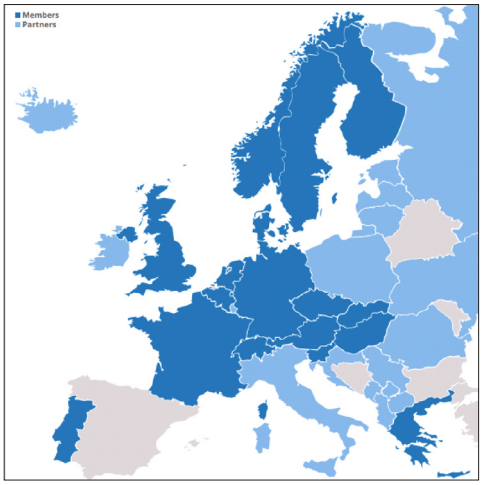
[1] ANDS, #dataimpact, stories about the real-life impact of Australian research data, ands.org.au, 2017, DOI: 10.4225/14/588ed360036eb; N. BEAGRIE and J. HOUGTHON, *Economic Impact Evaluation of the Economic and Social Data Service*, Charles Beagrie Ltd and The Centre for Strategic Economic Studies University of Victoria, 2012, https://esrc.ukri.org/files/research/research-and-impact-evaluation/economic-impact-evaluation-of-the-economic-and-social-data-service/; CESSDA, SaW Benefits Summary for a Data Archive, 2017, https://www.cessda.eu/Projects/All-projects/CESSDA-SaW/WP4/Cost-Benefit-Advocacy-Toolkit/Benefits-Summary; CESSDA, CESSDA Strategy 2018-2022, Bergen, 2018; L. VAN DROOGE, *The impact of research (infrastructures) starts at the end, presentation at Conference Stay tuned to the future, an international conference on the impact of research infrastructures for social sciences and humanities, Bologna, 24 & 25 January 2018*, http://www.Fscire.it/wp-content/uploads/2018/02/Leonie-van-Drooge.pdf; EUROPEAN STRATEGY FORUM ON RESEARCH INFRASTRUCTURES, *Strategy report on research infrastructures: Roadmap 2018*, http://www.roadmap2018.esfri.eu; EUROPEAN COMMISSION, *EC Staff Working Document 2018* (83), https://ec.europa.eu/transparency/regdoc/rep/10102/2018/EN/SWD-2018-83-F1-EN-MAIN-PART-1.PDF.

Goals

The Consortium of Social Science Data Archives – CESSDA – is a distributed research infrastructure in the social sciences domain. CESSDA has been on the ESFRI Roadmap since 2006 and is an ESFRI Landmark since 2016. As of June 2017, CESSDA has been assigned the ERIC[2] status by the European Commission.



Member States of the European Union, associated countries, third countries other than associated countries, and intergovernmental organisations can join CESSDA as a member or an observer.

Membership implies that a country assigns and supports a national service provider that will provide CESSDA services in their country and across Europe. Mid 2017, CESSDA ERIC had 16 members and 1 observer (Switzerland). Next to this, CESSDA partners with several service providers in non-member countries.

Annual operating costs of the consortium are 39 M€ – this refers to the costs of the main office in Bergen and the CESSDA-related activities by the national data service providers in the 17 countries.[3]

The mission of CESSDA, as given in the statutes, is:

1. to provide a distributed and sustainable research infrastructure
   - enabling the research community to conduct high-quality research in the social sciences
   - contributing to the production of effective solutions to the major challenges facing society today
2. to facilitate teaching and learning in the social sciences.

CESSDA's goal is to increase the reuse of data, or to quote the Euro-

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[2] ERIC stands for European Research Infrastructure Consortium. ERICs are European legal entities.

[3] European Strategy Forum on Research Infrastructures, *Strategy report on research infrastructures: Roadmap 2018*.

pean Commission: the goal is «moving from the current fragmentation to a situation where data is easy to store, find and re-use».[4]

Activities

In CESSDA's Strategic Plan 2018-2022,[5] we developed our vision, and performed environment and stakeholder analyses to set the strategy. CESSDA's strategy consists of four pillars:

Building on TRUST
Working on stakeholder confidence, transparency, and advocacy
Renown for TRAINING covering the whole research cycle
Promoting open science and data skills of researchers, and sharing expertise among service providers
Proficient in TECHNOLOGY
Building the platform infrastructure and driving consensus on standards on technology and (meta) data
User-friendly TOOLS & SERVICES
Facilitating researchers as data producers and re-users

For distributed infrastructures, working out their goals may consist of two-layers of activities. First, to deliver services, data, etc. to end-users – mostly the researchers. Second, there is a coordination role – to align the activities of the distributed services. It is important to distinguish these two roles when analysing benefits and impact.

CESSDA has annual work plans and an innovation budget of about 1.8 M€. In addition, national service providers also invest in new tools and services. Projects and activities within these work plans focus on:

– Development and realisation of tools and services for end-users, like the Data Catalogue, an online Data Management Expert Guide, Multilingual Question Banks, pilots on Secured Access.
– Its coordination role, on technological development, standards for metadata, setting up common vocabularies and thesauri. CESSDA also develops quality assessments and urges all national service providers to attain the CoreTrustSeal. CESSDA continued the EC project on Widening to share expertise with new and non-member service providers.
– Training: For both researchers and data experts we provide training and expert seminars, for example on data discovery and data management.

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[4] European Commission, *EC Staff Working Document* 2018 (83), https://ec.europa.eu/transparency/regdoc/rep/10102/2018/EN/SWD-2018-83-F1-EN-MAIN-PA RT-1.PDF.

[5] CESSDA, *CESSDA Strategy 2018-2022*, Bergen, 2018.

Benefits

In preparing a benefits analysis, we cluster results and outcomes in Van Drooge's scheme (Figure 1) into benefits. This connects with a Benefits Analysis that we performed in 2017.[6] This analysis was based on the Economic Impact Evaluation of the Economic and Social Data Service.[7]

This method originally distinguished six different categories, see Table 1.

Table 1. - Benefits Analysis Categories.

Direct Benefits	Indirect Benefits
Near-term Benefits	Long-term Benefits
Private Benefits	Public Benefits

Beagrie filled in these categories for Data Services.[8] But one can also use this methodology by deleting non-relevant benefits; adding new benefits; making generic benefits more specific or expanding them; moving key benefits to top of the lists. We did the latter to prepare for our analysis of impact: we aggregated and renamed categories, also to put more emphasis on the two-layered structure: benefits for end-users and for partners in the consortium.

In working out our benefits analysis, we distinguish between different stakeholders and planned versus realised benefits. For researchers, we distinguish between data producers and data users. For users, it is mainly the ease of finding, accessing and re-using data – the so-called FAIR principles. Data producers need services for archiving, curating and publishing their data.

Table 2. - Benefits by stakeholders.

Benefits to National Data Services
Benefits to Researchers
Benefits to Research Sponsors
Benefits to Society

[6] CESSDA, *SaW Benefits Summary for a Data Archive*, 2017, https://www.cessda.eu/Projects/All-projects/CESSDA-SaW/WP4/Cost-Benefit-Advocacy-Toolkit/Benefits-Summary.

[7] N. Beagrie and J. Houghton, *Economic Impact Evaluation of the Economic and Social Data Service*, *ibid.*

[8] *Ibid.*

We will describe the planned benefits and their status for each of these stakeholder groups.

For Service Providers	
Planned	**Status**
Be successful and visible In Brussels Be eligible for funding, receive status of 'trusted repositories'	Specific calls for RI's, participation in development of EOSC. 'Trusted' based on CoreTrustSeal
Set standards metadata, persistent identifiers	DDI-standard and specific CESSDA subset (CMM), working on suite of PIDs
Develop partnerships With other RIs, National Statistics, third parties	Exploring cooperation with e-Infrastructures and third parties
Joint Activities Safe and Secure Data Infrastructure Joint Research & Innovation	Two initiatives being tested Annual work plan and budget

Hence, for Service Providers the membership of CESSDA should induce scale effects – on access to funding, setting standards and joint developments – and on sharing expertise.

For Researchers	
Planned	**Status**
Data Users:	
Find, Access and Re-use data (FAIR-principles) Single point of access	Data Catalogue
Quality of documentation	Quality checks by service providers
Data Producers	
Tools for constructing metadata	Still to be developed for social sciences
Secure storage for sensitive data research	Two pilots; one finished, one starting up
Availability of data underpinning journal articles	Third party services on this
Removing user burden from depositors	Self-archiving tools
Fulfil grant obligations to deposit at trusted repositories	CoreTrustSeal status of service providers
Increased visibility, higher usage (and profile)	Via Data Catalogue(s)

Both groups	
Training	Data Discovery workshops, Data Management online tool and training, Seminars on specific data clusters

For Researchers, it is about easiness – to deposit and to use data – and saving time. But it is also about training, as data become more and more complex.

Benefits to Research Sponsors	
Planned	**Status**
No re-creation of data & no data lost - Reduce potential duplication of effort	Providing deposit and archiving services, and catalogue to find data easily
Re-purposing data for new audiences	Upcoming in new EC project for SSH
Lower (future) archiving and data management costs	Joining CESSDA will induce scale efficiencies

For Research Councils and Ministries, it is about providing infrastructure and services for researchers, and especially on efficiency gains.

Benefits to Society	
Planned	**Status**
Value added over time as collection grows and develops	Service providers already archive data for over 50 years
Enable international comparisons, visibility, and use	Large international surveys, e.g., ESS, SHARE, GGP, Wage-Indicator, EVS are already comparable by design; CESSDA tools for comparing other international studies
Induce new research and innovation High-quality and often unique data motivate research, that otherwise could not be undertaken, Induce new research opportunities, Input for future research use across user communities	To be accomplished via Data Catalogue and Data Clusters; two pilots (elections and migration) in new EC project
Research integrity others can check the outcomes of research	To be developed to facilitate and promote reproducibility of research

For society at large, it is about making (new) research possible, and about providing trust in existing research and research data.

Analysing Impact

The benefits of CESSDA are about scale, easiness, efficiency, new opportunities and trust. CESSDA is working on these benefits – some are realised, others are in the pipeline and some must start yet.

Still it is difficult to quantify the rate of success: impact is about the differences in the outcomes and results with and without CESSDA. We can tell what the costs for developing a joint Data Catalogue are, but it will be difficult to monetise the benefits of having this catalogue. The same goes for other coordination activities resulting in common standards, etc. Impact on activities for Research Sponsors and Society may have long timeframes and relationships between CESSDA activities and impact may be difficult to measure as many other effects come in.

On national level, we notice increasing interests. Since its ERIC status in June 2017, there are three new member countries and there is interest from non-European countries – although ERIC-requirements might impose some difficulties on becoming a member.

For new service providers, being part of CESSDA speeds up their development and they benefit from the sharing of expertise. It also opens additional funding opportunities. Most service providers would be too small to play an influential role at the EC in Brussels individually.

Experiences at CESSDA level with researchers are only recent, as we just started to participate – and expand our presence – in research communities. Demand varies from very basic services to archive the data to sophisticated projects to make data more interoperable via semantic linking of data.

CESSDA is part of a bigger cooperation within Social Sciences and Humanities. The cooperation with SSH ESFRIs and international data collections may lead to further benefits for all stakeholders. This SSH cluster can become a salient part of the European Cloud (EOSC) where e-infrastructures and research infrastructures from various disciplines work together.

Conclusion

In this chapter, we referred to the long way between goals, actions and impact. We went through this process for CESSDA, taking account of its distributed structure. In doing this exercise, we encountered difficulties to quantify or benchmark the impact that CESSDA has.

CESSDA will continue to work on visualising impact, based on our 2017 benefits analysis. One alternative approach could be the *storytelling* (2017) by the Australian National Data Service[9] (now part of ARDC, the Australian Research Data Commons). It is an effective way to present the research (data), the results and the real-life data impact within one page per case to a wider audience.

[9] http://ands.org.au

Franciska de Jong

CLARIN – INFRASTRUCTURAL SUPPORT FOR IMPACT THROUGH THE STUDY OF LANGUAGE AS SOCIAL AND CULTURAL DATA

Abstract

CLARIN aims to deliver infrastructural support for the study of language and speech as data that reflect social phenomena and cultural dynamics. The societal impact that can be expected from this data infrastructure is therefore as diverse as the angles of study covered by SSH. The open science paradigm helps to cater for the diversity within the communities of use. But the emerging support for re-use and repurposing beyond disciplinary boundaries also brings a growing potential for research in multidisciplinary settings and for integrating datasets from multiple linguistic origins and regions. The increasing potential for data integration can in principle stimulate comparative research across linguistic, national, cultural and temporal borders, but this requires reinforced collaboration between scholarly domains on the development of models for the integration of heterogeneous data types and on conceptual frameworks that can help to validate the outcomes of research in the social sciences that is (partly) based on language data. The SSH RIs can support and stimulate this development.

1. *Introduction*

Assessing the impact of investments in research infrastructures requires the availability of a suitable conceptual framework that is able to cope with (i) the diversity across disciplinary domains and (ii) the variation in the relative weight of direct and indirect effects, and in addition a good understanding of the time horizons relevant for specific conclusions. In this contribution we will present the case of CLARIN: a data infrastructure facilitating the use of language materials for the purpose of research. It will be argued that for the conceptualisation of the notion of societal impact in the domain of social sciences and humanities the potential added value of multidisciplinary collaboration is crucial. Furthermore the impact on human and social capital formation is underlined, and in particular the role of research infra-

structures in the education and training of the next generation of scholars for the establishment of new models of collaboration between researchers and non-academics.

2. *The CLARIN Infrastructure*

CLARIN is Europe's Common Language Resources and Technology Infrastructure. CLARIN received ESFRI ERIC status in 2012, and has been recognised as Landmark since 2016. It provides easy and sustainable access to digital language data (in written, spoken, video or multimodal form) as well as advanced tools for the discovery, exploration, exploitation, annotation and analysis of data irrespective of the physical location of the data centres at which they are stored. The research infrastructure aims to target the audience that is formed by scholars in the humanities and social sciences (and beyond) and it also serves as an ecosystem for knowledge sharing. The access functionality is realised through a single sign-on environment. By offering integrated access to the data and tools that are available in regional and national nodes, CLARIN leverages the local investments in data creation, data curation and tool development. Through the focus on interoperability and the reuse of research data it also is a strong contribution to the emerging Open Science framework.[1]

3. *The potential for Cultural and Societal Innovation based on language data*

The effective use of the digital infrastructure combined with the latest insights from information technology and data science are key factors for scientific and scholarly impact. At the same time support for research excellence also contributes to the potential for research communities to generate impact in other dimensions, to cross borders with other disciplines, to educate new generations of scholars, to set up industrial collaboration, and to generate societal impact at large.

The potential for societal impact that a research infrastructure (RI) such as CLARIN can contribute to or even advance, is in part inherent to the kind of data types that CLARIN is giving access to. They all can be seen as carriers of the societal and cultural dynamics and therefore as an entry point into the societal and cultural phenomena that are reflected in language use.

The following non-exhaustive list of data types may illustrate the richness

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[1] http://ec.europa.eu/research/openscience/.

of language materials and their potential for advancing research paradigms and enriching the value chain in data-driven studies with insights and instruments that can be adopted beyond scholarly contexts and that can play a role in what in the context of ESFRI[2] is labelled *Social and Cultural Innovation*:

- Parliamentary records
- Literary texts
- Social Media data
- Historical letters
- Oral History data
- Disciplinary libraries
- Institutional archival data
- Broadcast archives
- Newspaper archives

As for many of these datatypes resources are available in multiple languages, they form an excellent basis for comparative research of societal and cultural phenomena. This is in particular valuable in the context of Europe's multilinguality, which brings a clear demand for understanding how language affects identity and culture, and for the diversity across boundaries of time and regions.

Among the examples of research agendas that can illustrate the added value of well-supported access to the wealth of data types that are available for multiple languages are the research initiatives for the study of migration patterns, intellectual history, language variation across period and region, dynamics in mental health conditions, customer opinions and parliamentary discourse, just to name a few. In Fišer *et al.*[3] an overview is presented of a number of these so-called *families of language resources*[4] to which CLARIN gives access, including an analysis of the kind of annotation layers and licence models. In Section 4 we will dive into some more detail on the value chain in which there is role for parliamentary records.

4. *CLARIN and Open Science: FAIR and more*

For CLARIN to be able to play a role in the advancement of social and cultural innovation the adherence to the principles of the Open Sci-

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[2] ESFRI stands for European Strategy Forum on Research Infrastructure. Cf. www.esfri.eu.

[3] Cf. D. Fišer, J. Lenardič and T. Erjavec, *Meet CLARIN's key resource families*, «Proceedings of the Eleventh International Conference on Language Resources and Evaluation (LREC 2018)», Miyazaki, ELRA, 2018.

[4] https://www.clarin.eu/resource-families.

ence paradigm is a crucial precondition. What in this context is nowadays labelled as the so-called FAIR principles (Wilkinson *et al.*[5]) has been leading from the conception and earliest design of the data architecture adopted in the CLARIN infrastructure onwards. Figure 1 indicates schematically how a typical CLARIN-compatible data centre is organised in order to ensure the interoperability of data and tools across the centres in the infrastructure.

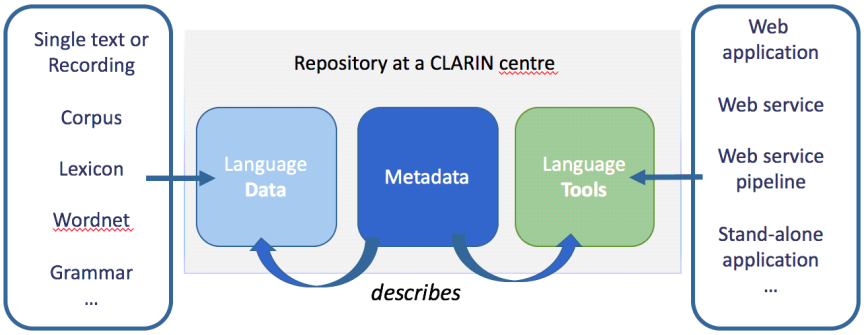

Figure 1. - The CLARIN data architecture: centre repositories.

The CLARIN single sign-on access platform is set up in such a way that through a metadata browser it gives pointers to all datasets integrated. This platform is known as the Virtual Language Observatory (VLO), CLARIN's metadata browser.[6] See De Jong *et al.*,[7] for a detailed description of how CLARIN materials are Findable, Accessible, Interoperable and Reusable (FAIR). The scalable environment for data and services is envisaged to enable digital data resources to be combined with relevant analysis tools.

To support the coupling of data and tools CLARIN has started to provide guidance on which tool is to select for which data type through a service called the Language Resource Switchboard (Zinn[8]). See Figure 2.

In addition to adherence to the FAIR principles, CLARIN aims to adhere to the principles of *responsible data science*, by promoting research that

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[5] M. D. Wilkinson, M. Dumontier, I. J. Aalbersberg, G. Appleton, M. Axton, A. Baak, N. Blomberg, J.-W. Boiten, L. B. da Silva Santos, P. E. Bourne, *The FAIR guiding principles for scientific data management and stewardship*, «Scientific data», 3 (2016), 160018.

[6] The VLO can be accessed here: http://vlo.clarin.eu.

[7] F. de Jong, B. Maegaard, K. de Smedt, D. Fišer and D. van Uytvanck, *CLARIN: Towards FAIR and Responsible Data Science in the Area of Language*, «Proceedings of the Eleventh International Conference on Language Resources and Evaluation», Miyazaki, ELRA, 2018.

[8] C. Zinn, *CLARIN Language Resource Switchboard*, «Proceedings of the CLARIN Annual conference», Aix-en-Provence, 2016.

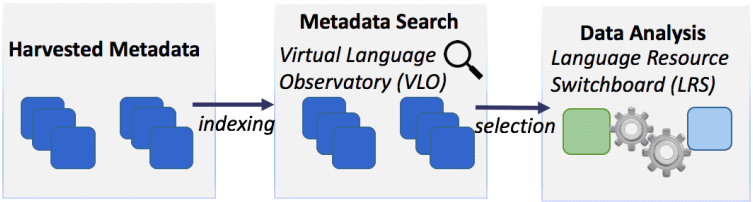

Figure 2. - The CLARIN data architecture: central processing of metadata.

can ensure adequate quality of underlying data, clarity on the performance levels of analysis tool offered by CLARIN, and transparency of the algorithms applied. The latter is considered crucial for the reproducibility of the outcomes of the studies conducted, and for the uptake in non-scholarly contexts. With the rapidly increasing amount of data-driven tools for analysis paradigms, often based on machine learning or similar methods, new demands regarding the explainability and interpretability of the results produced via data science, including text and speech mining, have emerged that CLARIN aims to integrate.

In addition, with the increasingly multidisciplinary contexts in which data-driven research is taking place there is strong need for deepening the insights in the validity of analysis outcomes and for novel frameworks for the integrated processing of multiple datatypes.

5. *The case of parliamentary data*

Parliamentary corpora are a very important multidisciplinary language resource that can be approached from many research perspectives, including not only political science, but also sociology, history, psychology, and applicative approaches to linguistics, such as critical discourse analysis. Parliamentary data can serve both as historical sources and as contemporary data, especially when contextual information is captured in the metadata.

In the current period of increasing social paradigm shifts, political polarisations and popular and populist movements, it has become increasingly important to examine political agendas and argumentation strategies, as well as the deeper motivations and ultimate goals of actors on the political stage in general, and in parliamentary institutions in particular, from diverse SSH angles.

Parliamentary data is an attractive data type because it is:

– a major source of socially relevant content
– a perfect basis for multidisciplinary research

– available in ever larger quantities under public licences[9]
– available for many regions and languages
– covering multiples modalities (text, audio, video)
– typically rich in metadata for multiple semantic layers

No wonder that in the case of parliamentary records a diverse community of users has indicated a strong interest and the potential value for societal impact of offering access to these datasets can be easily explained.[10]

The good availability of parliamentary proceedings in digitised form and granted access rights to public information in the EU countries have motivated a number of national as well as international initiatives to compile, process and analyse parliamentary corpora. The CLARIN infrastructure currently offers access to 18 parliamentary corpora,[11] covering almost all of the languages spoken in countries that are either members or observers in CLARIN ERIC. The corpora can be found through the VLO, and in the vast majority of cases the corpora can be directly downloaded from the national repositories or queried through easy-to-use online search environments.

In addition, CLARIN has supported the creation of a Linked Open Data translation of the verbatim reports of the plenary meetings of the European Parliament that has been enriched by links to other data in the context of the project Talk of Europe.[12]

Parliamentary recordings, and texts, such as transcribed debates and speeches, are of relevance for studying, for instance, how historical, cultural and religious attitudes are reflected in political discourse. Scholars have used the Talk of Europe dataset to study terms over time, for example in examining how the financial crisis was discussed in the European Parliament. The language captured in parliamentary records can also be studied as a carrier of emotion, and of the correlation with other phenomena related to cultural and social dynamics.[13]

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[9] The wide availability of parliamentary proceedings is in part due to the Freedom of Information Acts that are supported by the United Nations and set in place in over 100 countries worldwide.

[10] D. Fišer, M. Eskevich and F. de Jong, «Proceedings of LREC2018 Workshop ParlaCLARIN: Creating and Using Parliamentary Corpora», Miyazaki, ELRA, 2018, http://lrec-conf.org/workshops/lrec2018/W2/pdf/book_of_proceedings.pdf.

[11] An up-to-date list of corpora can be found here: https://www.clarin.eu/resource-families/parliamentary-corpora.

[12] See A. van Aggelen, L. Hollink, M. Kemman, M. Kleppe and H. Beunders, *The debates of the European Parliament as Linked Open Data*, «Semantic Web» 8 (2016), n. 2, pp. 271-281.

[13] See L. Rheault, K. Beelen, C. Cochrane, G. Hirst, *Measuring emotion in parliamentary debates with automated textual analysis*, «PLoS ONE», 11 (2016), n. 12: e0168843.

However, in order to turn this potential into actual impact a multidisciplinary research agenda is only a good beginning. To guarantee that the outcome can be taken up by citizens, journalists, policy makers and other professionals, representatives of these groups need to be actively involved in the design of research projects. Without applying the principles of co-design, the chain of steps in which CLARIN plays a role and by which value can be created out of data is unlikely to reach closure.

6. *How to demonstrate/increase impact*

In the previous section it has been argued that the kind of data that the CLARIN infrastructure gives access to, can be attributed a high potential for societal impact, but of course it takes more than a good data infrastructure for researchers, professionals, and citizens to be able to actually being able to generate impact. In order for potential communities of use to work with the data and relevant tools that are on offer, RIs also have to respond to needs and demands such as the following:

- ease of findability of data and access
- pointers to tools
  - with relevant functionality
  - with predictable performance levels
  - that interoperable with the data formats
- well-structured help files and adequate instructions for how to use the RI
- descriptions of scenarios of use for which the RI can have a contribution

In other words, in order to have impact, an RI has to be more than a technical platform. In addition it has the role of knowledge broker and supporter of initiatives that can bring methodological innovation. In the case of CLARIN this role is getting shape through:

- the organisation of workshops to stimulate multidisciplinary collaboration
- support for the establishment of training nodes
- maintenance of a network of knowledge centres covering a range of topics of expertise
- the offer of a platform for communities of use
- stimulation of collaboration between scholars and non-academic parties

The task of *demonstrating impact*, either along traditional scholarly dimensions (such as excellence), or other more indirect dimensions of impact (in the wider societal context, including uptake by policy makers, in educational settings, and through industrial collaboration) is coming with

yet another kind of demand. Apart from setting adequate frameworks for measuring key performance indicators and organising benchmarks, this is taking shape through, *inter alia*, specific awards that can help to show that the CLARIN infrastructure contributes to the training of the new generation of data scientist, videos with testimonies from users who explain the added value, and attractive narratives about breakthrough results that are of interest to a wide non-academic audience.

A perfect example of the latter is described by Kestemont *et al.* who summarise the process of solving the riddle of the authorship of the Dutch national anthem based on the data resulting from a large-scale digitisation project for textual cultural heritage data.[14] In this case alternative hypotheses could be suggested based on text mining, while only the confrontation with existing insights in the16th century cultural context and the literary conventions at the time of creation could bring the authorship attribution to a next level of validation. It should be underlined that for such use cases, the collaboration with domain experts is equally important as well as a thorough understanding of the dynamics of multidisciplinary collaboration. Being able to tell the story or new insight from multiple perspectives considerably helps to bring the discovery across.

7. *Concluding remarks*

In line with the conversion of human society into a data-intensive ecosystem, the sources and methods for research in the social science and humanities have undergone a huge transformation. Large volumes of cultural heritage material have been digitised, while 'born digital' material is made available at a pace that increases the demand for methodologies and tools in unprecedented ways. With well-equipped and adequately governed research infrastructures this demand can be addressed and geared towards realising the potential of the emerging research paradigms for social and cultural innovation.[15]

But attention for the prerequisites that go beyond what is needed to

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[14] See M. Kestemont, E. Stronks, M. de Bruin and T. de Winkel, *Did a poet with donkey ears write the oldest anthem in the world? Ideological implications of the computational attribution of the Dutch national anthem to Petrus Dathenus*, «Abstracts of DH2017», Montreal, 2017, https://dh2017.adho.org/abstracts/079/079.pdf.

[15] K. de Smedt, F. de Jong, B. Maegaard, D. Fišer and D. van Uytvanck, *Towards an Open Science Infrastructure for the Digital Humanities: The Case of CLARIN*, «Proceedings of the Third International Conference on Digital Humanities in the Nordic Countries (DHN2018)», Helsinki, 2018.

create technically sound and secure platforms should be carefully taken into account. The training of those than can benefit from the infrastructures in scholarly work directly is important, but in order to stimulate indirect impact as well, e.g., in the form of increased insights among professionals and citizens on how to collaborate with experts that understand the foundations of data science, new models of collaboration between scholars and people working outside academia need to be developed with high priority.

This recommendation is fully in line with the plea in Žic Fuchs for attributing value to 'multidisciplinarity' as a key factor for broadening the user base of RIs and fostering innovation.[16]

Any conceptualisation of the notion of impact that is adopted as a leading notion in the assessment of RIs and the evaluation of their sustainability should imply that this value is taken into account. This will help understand the diversity of paths leading to impact and identify chances for the increase in impact.

Acknowledgement

Some of the insights reported here resulted from investigations for which partial funding was received from the European Union's Horizon 2020 research and innovation programme under grant agreement 654119 for project PARTHENOS.

[16] M. Žic Fuchs, *ESFRI in Future Contexts of Impact: Research Infrastructures in SSH*, in this volume.

Rory Fitzgerald, Stefan Swift

MEASURING THE IMPACT OF THE EUROPEAN SOCIAL SURVEY

Abstract

The ESS has over 120,000 registered users and there are over 3,000 publications that have used ESS data. The ESS recently commissioned an impact case study that used a range of qualitative and quantitative measures to assess the impact of the infrastructure. This paper will give an overview of the methodology used in the study and present some of the key findings.

Introduction

The European Social Survey (ESS) is a pan-European research infrastructure providing freely accessible data for academics, policymakers, civil society and the wider public. It was awarded European Research Infrastructure Consortium (ERIC) status in 2013.[1]

The work of the ESS ERIC includes organising a survey every two years measuring social attitudes and behaviour; utilising and developing the highest standards in cross-national research; providing direct and virtual training programmes; and supporting free access to its growing data and documentation archive.

Participating Members fund a central team who design and provide quality assurance for the survey as well as distributing and curating the data. Members fund their own national teams to implement the survey in their country, most commonly engaging commercial survey agencies, National Statistical Institutes and non-profit research institutes to conduct interviews in peoples' homes.

The ESS has been mapping attitudes and behavioural changes in Europe's social, political and moral climate for over 15 years. Launched in 2001, the first round of surveys was conducted in 2002 and gathered results from 22 countries. Since its inception, 36 countries have taken part in

[1] *Eur-lex.europa.eu. (2013): EUR-Lex-32013D0700-EN-EUR-Lex*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013D0700> accessed 21 Jun. 2018.

one or more rounds of the ESS – a figure set to rise to 37 during Round 9 fieldwork in the latter part of 2018.

By adopting rigorous approaches to probability sampling, question-testing, event-recording, translation and response rate enhancement, the ESS has become an authoritative source of information about changing social values in Europe.

This general social survey measures attitudes on a wide range of subjects. The ESS was primarily designed as a time series to monitor changing attitudes and values across Europe.

The questionnaire therefore consists of a main core section that includes a number of questions that have been answered every two years since 2002. Each question has a unique identifier to enable people to easily compare data over time.

The development of this 'core' part of the ESS questionnaire followed recommendations made by academic experts who were consulted by the Core Scientific Team during the early planning stages of the ESS. Additionally, in each round of the ESS, multi-national teams of researchers based in ESS countries are selected to contribute to design part of the questionnaire. Two 'rotating' modules are selected following a Call for Proposals issued every two years.

As a result, the ESS always includes questions measuring attitudes towards the media, health and wellbeing, trust in institutions and governments, education and occupation, social capital and social trust, household circumstances, citizen involvement and democracy, social exclusion, political values and engagement, socio-demographics, immigration and crime.

The ESS has asked questions designed in collaboration with external academics on citizen involvement, health and care, economic morality, family, work and wellbeing, timing of life, personal and social wellbeing, welfare attitudes, ageism, trust in the police and courts, democracy, immigration, social inequalities in health and attitudes to climate change and energy security. Some of these topics have been repeated in subsequent waves of the survey.

Measuring impact

The ESS has always made attempts to comprehensively measure the impact of the data.

The ESS website records the number of users who access and download data from the ESS website.[2] All registered users must provide their

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[2] *Europeansocialsurvey.org. (2018): User statistics*, in *European Social Survey (ESS)*, <http://www.europeansocialsurvey.org/about/user_statistics.html> accessed 21 Jun. 2018.

name; email address; institution; country; type of activity and academic discipline. An agreement that all data users must adhere to stipulates that research published using ESS data is deposited in the online Bibliography. Whilst this has limitations (users are expected to deposit their own publications), the ESS is able to estimate the number of publications that include ESS data.

As at 15 June 2018, 124,217 people have registered to view or download ESS data. The information that users must provide allows the ESS to determine the country where ESS data is most commonly accessed: Germany (10.4%); the United Kingdom (8.3%); Belgium (8%); the Netherlands (6.1%); Spain (5.6%); United States (5.4%); Norway (4.9%); Poland (4.6%); Italy (3.9%); France (3.5%). These numbers represent the countries where the ESS data is most commonly accessed, accounting for 60.7% of all registered users.

The most common activity stipulated by these users is Students (65.8%) followed by Faculty and Research (18.1%). The remaining activities listed include PhD Thesis (7%); Private Individual (2.8%); Organisation (NGO) (1.7%); Government (1.5%); Other (1.5%); Private Enterprise (1.3%); and Journalist (0.3%). The total number of data downloaders, as at 15 June 2018, is 88,839.

When assessing the online publications repository, the ESS Bibliography,[3] it can be ascertained that 3,001 academic texts have been published using ESS data (as at 19 June 2018). These publications can be classified as: journal article; book; book chapter; report; working paper; thesis/dissertation; conference paper/poster; newspaper/magazine article; available manuscript; and anthology/edited volume. It is probable that this system of self-reporting means that the ESS significantly underestimates the total number of research papers that have been published. Further initiatives introduced to measure the impact of the ESS data detailed later in this paper confirm this.

Google Scholar

A work package led by Brina Malnar, University of Ljubljana, to analyse impact indicators has been included in the ESS ERIC Work Programme since the ESS became a European Research Infrastructure Consortium in 2013. From this work, the ESS is able to measure more accurately the total number of publications using Google Scholar.

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[3] *Europeansocialsurvey.org. (2018): Bibliography*, in *European Social Survey (ESS)*, <http://www.europeansocialsurvey.org/bibliography/> accessed 21 June 2018.

The most recent analysis – ESS annual bibliographic report 2017 – was produced in December 2017 and assessed publications listed on Google Scholar that made reference to ESS data in the period 2003-2016. Analysis found that 3,554 English-language publications (journal articles; books and chapters; working papers) could be found on Google Scholar over the period: a significantly higher number than those listed in the ESS Online Bibliography over a longer period of time (up to 19 June 2018).

This analysis also found that over 400 publications are published every year, and compared the number of publications that feature ESS data with those that are published based using data from other comparable international social survey projects, specifically, the World Values Survey (WVS); International Social Survey Programme (ISSP); and European Values Study (EVS). In terms of a keyword search over the period (2003-2016), the ESS was mentioned in 22,210 publications – second only to WVS (31,929) and considerably higher than ISSP (10,556) and EVS (9,430).

Analysis of Google Scholar also allows the ESS to assess which subject areas are covered by the publications using ESS data, and even which items of the survey are most commonly used amongst academics, researchers, scholars and students. Among the 3,554 ESS publications and presentations in the 2004-2016 period, 84.4% were found to be substantive and 15.6% methodological. Similar to other comparative surveys the most popular topic is politics and democracy and political participation in particular (803 publications). Other areas where relatively large numbers of publications have been produced using ESS data include immigration (430); public policies, welfare (366); work (361); economy (240); social wellbeing, quality of life (299); social capital (285); family (278); culture, values (269); and inequalities (266).

The research also established detailed information about the journals where ESS-related research is most commonly published. 670 journals published articles based on ESS data. However, almost 45% of ESS articles were published in just 26 journals, while the remaining 55% are dispersed across 644 journals. In fact, there are 534 journals with just one or two ESS based articles, reflecting the worldwide trend of growth in the number of active, peer-reviewed journals, in particular online-only journals.[4]

Accordingly, there is a relatively small number of journals with high concentration of ESS articles (2-4 with very high and about 20 more with moderately high), an interesting insight when planning communication or dissemination actions targeting journals or editors who are well acquaint-

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[4] X. Gu and K. L. Blackmore, *Recent trends in academic journal growth*, «Scientometrics», 108 (2016), n. 2, pp. 693-716.

ed with ESS, or targeting specific groups of academics to exploit less used modules. In any case, the spread of ESS articles across journal fields indicates ESS has established itself as an important data source in a number of social science academic communities.

This Google Scholar research also attempts to understand the geography of the first authors who have undertaken this published research; which country's data were used in all the publications; the use of core and rotating modules; and the use of ESS questionnaire items. Some of this data is currently being used to inform a review that is being undertaken of the core questionnaire.

European Social Survey sustainability (ESS-SUSTAIN)

ESS ERIC was awarded a € 2.3 million grant through the European Commission's Horizon 2020 programme to implement a new project, ESS-SUSTAIN (project number 676166). The project, which began in October 2015, aimed to strengthen the long-term sustainability of the research infrastructure and measure the impact of existing data more comprehensively. SUSTAIN's work programme was ultimately designed to help increase the number of countries that participate.

The most important activities in the project were set out in September 2015:

- To enhance the long-term commitment of existing Members and Observers of ESS ERIC;
- To effect the transfer of the current Guest status of some countries to more stable memberships;
- To expand the coverage of the ESS to not yet affiliated countries;
- To foster global links with other regional cross-national social surveys; and
- To highlight the impact of the ESS in participating countries

The project aimed to increase the number of member countries (members must commit to two waves – or four years participation) which would lead to reduced participation costs for all countries, and would strengthen the coverage and analytical power of ESS datasets. The grant has supported a number of activities, including an impact case study in member countries, the appointment of ESS ambassadors to promote the study in non-member countries and enhanced communications to highlight the output arising from the survey.

Activities included in the ESS-SUSTAIN have enabled the ESS to expand its knowledge of measuring the academic, non-academic and teach-

ing impact of the project. The INFRADEV 3 project began on 1 October 2015 and included work package specifically dedicated to communications, membership development and monitoring impact. This latter work package included a number of deliverables to help the infrastructure better understand the full extent of the impact of its data.

This has enabled the ESS to introduce an Impact Monitoring Tool that is accessible through the national coordinators' intranet. This enables national teams to record any dissemination activities – press releases, events, seminars, etc. – that have been undertaken and allowed them to measure the impact (in terms of number of attendees, media articles, etc.) This tool has been designed to enable the central ESS team to better understand where dissemination efforts have been made, and what impact this has had. This will ensure more thorough insight into the impact of ESS data.

Impact study

Funded by the ESS-SUSTAIN project, Technopolis Group (UK) were tasked with undertaking an ESS ERIC Impact Study[5] in June 2016 following an invitation to tender (ITT) issued in May 2016. Published in September 2017, the report assessed the academic, non-academic and teaching impact that has been achieved through the ESS. It also considered how these were achieved, what constitutes best practice and made recommendations to ensure the project's long-term future.

The Impact Study was included in SUSTAIN in order to provide the ESS with more comprehensive data measuring impact. This data is aimed primarily at funders to estimate the return on investment and provide inspiration for greater and more diverse impact in the future. The description of the work was built on an earlier study procured by the UK funding agency for the social sciences, the Economic Social Research Council (ESRC) and conducted by the University of the West of England.[6]

The study assessed the impacts that have been achieved through the ESS, by all different user groups and in all current member/observer countries. It also assessed how these impacts came about (pathways to impact), identified best practice, and made recommendations to ensure the long-term sustainability of the ESS.

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[5] *Europeansocialsurvey.org. (2018): ESS Impact*, in *European Social Survey (ESS)*, <https://www.europeansocialsurvey.org/findings/impact> accessed 21 June 2018.

[6] *Esrc.ukri.org. (2013)*, <https://esrc.ukri.org/files/research/research-and-impact-evaluation/wers-and-ess-impact-study/> accessed 21 June 2018.

In undertaking the study, Technopolis examined academic resources, sought out examples of non-academic use of our data, interviewed stakeholders and carried out an online survey of data users. The report found that the ESS continues to be highly regarded amongst international surveys, offering high quality data that is a critical academic resource for researchers across the social sciences. It also found that ESS data is notable as a teaching resource, particularly within materials developed for use by students who are learning about survey methodology and quantitative data analysis.

Technopolis explored the ESS user statistics in more detail. They established that it took approximately eight years to reach 50,000 registered users (2004-2012) but less than five additional years to reach 100,000 (2012-2017), with around two thirds of registered users having downloaded ESS data. It also stated that, since 2014, there have been 12,000 new registered users on average per annum. The report also analysed the number of users per country according to their ESS user density. For example, it established that Slovenia has the highest number of users as a proportion of its national population.

The Impact Study also made attempts to understand in which institutions that the ESS data is most used. It included a table of the 20 institutions with the highest number of registered user users. It established that ESS data is most used amongst those at Universiteit Antwerpen (Belgium), University of Ljubljana (Slovenia), KU Leuven (Belgium), University of Amsterdam (Netherlands), University of Bergen (Norway), Sciences Po (France), Université de Liège (Belgium), Norwegian University of Science and Technology (Norway), University of Vienna (Austria) and National Research University (Russia). The top 10 institutions referenced accounted for 11,404 registered users (over 10% of the total).

This additional analysis of existing ESS user data was also able to identify slumps, spikes and accelerations in the number of people registered to access ESS data by country. This is enabling the ESS to better target resources to increase the number of users, and therefore increase impact arising from use of its data.

The Impact Study included bibliometric analysis undertaken by the Centre for Science and Technology Studies (CWTS), which found that the ESS online Bibliography underestimates the actual number of journal articles using our data by around 20%. CWTS searched for publications based on keyword searches in titles and abstracts ('European Social Survey' or 'ESS'). This uncovered 245 additional publications, which were not registered in the online bibliography. The analysis therefore found a total of 960 ESS-based publications in the Web of Science (WoS) database: 933 articles, 9 reviews and 18 non-citable items (such as letters or editorials). Of these, 715 were

listed in the ESS Bibliography, which, for this particular sub-section of journal articles, meant that the ESS Bibliography accounted for 76.6%.

CWTS also discovered that academic output using ESS data tends to perform highly on bibliometric indicators across a broad range of topics. Overall, ESS publications show a relatively high academic impact in achieving a mean normalised citation score (MNCS) of 1.79 which is substantially above the average of 1.0. Similarly, with 181 high-impact publications (i.e., belonging to the top 10% most-cited of their microfield), the ESS publications perform well (22% achieve such a high impact, where 10% would be the world average).

The publications appeared in journals that perform relatively well with a mean normalised journal score (MNJS) of 1.43. Since the MNCS (1.79) is higher than the MNJS (1.43), ESS publications do a bit better than would typically be expected based on the metrics of the journals in which they were published.

The impact study also found evidence of non-academic impact. Across member countries, many cases where ESS data was used in many different policy and practice contexts was found. This has helped to influence policy decisions and inform public and political debates. The Technopolis report found that in some current member/observer countries, there is widespread use of the ESS in parliaments, ministries or government agencies.

Examples of where ESS data has been used by Governments or their agencies include the Austrian Ministry for Social Affairs, Estonia's Ministry of Social Affairs, the French governmental think tank, France Stratégie, the German Federal Government, the Irish police force, Poland's Central Statistical Office, the Portuguese Centre for Judicial Studies and the Institute of Macroeconomic Analysis and Development of the Republic of Slovenia.

ESS data has also helped inform international organisations such as Eurofound, United Nations Economic Commission for Europe (UNECE), European Commission's DG EMPL (Employment, Social Affairs and Inclusion), OECD as well as think tanks including the Centre for European Policy Studies and European Policy Centre.

In making recommendations, the Technopolis report stressed the importance of continued funding and consistent involvement of countries over time. The addition of other European countries not already involved in the ESS would further help to ensure the long-term sustainability of the project.

Media coverage

The ESS-SUSTAIN project also included a work package to enhance the communications activity of the ESS. This included provision for the ap-

pointment of a Media and Communications Officer who has been attempting to increase non-academic impact. This has led to comprehensive monitoring of media articles that include ESS data that have been published since January 2016. Accounting for online and traditional media outlets – including print and broadcast media; academic institutes; and blogs, there has 2,748 media items that mention the ESS in the period from January 2016 to May 2018. This has included media coverage published in 74 countries across the world, most prominently in ESS member countries and the United States of America.

The ESS has also launched three social media channels, notably on Facebook, LinkedIn and Twitter. The first of these accounts to launch, Twitter, has posted on almost 4,000 occasions to over 5,000 followers. This leads to an average of 200,000 impressions ('Times a user is served a Tweet in timeline or search results') each month. The ESS Facebook page is followed by 603 people. This led to 1,047 engagements over the most recent twenty-eight day period (23 May to 19 June 2018). The LinkedIn company page is followed by 282 people.

Methodological impact

The ESS has influenced the methodology used for high quality comparative social research and set new standards of openness in terms of access to data. Surveys such as the Survey for Health, Ageing and Retirement in Europe (SHARE), the European Values Survey and the Eurofound surveys amongst others have referenced ESS approaches in their work whilst ESS itself has also improved by reference to some of those studies (in particular SHARE). Much of this impact happened in the earlier days of ESS however the survey remains a key reference source for comparative surveys. Through the SERISS grant ESS (www.seriss.eu) has ensures it remains at the forefront of new methods including experiments regarding different translation approaches and the trialling of the words first input harmonised, cross-national probability based on-line panel.

Conclusions

The ESS has achieved data user figures beyond initial expectations with data user figures being rather impressive. The use of data by students across Europe is particularly encouraging and suggests a positive increase in other outputs in the future is likely. The number of publications is also prom-

ising however it would be good to see this increase in the future and for more data users to translate data use into the production of publications or other outputs.

The ESS is clearly informing public policy and public discussion of some of the grand challenges facing society. The scale and reach of this international impact is a source pride for the ESS team. Furthermore by taking the impact agenda so seriously it is likely that ESS itself will promote the value of the social sciences beyond academia a response to the grand challenges facing Europe and the wider world in the future.

Axel Börsch-Supan

THE SOCIO-ECONOMIC IMPACT OF THE SURVEY OF HEALTH, AGEING AND RETIREMENT IN EUROPE (SHARE)

Abstract

SHARE, the Survey of Health, Ageing and Retirement in Europe, is an infrastructure of longitudinal micro data to better understand ageing and its social and economic challenges. It measures individual health, economic and social living conditions in twenty-seven European countries and Israel. Data cover about 230,000 interviews of about 120,000 respondents aged fifty and over (March 2018). They include detailed income and assets, social environment, physical health, blood and cognitive batteries.

Deepening our knowledge of individual and population aging

Europe's population is ageing. Consistently low birth rates and increasing life expectancy are transforming the age pyramid of the European Union towards a much older population structure. This development will lead to a decreasing number of people of working age while the relative number of pensioners is increasing. The challenges resulting from this transformation are manifold. While maintaining the stability of pension, health care and long-term care systems in the face of less-younger people having to provide the social expenditures for the increasing share of older persons is the overarching problem, its implications for the various individual domains of social policy are complex and there are many knowledge and information gaps. These gaps include most prominently the determinants of healthy ageing, the implications of the ageing process for the well-being of the population, and the societal costs of improving public health and maintaining social insurance schemes. Examples of socio-economically relevant research questions are:

– Which causal pathways create the ubiquitous link between health and economic status? How important are they? Can they be influenced by welfare state policy? If so, how and ideally when during the life course?
– What are the effects of a shift of retirement age in the wake of population aging? How much labour supply can and will be added? For which type of individual (including their work history) will the side effects on health, cognition and social inclusion be positive or negative?

– How will intergenerational relationships change as Europe's diverse populations age? What is the interplay between family help and state support when long-term care needs will increase due to higher dementia prevalence? How will bequests and transfers react to cuts in pension benefits? How do these developments differ between the Nordic, Western, Central, Eastern and Mediterranean countries?

These research questions need data to be understood. Such data will also help to handle the underlying socio-economic challenges in a rational and effective matter. SHARE, the Survey of Health, Ageing and Retirement in Europe, is designed to provide these data.

SHARE is a cross-national longitudinal population survey focusing on the interactions among employment, health, economic and social status with a European focus. SHARE provides data on health, socio-economic status as well as social and family networks, thus enabling interdisciplinary research and evidence-based policy making on both the national and the European level. SHARE currently covers all continental Member States of the European Union as well as Israel and Switzerland. Furthermore, SHARE's harmonisation with its various sister studies, most notably the HRS and JSTAR, permits demographic analyses in a truly global perspective.

SHARE started data collection in 2004. Every two years a new wave of data has been added. The most recent main data collection – Wave 7 – took place in twenty-eight countries in 2017, extending SHARE to eight EU Member States which had not been covered so far: Finland, Latvia, Lithuania, Slovakia, Romania, Bulgaria, Malta and Cyprus. The integration of these countries means that full European coverage will be reached with the release of Wave 7 data: all continental EU Member States will be included in SHARE while data for Ireland is available from SHARE Waves 2 and 3, and England is covered by SHARE's sister study ELSA, the English Longitudinal Study of Ageing. This extended coverage will enable the European Commission and researchers to perform comparative analyses of employment, health, economic and social status with strictly harmonised data across all EU Member States.

This «European coverage» is essential to stay on top of the challenges posed by population aging since policy makers need detailed evidence to base their decisions on and to evaluate where they are standing relative to other countries, e.g., as part of the «European semester». The plurality of European countries in SHARE, their different cultures, histories and policies provide a unique database to comprehensively study the interactions of macro-level forces with the heterogeneity of individual life circumstances in the European population. It is exactly this plurality, which makes the SHARE data so powerful for policy analyses and gives Europe an advan-

tage vis-à-vis the US. SHARE data for all twenty-eight countries provide sufficient long-term data to study the many complex interactions between health, gender, economic and socio-psychological status.

SHARE has three types of socio-economic impact. Firstly, it delivers data for many researchers in order to close the many knowledge and information gaps in understanding individual and population ageing. This new knowledge will then help citizens directly, e.g., with better preventative public health actions. Secondly, SHARE helps governments and international institutions on the global, European, national and regional level to make more informed policy decisions. Thirdly, SHARE provides jobs for young researchers and a host of small and medium sized enterprises.

User uptake and publications

In March 2018, SHARE welcomed the 8000th officially registered data user (Figure 1). Users come from all over the world. The increase in user registrations has been more than proportional from the outset: From about 200-300 user registrations in the first four years, the number of new users has increased to more than 1,100 in 2017. The ever-growing number of new users demonstrates the importance of SHARE.

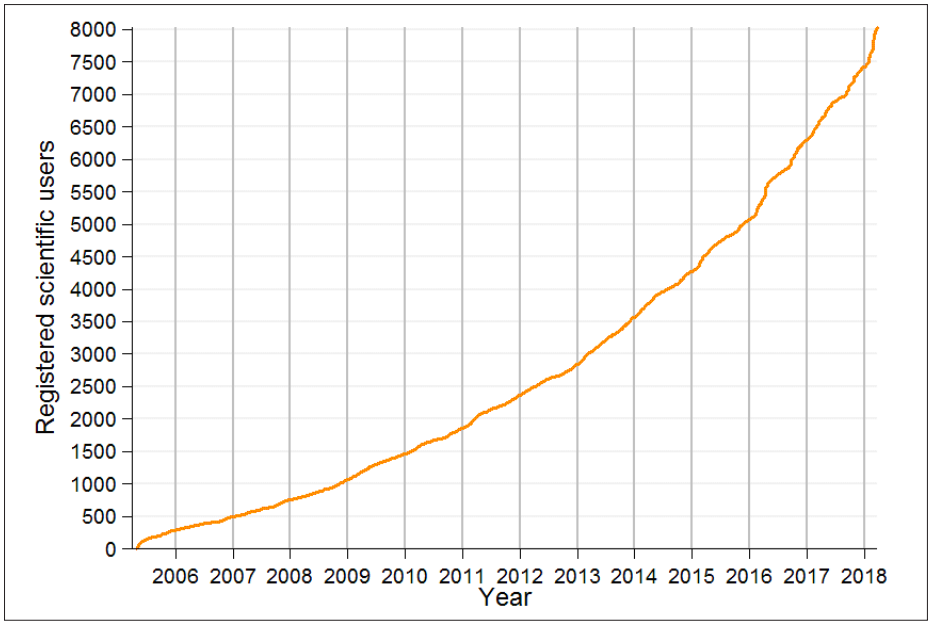

Figure 1. - Registered users or user groups of the SHARE data as of March 2018.

The almost exponential growth of users reflects the fact that each new wave adds additional value to the earlier waves. This in turn has a scientific reason: the ageing process needs to be studied in its development over time; it cannot be identified in purely cross-sectional data; the longer the time horizon covered by the study, the more we learn about the ageing process from the pre-retirement period to illness and death.

Most of the users are from European countries, but there is also an increased number of users from countries all over the world. The US remains the country with the highest number of users outside Europe. This shows the value of the comparability of SHARE data with other international ageing surveys, especially the Health and Retirement Study (HRS) in the US and the Japanese Study of Aging and Retirement (JSTAR).

While the community of SHARE users is continually growing, so is the number of publications based on SHARE data (Figure 2). By the end of 2017, more than 2,000 publications had used SHARE data for their analyses. The majority of publications are articles in scientific journals, including about 530 Social Science Citation Index ranked articles. In 2017 alone, 117 articles using SHARE data have been published in peer-reviewed journals. An overview of all SHARE based publications is available on our website: www.share-project.org/share-publications.html. Note that the publications in 2018 refer to the first two months only.

Evidence-based policy design

SHARE data and SHARE-based research have been used for the analysis of a wide range of policy issues, ranging from the supply and demand of care to the effectiveness of governmental efforts to better prepare citizens for retirement, from cross-country comparisons of health system performance to the health condition of older people in Europe. We have selected a number of examples to illustrate how SHARE's strength of providing scientific evidence has been used by the European Commission, individual EU Member States and international political organisations.

Austria: SHARE research was used by the Austrian Federal Ministry of Science, Research and Innovation and the Austrian Statistical Office in a feasibility study aimed at estimating differential mortality. Socio-economic differences in mortality have become increasingly important in pension reform. Many European countries cannot provide official figures on the subject, and available figures are not easily comparable between countries. The study develops a new approach to obtain comparative European figures based on the harmonised SHARE survey data.

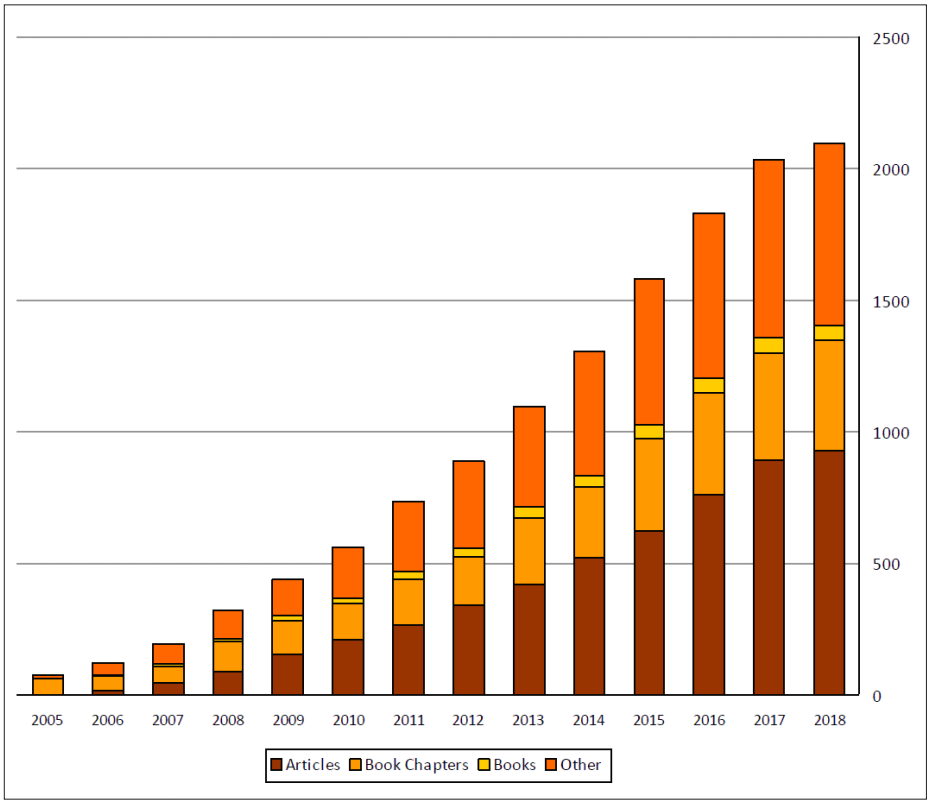

Figure 2. - Cumulative publications using SHARE data as of March 2018.

Estonia: SHARE data was used in the report «Reducing the Burden of Care in Estonia» which was delivered by the World Bank and commissioned by the Estonian Ministry of Social Affairs. It contains an assessment of the current situation of long-term care in Estonia and projected needs and spending, which is then used to develop policy recommendations and scenarios. SHARE data was intensively used in outlining the state-of-the-art on this issue. In Estonia, the burden of care is mainly carried by family members while care services and funding possibilities are only poorly developed. The report outlines the policy scenarios which distinguish between urgent priorities that must be addressed even in the context of current low spending on the one hand, and investment in the building blocks needed to achieve the 'ideal system' on the other. Furthermore, the analysis department of the Estonian Government Office has used SHARE data to inform members of parliament about the current employment situation of older people in Estonia. The data have been used to provide members

of parliament with evidence in the ongoing discussion about working beyond retirement age.

Germany: SHARE data was used to compare people's expectations of their future pensions with the actual projected amount. It was shown that Germans overestimate their future pensions. Furthermore, it could be demonstrated that targeted information about future pensions incentivized citizens to better prepare for retirement through increased private retirement savings. This has sparked a new law that will provide targeted information on future pension benefits for all citizens. The analysis was made possible by the linkage of SHARE with administrative data of the German Pension Insurance.

European Commission. SHARE research was used for DG EMPL's report «Employment and Social Developments in Europe 2017». The report has become the key reference document for policy-makers and stakeholders active in social and labour market policies. It provides comprehensive coverage and thorough economic analysis of major trends affecting the social and employment situation of EU citizens. The 2017 review focused on intergenerational fairness and solidarity. SHARE research was used to analyse how older employees can extend their working lives by means of a transition to self-employment and how this is influenced by institutional settings. SHARE analyses have been used for many other policy issues, among them:

- the supply and demand of long-term care in Europe
- adequate and sustainable pensions to achieve good living standards in older age
- delivering higher effective retirement ages
- the linkages among socio-economic status, health, health behaviours, health utilisation, insurance coverage, and social participation.

Furthermore, DG SANTE is using SHARE data to study chronic, non-communicable diseases.

OECD. As in previous editions, SHARE data are part of the «Health at Glance 2017: OECD indicators» report. The report is a cooperation between the European Commission and the OECD and presents up-to-date cross-country comparisons of the health status of populations and health system performance in OECD and partner countries. SHARE research was used for an overview of perceived health status. Furthermore, SHARE data was used to analyse the providers and recipients of informal care in Europe. The analysis also uses the harmonisation of SHARE with its sister studies HRS and ELSA to compare the prevalence of informal care in Europe, the US and the UK. In its 2017 report «Preventing Ageing Unequally», the OECD extensively uses SHARE data. The report examines how population ageing

and rising inequalities have been developing and interacting, both within and across generations. It suggests a policy agenda to prevent, mitigate and cope with such inequalities, drawing on good practices in OECD countries and emerging economies. Specifically, SHARE data is used to

- demonstrate the inequalities in ageing and the reasons why policymakers should care about this issue
- show that employment and income patterns are changing across generations
- analyse trends and social disparities in disability among people aged 50 and over
- study the barriers to longer working lives and the retirement decision
- examine living conditions in later life, specifically in terms of long-term care.

Furthermore, the OECD has used SHARE data in a study aimed at measuring social protection for long-term care. The report presents the first international quantification and comparison of levels of social protection for long-term care in fourteen OECD and EU countries. It quantifies the cost of care, the level of coverage provided by social protection systems, the out-of-pocket costs that people are left facing, and whether these costs are affordable. Specifically, SHARE data was used to analyse the impact of care on caregivers to develop ways of providing support to help informal caregivers remain in work and good health.

United Nations. The UN's European Centre for Social Welfare Policy and Research has used SHARE data in a project that aims at providing policy-relevant analytical and methodological support on the developments in income distribution, poverty, social exclusion and material deprivation as well as health. It helps the Commission in its efforts to monitor living standards and life chances across the EU and across different groups in society, and to evaluate how policies affect them. SHARE data is specifically used to examine the health condition of older people and the extent to which they are affected by impairments, including mental disabilities. It is also used to compare the health condition of those in employment with those who have retired or are unemployed as well as with those who are economically inactive but not yet retired.

Jobs: Researchers and small and medium-sized enterprises

SHARE provides jobs for researchers and support personnel in its twenty-eight-member countries. About 200 researchers are paid by SHARE; another about 100 SHARE researchers are paid by their universities or academic institutions. SHARE has generated many B.A., M.A. and Ph.D. theses

as a foundation for careers. Furthermore, SHARE gives subcontracts to software developers and survey agencies in a large scale. SHARE has advanced the state of survey software with large cross-effects on other studies and surveys. About thirty survey agencies hire more than 2,000 interviewers to conduct the interviews in forty different languages. SHARE subcontracts also the chemical analyses of blood collected from the respondents to specialised laboratories. They have developed new techniques to identify biomarkers with very tiny amounts of dried blood so we can spare our respondents the pain of taking venous blood.

Conclusions: Measurable and unmeasurable impact

Socio-economic impact is most easily measured in money units if it relates to creating jobs and subcontracts. This is the third of the three types of impact briefly described in the preceding section. Much more important, however, are the other two types. Improving the lives of individuals in an aging society is the primary goal of SHARE. For instance, changes in preventative care thanks to research that helps to better link medical care to the social background of older individuals can have a huge impact on many people, but are hard to measure in monetary terms. Even harder to measure is the impact of SHARE on better policy design. A good example is pension reform. Public pension expenditure in the EU amounts to about 2 trillion Euros. Already small changes in pension policies carry thus very large price tags. SHARE is designed to help policy makers to make informed decisions about these huge sums of money.

Laurent Romary, Jennifer Edmond

A TANGENTIAL VIEW ON IMPACT FOR THE ARTS AND HUMANITIES THROUGH THE LENS OF THE DARIAH-ERIC

Abstract

The reflections in this chapter stem from the perspective of the DARIAH-ERIC, a distributed infrastructure for the arts and humanities. They explore how impact can take a variety of forms not always considered when the term is applied in a strictly technocratic sense, and the idea that focussing on the user of a research infrastructure may not describe an optimal relationship from an impact perspective. The chapter concludes by presenting three frames of reference in which an infrastructure like DARIAH can have impact: to foster excellence through impact on researchers, promote fluidity through impact on policymakers, and support efficiency through impact on our partner organisations.

Introduction

We find ourselves in a time when data, and in particular big data, has become an object of central focus in both research and in industry. In the arts and humanities, however, having big data is far less important to creating insight than having smart data. By smart data, we mean digital information that may or may not be structured, but which is rich in context and readily linked to related resources, analogue and digital, that can help to corroborate conclusions and instigate the development of new theories. Researchers looking at sources in domains such as history, geography, literature, linguistics and the arts know that each piece of data is something essential, which needs to be documented, identified, analysed and communicated in such a way as to preserve these many marks of provenance and honour the people and institutions involved in its curation and preservation.

Dealing with this kind of data and processing workflow requires particular skills, such as how to transcribe difficult handwriting, and knowledge to allow the researcher to identify the important aspects of an object, such as when it was written and who or what is being discussed. But not all of the required knowledge for dealing with such documentation is necessarily

related to the time period of its production, for a researcher will also have to know how much of this content could be republished or reused, and of course whether to trust the source in the first place (a skill we instil in humanists that we could all use more of in this era of 'fake news').

Supporting these requirements for smart data research in the arts and humanities is the mission of the Digital Research Infrastructure for the Arts and Humanities, or DARIAH. DARIAH was established as a European Research Infrastructure Consortium (ERIC) in August 2014, and currently, DARIAH has seventeen national Members and many cooperating partners across eleven non-member countries.

DARIAH enhances and supports digitally-enabled research and teaching across the arts and humanities. DARIAH is a network of people, expertise, information, knowledge, content, methods, tools and technologies from its member countries. It develops, maintains and operates an infrastructure that sustains researchers in building, analysing and interpreting digital resources. By working with communities of practice, DARIAH brings together individual state-of-the-art digital arts and humanities activities and scales their results to a European level. It preserves, provides access to and disseminates research and research outputs that stem from these collaborations and ensures that best practices, methodological and technical standards are followed.

Through these activities, DARIAH integrates digital arts and humanities research and activities from across Europe, enabling transnational and transdisciplinary approaches. It promotes the further development of research methods in the arts and humanities, documenting the state-of-the-art, supporting the re-use of research data with a focus on particular challenges including diversity, provenance, multimedia collections and granularity, and acting as a coordinator and integrator for a diverse community of practice.

The notion of smart data influences our activities at every level, driving the services we offer and the tools we provide, as well as the impact we seek to have. Impact is not always a welcome rubric for the assessment of research in the arts and humanities, having come to be associated with quantitative measurement, applied research and immediate economic gains. In addition, while impact can sometimes be evidenced and observed directly, and measured as such, very often, the impact that we can see is merely the tip of a hugely complex iceberg of influences and environmental factors, a reality that makes it very difficult for one initiative or organisation to make a clear claim to their role in bringing that event or object into being. The arts and humanities do have a significant role to play in the development of culture and society however, and to understand DARIAH, it is

important as well to understand how we see this impact as it stretches beyond its horizon of easy measurability.

The concept of impact for an Arts and Humanities Research Infrastructure

Arts and humanities research informs human understanding of our ever-evolving cultures and societies. Unlike the natural sciences, the arts and humanities cannot base their work on fundamental laws that persist in supporting scientific theories over centuries, like gravity or thermodynamics, but on the fluid and diverse norms and values of humans, cultures and societies. The object of humanities research is therefore both ever-changing and strangely constant: while many of the ideas of Plato and Aristotle remain as relevant and exciting today as they may have ever been, it is undeniable that in other ways, the values of twenty-first-century Europe are far removed from those of Classical Greece.

Unlike the methodologies generally associated with the social sciences, the arts and humanities explore such issues not through the lens of targeted data collected for a pre-defined purpose, but through the more rich, subtle and ambiguous instrument of the artefacts humans and cultures create and leave behind. In historical documents we seek not only evidence of what happened, but how historical records show, through their language, their gaps, and their origins, the biases of their creators, and the later diffusion and impact of their thoughts. In the record of human creativity, we find not just what people say they know, feel or do, but empirical evidence of what inspires us, how we feel our identities and interconnectedness can be expressed, what makes our own time and place unique, and what makes our experience universal. Understanding those aspects of lives and cultures that are so deeply held that we can hardly describe them ourselves: this is the realm of humanistic and artistic enquiry.

Study of the arts and humanities results in an informed citizenry with agile minds and broad perspectives; creative and able to draw from different points of view to build industrial and social innovations; tolerant and able to view their own actions in a broad and ethically informed perspective; individuals empowered to build their own health and self-confidence through generative action, and support this process in the next generation.

Nowhere are these methods more powerful than when they are used in combination with other forms of knowledge creation, and it is this process, more than anything else, that DARIAH seeks to promote and support for the arts and humanities. There are many ways and places to do this, but the intersection of the digital and the humanities is a particularly rich one,

where the methods of history, literary studies, linguistics and other such disciplines come together with the quantitative and engineering traditions of computer science. Technology is currently reshaping our societies and our lives, but such a transformation must not be affected by engineers alone, without the input and expertise of those with deep knowledge of how we as humans communicate, how we interact, what we value and how we form identities. Strong societies need this, as do strong economies.

Among its fellow research infrastructures, and in particular the group of those constituted under the European legal instrument of the Research Infrastructure Consortium (ERIC) DARIAH is unique for the diversity of the community it serves. Methodological and epistemic divides between even two historians can sometimes be vast, and DARIAH encompasses as well literary studies, linguistics, cultural studies, art history, media studies, musicology, and many more approaches. Our task in this respect is no less complex than providing the fullest possible representation of the diverse range of subjects falling under the umbrella of humanities, and translating their common and divergent needs into support structures and technologies that meet their needs and harness trends in the wider environment.

DARIAH seeks to ensure that humanities researchers are able to assess the impact of technology on their work in an informed manner, access the data, tools, services, knowledge and networks they need seamlessly and in contextually rich virtual and human environments and produce excellent, digitally-enabled scholarship that is reusable, visible and sustainable. How we propose to build upon our unique position to provide the foundation for this vision is at the heart of the DARIAH strategy, and in how we view our 'users'. This term is also one that sits somewhat uncomfortably with the work we do and the community we serve, however, and also requires some explication.

The concept of the user for an Arts and Humanities Research Infrastructure

The concomitant question to that of 'what is impact?' is, of course, 'impact for whom?' Of the many actors DARIAH interacts with, we would see the following as our most critical audiences: our national members, and the researchers they represent. The term most recognised widely within research infrastructural policy and practice as a descriptor for such beneficiaries of the services an infrastructure provides, is 'user', and yet we in DARIAH use this term only with some hesitation. In DARIAH, we can hardly recognise the distinctive roles of producer and consumer. Our users, if indeed they are such, are as much contributors as beneficiaries: the DARIAH stat-

utes require high in-kind contributions of our members. This fact canonises a much more equal standing between those who might be considered central within DARIAH and those who might be seen as peripheral. We therefore use the term only in the sense of the 'produser' or 'prosumer', whose input is as essential to the eventual quality of the services and experiences DARIAH provides, as is DARIAH to the services and experiences they partake of.

Serving this community requires us to bring value to some of our other relationships as well, however: with the European Commission, with cultural heritage institutions, and with other ERICs, for example. Beyond this, we can abstract to a further level of general impact, reaching out to society and research as a whole, though we would generally consider these primarily indirect, rather than direct targets for our impact.

On the basis of this understanding of the impact of arts and humanities research, of a research infrastructure in this domain, and upon the relationship between DARIAH and its community, we can propose three main areas of impact that we can seek to trace our influence through, namely that we:

- Foster research excellence.
- Support organisational efficiency and effectiveness (eg. at the national partner level).
- Promote more fluid interactions between policy and practice.

These user-centric impact areas provide instructive windows into how DARIAH can shape and improve the research environment for the arts and humanities. Each of these areas is discussed in more detail below.

Fostering research excellence: Impact on research and researchers

Through DARIAH, individual researchers can access the partnerships, knowledge, tools, services and other assets they need for their work. They can join or form working groups to easily assemble groupings of researchers to explore new ideas. Digital work in the humanities is well-known for its ability to be hidden from or otherwise inaccessible for reuse, or removed from developments in other research areas. Through DARIAH, these opportunities can be maximised.

Impacting on research is also centrally and essentially about training. We need to bring researchers, who have sometimes little or no knowledge of digital methods beyond Microsoft Word, to understand the potential of tools, so that when they encounter digitised content, they understand better what they can do, and what they should not. DARIAH operates always un-

der the maxim that digital methodologies supplement, rather than supplant, existing approaches, we do not seek to change researchers in such a way that they do something else, but empower them to adapt to digital content and methods. To ensure this transition to the digital methods we need to also bring them to new descriptive possibilities, providing guidance about standards and best practices in digital scholarly work, for example. As such, we introduce ways of asking old questions new ways or asking new entirely questions with the data, through approaches such as distant reading, information extraction, and data visualisation.

Of course, we also need to train trainers. The number of researchers in the humanities is so immense that we cannot reach out to them all, and the specificity of the requirements of their sources and questions makes the goal of providing them with the knowledge and skills they need, when they need it, a challenging one to deliver upon directly. The notion of having impact by touching each researcher in the arts and humanities is not achievable, but creating a waterfall effect, starting with a smaller group of ambassadors within the community through training is something we strive to embed. As many countries and institutions respond to a similar impetus with the appointment of professors and other academic staff with a digital humanities leadership role locally, we can see a network forming that we might support, helping them to broaden their skills beyond their own interests, and increase their own impact as institution-level agents for growth and development.

This commitment can take many forms, and we have a catalogue of options. DARIAH and CLARIN jointly support a course registry[1] for digital curricula in Europe, and we work as well through our Working Groups to identify the needs of the communities. DARIAH hosts and supports a lot of training events, seminars and schools, including many joint events with a variety of partners, and finally we also use these various events to feed an ever-growing corpus of on-line training materials which in turn can be used by our ambassadors and their students.

Promote more fluid interactions between policy and practice: Impact on policymakers

In DARIAH, we speak a lot about how we are very much an organisation built from the 'bottom-up', serving researchers and following their needs, rather than the other way around. To do this effectively, however,

[1] https://registries.clarin-dariah.eu/courses/.

the overall environment from the 'top-down' must also be in line with these researcher needs, and research policy has very often been seen as being in conflict rather than in harmony with the distinct needs of arts and humanities research. DARIAH, as a large and representative body with national ministry buy-in and recognised at European-level, is in a unique position to inform policy, in particular as our expertise and interest in technology places us at the heart of so many debates, from Open Science to the Digital Economy.

Open Science is a good example to look at in more detail. You cannot speak about changing research in Europe without having a strong Open Science policy, and we in DARIAH have developed this step-by-step. Many aspects of the discourse on Open Science are either not well-matched to the manner in which arts and humanities researchers work, or they are commonly discussed at a level of abstraction that can seem a barrier to communities still trying to understand how their norms of communication and publication can become open. Some of our partners have been very active in this space: for example, our partners in the Netherlands DANS have developed the Data Seal of Approval, and have been leaders in promoting responsible data management and the FAIR principles across the disciplines. DANS is not the norm, however, and we need to remain mindful of the fact that the humanities are not at the forefront of the OA movement. It is difficult to forget the statement by the American Historical Society some years ago urging students not to put the pdf of their PhD thesis online, because it would impact on the business model of the publishers, who may not choose to publish a thesis already openly available, and who should be protected with an embargo of at least five years. We need to evangelise to researchers about the most basic aspects of open access. But not everything about the mismatch between Open Science and the humanities is down to disciplinary conservatism. In the realm of Open Data, for example, there is also a need to redefine the relationship between researchers and cultural heritage institutions, as the open sharing of data is currently not possible for researchers whose source material is under the care and protection of libraries, museums and archives. DARIAH is developing, together with CLARIN but also with Europeana, Archive Portal Europe and others, a data reuse charter[2] that will ease this discussion between memory institutions and researchers, but also between researchers and the funders who might expect a data deposit in addition to any traditional publications coming out of funded research.

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[2] https://datacharter.hypotheses.org.

We also need to be very open in the domain of openness, as it were, rather than letting current policies and fashions shape our imaginations. Openness must go beyond basic aspects such as access to publications, and so, for example, in DARIAH we are also working to create clear guidance about using standards, which can increase reuse as well as visibility for objects that might not normally be conceived of as fitting under the rubric of the FAIR. The notion of authorities is relevant here too, making sure we give guidance on ensuring proper authorship of datasets, the notion of licenses, and finally of course we need those technical components like repositories to ensure that researchers have the capacity to be open through the infrastructures we deliver. This is the policy space where DARIAH is seeking both to sustain dialogue and to build solutions.

Support organisational efficiency and effectiveness: Impact on partner institutions

Having access to DARIAH helps research groups and national partner institutions to gain access to and maintain visibility over a European horizon of research and development. In addition, they can learn from other partners, and access tools and services that can benefit their research projects and communities, without the need to necessarily instigate or fund such developments from scratch.

This form of impact has to do with the notion of institutional change. Reflecting on the first twelve years of DARIAH's development, even if we had done nothing technical, over this time we would still have seen in a lot of countries how national programmes have developed, and for the better, in relation to that country's participation in DARIAH.

One case in particular is memorable. When Serbia joined DARIAH, then Minister of Culture, Ivan Tasovac, met with us and said that he was in a situation where his major cultural institutions seemed to be behind the curve in terms of digital methods. He had found a couple of institutions that were progressive and ambitious, and what he needed, more than anything else, was a forum to exchange with others and ensure that the process of digitisation he wanted to enact in his own country reflected what had happened and was going on in other countries. This is a major example of the kind of political impact we can see within our partner countries.

Conversely, it also is very important that we take the best of 'the jewels', that is, what has been developed nationally in the various countries, and expose them outward as well, redistributing this knowledge toward the other countries. This is the main role of an infrastructure like DARIAH. It

has to do with datasets, it has to do with tools, it has to do with skills, and knowledge – the transformative spark for a country looking to make major changes, or indeed even for one well-established but seeking ever to stay at the cutting-edge – can come from many places and in many forms. There are barriers to this form of openness, however: issues such as multilingualism, documentation and community recognition all pose greater challenges at the European than at the national level. In addition, issues of maintenance arise, in which the balance between what can and should be provided at institutional, national and European levels is delicate indeed. We are working to ensure appropriate and sustainable sharing and reuse across our partner countries through the development of what we call the SSH Marketplace. The concept behind this is to create a context-rich registry, fed from our in-kind contributions, of user-centred information concerning existing tools, existing methods, existing knowledge centres, which we will supplement with community enhancements and the kind of transparency scholars require, down to the description of algorithms.

Conclusion (transverse issues)

In some ways, none of the things described here are specific to DARIAH on a conceptual level, and we recognise that in particular among the SSH RIs we should work together more towards developing joint policies and impact stories. In this sense, two more forms of impact close to the heart of DARIAH come to mind, as these areas, while strong motivators for us, also will be stronger still when we expand their scope beyond the confines of our one infrastructure.

In specific we mean things like the impact of developing networks and collaborations. More the anything else, DARIAH is about people, and about sharing knowledge in large groups and small conversations. These networks can lead to large scale funding proposals, or to more limited (but no less valuable) insight, publications and events, all of which ensure the fluid circulation of knowledge among experts and curious alike. As we move into an age where more will be expected from digital scholars in terms of their fluency with data originating from approaches and disciplines that are not their own, we need to work together to enhance our capacity for such impact.

A second such area to explore is the promotion of innovation. Because of its scale and place between humanities and arts research and technology, DARIAH is able to support new modes of research that may follow either a policy imperative or an applied or translational one. Through DARIAH, researchers and research performing organisations can develop their ca-

pacity in research approaches that are mission-oriented or facing new audiences or societal challenges. This too, however, should naturally lead us into new collaborations across disciplines and for the benefit of both industry and society.

It is common now to speak about digital humanities, but it is the nature of such methodological and social shifts that such an expression of hybridity will disappear in another decade or so. It is the overarching goal of DARIAH to be a part of that transition, ensuring the preservation of the traditional strengths of arts and humanities research as it reaches a new potential for integration and impact in a digital age.

PART V

Increase of Impact through Interaction of Domains

Minh-Quang Tran

SOCIAL SCIENCES, HUMANITIES AND EXACT SCIENCES: A NECESSARY BRIDGE TO BE BUILT

Abstract

A description of the activities of the ESFRI SWG on energy will be first given. They include the technical assessment of past ESFRI projects as well as projects. Another important work of our Group is the preparation of the Landscape analysis in the field of energy. I would like to give then some personal views on the importance of Social Sciences and Humanities for Energy development, especially for new technologies.

Introduction

Let us introduce the situation immediately: Social Sciences, Humanities (SSH) and Exact Sciences (ES) do not have enough contact! The problems from ES are often difficult to grasp outside the community and the technical and scientific jargon used render the relations with SSH difficult. While Exact Sciences are often clear for everyone, SSH is not clear for the ES community. For me SSH includes many aspects, encompassing different economic sciences and social sciences. When I was 'EFDA Leader' (i.e., responsible for European common activities in the frame of fusion) I have myself experienced the necessity to involve these two branches when dealing with fusion, a long-term project.

The text is organised as follows. I shall very quickly outline the energy landscape where fusion could be an important player for the supply of electricity in the long term. I shall then describe, from my own experience, why I claim that SSH need to play a role to convey important messages towards the public and the political level in many ES fields in general, and in fusion in particular. The establishment of this dialog is, by no means, easy for any of the sides. The reasons are numerous but can be mainly traced to a lack of link between the two communities, again based on my own experience. As a conclusion, I would like to advocate building bridge between SSH and ES.

Fusion, a long-term energy option

Since the last decades of the twentieth century, energy questions are recognised to be a key issue for the development of mankind. More and more, users are favouring electricity in all fields, from transport to industrial use. The way to convert prime energy to electricity must satisfy many criteria: the primary energy source (or fuels) must be abundant, the conversion must respect environmental issues (no production of greenhouse gas), avoid the risk of severe accidents (such as those, which would force evacuation of population), allow societal acceptance (e.g., does not imposed burden (real or perceived) on the future generations such as those linked to geological repository of nuclear waste). Important to note also is that the understanding and acceptance of the Society of new technologies is part of the issue to be addressed before any large-scale implementation is contemplated.

Fusion is a way to produce electricity from the 'fusion' of two light nuclei (in this case two isotopes of hydrogen called Deuterium and Tritium) to produce heat and then convert it to electricity. It is often shown that all the criteria mentioned above are met with the realisation of fusion.[1] Let us first discuss the issue of the fuels. The Deuterium is a relatively abundant of form of hydrogen: one litre of water contains 33 mg of Deuterium. Tritium can be generated from Lithium, which is abundant both in the earth crust and in sea-water. The fuels are therefore abundant. The process of transforming the fuels into electricity does not generate greenhouse effect. If one does consider the whole life cycle of a electrical power plant, the relevant quantity is the gram of CO_2 produced per kWh of electricity during the whole life of the plant, including the CO_2 produced during its construction and dismantling (i.e., «from a green field back to the green field»): a fusion power plant produces an amount of CO_2 similar to renewable energies or nuclear power plant. Regarding the social acceptance, the following points must be highlighted: the fusion reaction does not produce chain reaction. In case the conditions are not the right ones, the fusion reactions will stop. Two other features are especially important. After a shut-down of the reactor, the heat produced by radioactive components in the structure does not cause the generation of high power and would not lead to temperature above the melting temperature of steel, even in case of loss of coolant. Finally, the radioactive components induced in the reactor structure will not require a geological repository.

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[1] M.-Q. TRAN in http://www.bfe.admin.ch/themen/00526/index.html?lang=fr&dossier_id=05238.

The main steps in the programme are, firstly, a reactor ITER, which will produce 500 MW of thermal power during pulse up to 3600s. The following step is a DEMOnstration reactor (DEMO) capable of producing a few hundreds of megawatts of electricity power. According to the present roadmap.[2] DEMO construction is foreseen by the mid of the twenty-first century, to be followed by the deployment of fusion power plants. Similar visions exist in many other countries such as China, India, Korea, Japan.

Fusion and SSH

Fusion has many characteristics which render the involvement of the SSH important. First, as mentioned before, it is a long-term 'big science' project: as an example ITER, the experiment under construction is an international endeavour gathering the China, European Union, India, Japan, Republic of Korea, Russia, and the USA and the demonstration of the release of substantial amount of fusion power (500MW of thermal power[3]) is expected in 2035. As in many big science projects, it is important that the public becomes partner of the project and endorses its goals, since explaining the energy challenges and how fusion science and technology and the project ITER can solve them are not sufficient.

This remark points in fact to a much broader problem: what does the public understand about energy production, what are the criteria for societal acceptance, what are the expectations of the public in the long-term energy mixes? SSH and its methodology are of paramount importance for helping ES in this field. Here the dialog between SSH and ES is essential since (from my personal experience) physicists and engineers often do not understand the SSH methodology and therefore question it.

As mentioned above, industrialisation of fusion will be performed towards the third part of this century. This characteristic in turn brings many socio-economics issues of primary importance. From an economic point of view, the main question is: in the second half of the twenty-first century, what are the 'reasonable' energy scenarios and, among those, what could be the role of fusion? The construction of energy scenarios is complex,[4]

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[2] European Research Roadmap to the realisation of fusion energy (SOFT 2018): https://www.euro-fusion.org/eurofusion/roadmap/.

[3] ITER will not produce electricity but only thermal power. No conversion of the thermal power into electricity is foreseen. It will be mission of DEMO to produce substantial electrical power to be fed to the grid.

[4] The word scenarios should not be confused with prediction since scenarios are based on models and a set of hypotheses.

since it involves the build-up of assumptions of future energy policies (from Business as Usual policy to strongly ecological one), of reasonable discount rates, and, of course underlying all the other considerations, the energy and electricity needs of the Society. Such an exercise is often made for a region (e.g., Europe), but, within the globalisation, such study must be extended to the whole world. The expected outcome is what would be the share of electricity from fusion under a specific scenario.

Another topic for study by social science was brought to the author's attention during the review process of this paper.[5] It is clear that, during the last decades, there is a clear shift in the opinion of the public and the experts. This shift could be linked to changes of political decisions, of the development of technologies, of the impact of severe accidents, of the coverage by media. How each cause does contribute to the shift of the opinion is worth a deep study using well-established social science methods.

Another often asked question is what would be the cost of electricity from fusion? What would the external costs for fusion? Again, the often-used expression «Internalise the externalities» is a little bit mysterious for us in ES: what do externalities encompass? How does one compute the money impact of greenhouse gases effects, of the dead caused by pollution? In fusion, we take a pragmatic approach: by applying the same methodology used for other energy production methods, fusion externalities can be defined in a useful way. Finally, for the establishment of energy scenarios, the credibility of the cost of electricity will depend on the assumptions, such as how to define the cost of the power plant, and the model used for the establishment of the external costs.

Conclusion: What bridges are to be established between energy research and SSH?

It is often mentioned and accepted that big challenges in our twenty-first century can only be met not only through excellent scientific and technical research and development of the ES, but also with the contributions of SSH. I fully share this view, but its implementation reveals to be more difficult than it appears.

The principal cause may be the lack of link between the two communities. We, from the technical side, are not aware of the methodology used, and, as simply as this, «who is who» in SSH! So let us work on this as a

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[5] I thank the anonymous referee, who brought this topic to my attention.

first step to establish joint project. Can we get help from the existing scientific structure? I believe so. Let me mention the case of Switzerland. We have the traditional learned societies in ES and SSH. But we also have the «academy of academies», the Swiss Academies of Arts and Sciences,[6] which could act to help building bridges and establish common project.

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[6] http://www.swiss-academies.ch/en/index/Portrait.html.

Ana Proykova

DIGITAL INFRASTRUCTURES INTERACTION WITH HUMANITIES INFRASTRUCTURES

Abstract

The development of a Research Infrastructure that links various local efforts regarding Open Access in the SSH domain is clearly needed. The SSH domain differs from the science, technology & mathematics (STM) domain, notably when it comes to using books and monographs as an important vehicle for scientific output. Moreover, one can expect that in the near future we will see other forms of scientific communication emerge. Matters are complicated by the fact that different languages are used in scientific communication, unlike the STM domain where the English language is currently de facto a standard. A pragmatic view in the development of a SSH RI: Shared services, focusing on enhancing and improving the services offered locally; EOSC integration, with emphasis on development of metadata and machine-readable content; global services for certification, resource discovery, and multi-party collaboration.

Interaction occurs as two or more entities affect each other. It is essential to realise that interaction is a two-way effect in contrast to one-way causal effect. Thus, the interaction changes both entities. In some cases, a combination of well-understood interactions results in new, unexpected properties of the system as a whole. In the current context, 'system' means all interacting entities.

To achieve a positive result due to interaction of Research Infrastructures (RIs), care should be taken to coordinate development stages of humanities infrastructures, digital infrastructures[1] and e-infrastructures.[2] This is always a challenge because of different time-scales of all phases of the li-

[1] Joint fiber-optic and wireless-based advanced information and communication technology platforms with embedded multi-functional application services that facilitate 24/7 online real-time connectivity between nodes in the operational network to allow remote management of production assets.

[2] Advanced fully integrated communication and information processing services, which provide transparent, easy, cheap and secure access to all types of distributed resources (computers, databases, heavy research instruments).

fecycle of RIs in these different sectors. The phases – design and preparatory phase, implementation phase, operational phase, and decommissioning phase – are very much different for these RIs, which makes their integration a complex process. Since complexity characterises the behaviour of a system, whose components interact in multiple ways and follow local rules, there is no reasonable way to define all possible interactions. Therefore, it is important to establish a strategic procedure to monitor and evaluate the interactions between the RIs in a long term.

The ESFRI (European Strategy Forum on Research Infrastructures) roadmap identifies vital European RIs (new and already existing) capable to maintain excellence in research for the next 10-20 years. RIs play also a role in training the next generations of researchers and facilitate collaborations between different disciplines, research sectors and industry in different countries. RIs can provide complementary educational services and training for students at master and doctoral levels.

Digital infrastructures are expected to boost research, growth, innovation and job creation, and it is clear that education of digital scientists and practitioners are a priority for Europe as this can effectively give people the knowledge, skills and competences to use and benefit from scientific data, to contribute creating the European identity, building on common values and cultures. Education on newly emerging technologies for data collection, compression, preservation, and analysis can be realised in collaboration between the humanities infrastructure, digital infrastructures, and e-infrastructures. The e-learning programs enhance traditional learning, support existing teaching methods and provide a valuable reference point, which can be accessed anytime, anywhere. These programs cover computer science, data and statistics, engineering, life sciences and other fields, and more, providing proper platforms and, which is extremely important, sharing the knowledge and data stored by all RIs connected via networks. The training in data sharing, on how to make data FAIR (Findable, Accessible, Interoperable, Reusable), and on the broad implications of Open Science should be substantially supported jointly by digital, e-, and humanities research infrastructures.

Nowadays the humanities are more frequently contrasted with natural, and sometimes, social sciences. The humanities use methods that are primarily critical – methods of disciplined, systematic study of a written or oral discourse for fault finding and negative judgment it can also involve merit recognition, and in the philosophical tradition it also means a methodical practice of doubt. Because of this methodology it is rather difficult to put together the various stakeholders in an infrastructure designed to be useful for all. In this respect, the interaction with e-infrastructure, which is equally remote from all players, but serves all players equally well, could be highly beneficial.

Investments in RIs and their usage became one important priority in accomplishing the goals of the European Research Area (ERA). The Council emphasised the need and importance of e-infrastructures.[3] RIs on the ESFRI roadmap provide a unique combination of scientific expertise to boost the synergy of research by ensuring the proper communication between different sectors (energy-ENE, environment-ENV, health & food-H&F, physical sciences & engineering-PSE, social & cultural innovation-SCI).

Distributed RIs in the H&F, ENV, and SCI areas are seeds for research and innovation hubs of excellence throughout Europe, also offering services to small and medium enterprises, from quality control to new product development. Overall intellectual properties rights are sensitive issues for cooperation with industry the commercial use of scientific data.

The European Open Science Cloud (EOSC) is an emerging digital infrastructure, which aims at improving the impact on science. EOSC is a vision for interdisciplinary environment that will let researchers, innovators, companies and citizens publish, find, use and reuse each other's data. EOSC will combine high-capacity cloud solutions with super-computing capacity, federating its services to RIs and community produced ones and widening the user base to the public sector and industry. The EOSC will be a fundamental enabler of the digital transformation of science. The potential to leverage past investment in research data infrastructures makes the EOSC a promising tool. The ESFRI understands that the research infrastructures and their users will enable a successful start of the EOSC. To achieve this, the ESFRI roadmap must be tailored in a way to facilitate the EOSC realisation expected to influence the impact of the digital infrastructures on the humanities infrastructure.[4]

Humanities and social sciences RIs have a large social impact as they preserve and offer information about our cultural heritage, art, and history. These RIs affect the public policy via evidence-based research. The analysis of data collected in the SHARE ERIC (European Research Infrastructure Consortium) revealed a strong correlation between early retirement and the loss of cognitive abilities. This finding strongly influenced policy decisions at European and national levels.

Digital RIs create a safe and seamless environment for sharing research data thus making the impact of the humanities RI stronger on the general public. These RIs provide new platforms and software tools that increase

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[3] *Council conclusions dated 5th December 2014*, <http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/146063.pdf>.

[4] EOSC will be built by federating existing resources across national data-centres, European e-infrastructures and research infrastructures, as well as by increasing capacity through acquisition of resources to be offered on a pan European level by EOSC operators.

the scientists' productivity, enable data reuse, and help in generating new science and services. As a result, a more efficient usage of the existing infrastructures' outputs (results of investigation) is registered. The multidisciplinarity of data-intensive themes makes the scalability of the digital infrastructures with increasing e-needs very important.

An example of digital-humanities infrastructure interaction is the new (*ESFRI Roadmap 2018*) project European Holocaust Research Infrastructure, which will integrate the data, services and expertise of existing Holocaust infrastructure on a much larger scale. Such a rescaling would be unthinkable without a digital platform and e-infrastructure capable of providing expanded services.

The European Open Science Cloud is expected to realise a framework for RIs and e-infrastructures, assuring data preservation and protection, data interoperability (i.e., the ability of computer systems or software to exchange and make use of information), and suitable data analytics and computational resources across all disciplines. Notably HPC (High Performance Computing) applications for data analysis are expected to have a multi-scale integrating feature and to fill gaps between data storage and research platforms.

EOSC will federate the most advanced data and service infrastructures, often directly built and supported by the RIs. ESFRI RIs represent a large investment in data infrastructure. In contributing to the EOSC the RIs will retain control over the quality of their data, its persistence in time, and over the quality of the data services that might eventually be also provisioned by others to the general scientific users and for innovation purposes.

Human Resources (HR) are at the core of all aspects of the overall e-infrastructure and Big Data ecosystem at institutional, national, European (EOSC, European Distributed Infrastructures, European High-Performance Computing, etc.) and global levels. Sustainability of the RIs and e-infrastructures must be approached simultaneously with an unprecedented effort in training of data scientists and, on the other hand, more and more users of the data should gain broad data literacy. These aspects were discussed in depth at the conference *Stay tuned to the future* held in Bologna, 24-25.01.2018. The conference was initiated by the ESFRI Social and Cultural Innovation Strategy Working Group and hosted by the Fondazione per le Scienze Religiose Giovanni XXIII.

The session *Increase of impact through interaction of domains* underlined the difficulties in satisfying the expectations of the diverse societies – working in the field of humanities and computer sciences. On one side, the development of a research infrastructure that links various local efforts regarding Open Access in the humanities domain is clearly needed. On the other side, it is questionable if large-scale single-sited infrastructures would attract the scien-

tist and generate innovations, as it is the case for natural sciences where centralised infrastructures like the European Organisation for Nuclear Research (CERN), Helmholtz Centre for Heavy Ion Research (GSI), and Grenoble Research centre can be easily justified. Scientists from the full spectrum of humanities raised concerns due to small-scale human development facing the large-scale technological development. Because of this, distributed research infrastructures seem to be more impactful not only for scientists but for the regional development since most popular existing infrastructures are databases (catalogues, reference indexes, bibliographies). CLARIN (European Research Infrastructure for Language Resources and Technology) and DARIAH (Digital Research Infrastructure for the Arts and Humanities) are examples.

The distributed RIs provide opportunities for regional development of all Member States of the European Union. They increase active participation of all Member States in RIs, support regional research output, offer new capacities and expertise, prevent brain drain and regional unbalance, and ensure coherence and synergy of resources throughout Europe. To enhance regional impact of humanities RIs integrated with Digital Infrastructures, it is necessary to focus on designing smart specialisation strategy.

Participation in already established and future humanities RIs should be of highest priority in order to reach a robust European Research Area. Strong political support to humanities RIs and wise targeting of European support programmes are crucial for strengthening and accelerating their successful implementation.

The aim of all ESFRI RIs is the transformation of its data intensive part to address one of the major scientific and societal challenges of Europe – digitalisation of science and industry to introduce the open science and open access paradigm. To achieve the goal, RIs collect expertise in different EU countries in order to combine and accelerate efforts.

In humanities research, it is vital to better know and understand cultural diversity. In evaluating the risk acceptance when establishing humanities research infrastructures (distributed in several countries), it is essential to understand as well social cohesion, economic development and wellbeing. Unexpectedly the huge flow of information could be overwhelming after enabling digital and e-services: researchers in the humanities will receive all printed information. How they put this information to effective use is a question that remains to be answered. Of particular importance will be the RIs, which serve to understand the driving forces to be used to enable our society to offer a better framework for integration.

It is also important to see what is happening outside Europe to learn from sharing data and best practices. The opportunities generated by global RIs for the worldwide scientific communities are crucial to address the

global challenges of all areas. Global impact of the ERA emphasises the role of digital RIs in providing a sustainable world-class quality infrastructure environment and services to serve the humanities research community and to assist in attracting top scientists and collaborations worldwide from public research as well as industry.

Global cooperation on RIs is strategic to Europe for maintaining leadership in standardisation of data protocols and the sharing of best practices all over the world. The role of e- and digital infrastructures is central on this playground. The e-infrastructures that provide services to global humanities RIs ensure the opening of these infrastructures to the world fostering cooperation between European RI and other international world class RI. Developing a staff exchange programme at the global level, including the organisation of thematic courses and workshops for staff managing and operating research infrastructures, is largely facilitated by the electronic platforms available via electronic infrastructures.

It is important to say that there is a clear need to bring together data from multiple platforms to solve increasingly complex problems, and this requires more open access and transferability of data, but the issues related to industrial confidentiality, intellectual property rights, and privacy might challenge this openness. Novel approaches to handle this aspect might then be a goal for all the RIs and especially for those intensive in industrial R&D. The research infrastructures in humanities are to be established in a way to meet a large range of needs, which include text, image, and sound materials. Currently, most humanities infrastructures are divided into libraries, data processing centres, media centres, centres for e-learning, audio-visual archives, traditional archives and other institutions. This is an outdated model and a new concept for infrastructures that integrate these diverse institutions is needed: a close collaboration between researchers in humanities and computer scientists who are opened to the needs in humanities.

The development and expansion of innovative research infrastructures in humanities need a boost. Innovations include a wide range of methods and approaches based on modern information and communication technologies, such as the quantitative evaluation of digital sources and the visualisation of datasets that create new ways to approach research questions and thus pave the road to discoveries. Digital technologies change the style of work in humanities – new forms of collaborations emerge: researchers all over the world use virtual research environments to collaborate on joint projects. These virtual research environments offer researchers a number of advantages when compared with a single source. Furthermore, many areas of research in the humanities are tackled today using interdisciplinary approaches.

Complementing traditional methods of analysis with quantitative procedures in the field of humanities means that traditional hermeneutic methods of analysis can be complemented by quantitative procedures, as is common in empirical research in the natural sciences. These new opportunities are possible because of the development of computers, memory, storage and Internet. The ongoing expansion and development of innovative research infrastructures does not mean that qualitative methods will be discarded in favour of quantitative ones. Both approaches make important contributions and deserve ongoing mutual acceptance in today's range of disciplines.

At the national level, the humanities research infrastructures form a vital part of the national research infrastructure roadmaps, facilitating research that guides policy and contributes to our understanding of the human development. European research infrastructures serve similar research interests with the advantage of enabling cross-national comparisons and/or the sharing of resources across national boundaries.

Recently, remarkable developments have been seen in the social research area: The European Social Survey and the Survey of Health, Ageing and Retirement in Europe (SHARE) are examples of infrastructures designed specifically for cross-national comparison. The Data without Boundaries project will give researchers access to micro-level data for all countries in the European Union. The Council of European Social Science Data Archives is promoting cross-national access to national data repositories. While Member States define and determine their national research infrastructures, the European Strategy Forum on Research Infrastructures helps fulfil this role at the European level.

To conclude, research infrastructures need to be sustainable on a long-term basis to avoid losing accumulated benefits. Therefore, the establishment and maintenance of infrastructures require effective communication to ensure that policy-makers and the public recognise their legitimacy and benefits to society as a whole. That is why the infrastructure must be able to offer services that are necessary for researchers on a long-term basis. By offering transparent and open access to data, research infrastructures generate opportunities for hypothesis testing under harmonised standards. The computational modeling of artefacts of cultural heritage can provide insights into the nature of Humanities. Although some researchers think that standards in research kill innovations in humanities,[5] positive interaction is expected when humanities infrastructures encounter digital and e-infrastructures.

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[5] J. VAN ZUNDERT, *If you build it, will we come? Large-scale digital infrastructures as a dead end for digital humanities*, «Historical Social Research», 37 (2012), N. 3 (141), pp. 165-186.

BIOGRAPHIES

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PATRIZIO BIANCHI is Full Professor of Applied Economics and Public Policy. He studied at the Bologna University and at the London School of Economics and Political Sciences. Professor at Bologna University, in 1997 he moved to the ancient University of Ferrara to found the Department of Economics and Management, which now is listed among the best economic research centres in Italy. He has been Rector of the University of Ferrara and President of the Foundation of the National Conference of the Italian University Rectors. Since 2010 he is Minister of University and Research of the Regional Government of Emilia Romagna. He has worked as expert with European and International institutions on industrial and economic policies. He has published about 200 scientific articles and almost 40 books on economic and social analysis of structural change, economic dynamics and public policies for development.

AXEL BÖRSCH-SUPAN, after studies in mathematics and economics at Munich, Bonn and MIT and professorships at Harvard, Dortmund and Mannheim, became Director of the Munich Center for the Economic of Aging (MEA) at the Max Planck Society. He leads the Survey of Health, Ageing and Retirement in Europe (SHARE), is member of several academies of science and is active in policy consulting at the national level, the EU, OECD and World Bank, among others.

Ron Dekker is the director of CESSDA ERIC, the Consortium of Social Science Data Archives, with its main office in Bergen, Norway. CESSDA is a European Infrastructure with seventeen members (countries) and combines the work and expertise of these countries' social science data service providers, see www.cessda.eu. Dr. Dekker studied econometrics and worked for ten years in labour market research at Dutch universities. He was at the national research council for almost twenty years – running a data agency, program committees and in general management (institutes, infrastructure and open science). This included secondment to the Dutch government for project leadership on Open Science of the Dutch EU Presidency in 2016 and as national expert at the European Commission in Brussels in 2017.

Jacques Dubucs' field of research is philosophy, logic and cognitive science. He is Senior Scientist at the Centre National de la Recherche Scientifique (CNRS), member of the «Sciences, Norms, Decision» Research Lab (Paris Sorbonne Université/ CNRS), member of the French National Committee for Philosophy of Sciences (Academie des Sciences) and the Head of the Human and Social Sciences Department at the French Ministry for Higher Education, Research and Innovation. He is also the Chair of the Social and Cultural Innovation Strategic Working Group of the ESFRI.

Elena Esposito is Professor of Sociology at the University Bielefeld and at the University of Modena-Reggio Emilia. She published many works on the theory of social systems, media theory, memory theory and sociology of financial markets. Her current research projects focus on a sociology of algorithms. Esposito's recent publications include A*rtificial communication? The production of contingency by algorithms*, «Zeitschrift für Soziologie», 2017; *Algorithmic memory and the right to be forgotten on the web*, «Big Data & Society», 2017; *Critique without crisis: Systems theory as a critical sociology*, «Thesis Eleven», 2017.

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Rory Fitzgerald is Professor of Practice in Survey Research at City University of London UK and Director of the European Social Survey (ESS) ERIC. The ESS is a rigorous comparative biennial survey of changing attitudes and values in up to thirty-four European countries. He directs the ESS Core Scientific Team and its National Coordinators Forum. In 2013 the ESS became an ERIC and in 2016 was declared a landmark infrastructure by the European Strategy Forum for Research Infrastructures in Europe (ESFRI). Professor Fitzgerald is a survey methodologist with expertise in Total Survey Error, questionnaire design and pre-testing as well as survey non response. He is also the Coordinator of the H2020 cluster project «Synergies for Europe's Research Infrastructures in the Social Sciences».

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Yves Gingras is scientific director of the Observatory of Science and Technology (OST), which celebrates in 2017 its 20th anniversary of foundation. He is also Professor in the History Department and Canada Research Chair in History and Sociology of Science at the Université du Québec à Montréal. He has published many books in history and sociology of science and papers in the field of bibliometrics. His most recent books are *Bibliometrics and research evaluation: Uses and abuses* (Boston, MIT Press, 2016) and *Science and religion: An impossible dialogue* (London, Polity Press, 2017). His research covers the transformation of the universities, science policy, research evaluation and the dynamic of scientific disciplines.

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Juan de Dios Llorens González is Granadinian, a telecommunication engineer and civil servant with twenty-one years of public service working in diverse areas ranging from technical monitoring of electromagnetic emissions to language

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ALBERTO MELLONI is a member of the National Academy of Sciences Lincei and an historian of Christianity known especially for his work on the Second Vatican Council of the Roman Catholic Church. He is Professor of the History of Christianity at the University of Modena-Reggio Emilia and holder of the UNESCO Chair for Religious Pluralism and Peace at the University of Bologna. He has been a member of FSCIRE since 1982, Vice-Secretary from 2002 to 2006 and General Secretary since 2007. Founded in 1953, the Foundation is one of the most important research centres on the history of Christianity in Europe.

JEAN MOULIN, PhD in physics, spent most of his career in the Belgian Federal Science Policy Office (BELSPO) where he has been involved in international cooperation on Research Infrastructures since 1990: member of the ESFRI (2002-2016), chair of the WG on Innovation (2012-2015), delegate to EU FP Programme Committees (1989-2014), delegate to the OECD Megascience and Global Science Fora (1992-2014), member of the Council of the European Synchrotron (ESRF) (2002-2015), chairman of ESRF's Council (2011-2013). He is currently expert for the GSF on RI matters, member of the H2020 Advisory Group for RIs and involved in European projects.

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Ana I. Proykova, PhD, Doctor Habil, is a Full Professor at the University of Sofia and the Head of the High Performance Computing Laboratory of the Sofia Tech Park. In her professional career she has worked at universities around the world, including Belgium, Germany, Israel, Italy, the USA, Japan, Singapore, Taiwan and in the 1980s – the USSR. She has over thirty years of experience in the field of computational physics with achievements in phase transitions of low-dimensional systems, simulation techniques and data analysis. She coordinated the Work Package on Modeling and Simulation of the CoNanomet FP7 project. Currently she coordinates the WP Advancement in research e-infrastructure in the GATE H2020 project on Big Data for Smart Society and is the Advisory Board member of the InRoad H2020 project. She is a member of the Program Committee on the Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology (H2020) and a member of the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER), European Commission. She is the Chair of the ESFRI Strategic Working Group on Data, Computing and Digital Research Infrastructures and Bulgarian delegate in the ESFRI Forum.

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MATTHEW WOOLLARD is the Director of the UK Data Archive (University of Essex) and the Director of the UK Data Service. His primary responsibility is in providing leadership and strategic direction for the UK's national social science data service, the UK Data Service (which is also a Service Provider to the new CESSDA ERIC. He is also responsible for setting and ensuring the strategic goals of the UK Data Archive which include the promotion of best practice in data curation, data management and data security; driving archival innovation, advancing the professionalisation of data service infrastructures and integrating these activities into the UK Data Service. He is a historian by training, but has spent most of his career in data service infrastructure.

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