



Status of the DiDaT project at the end of the initiation phase

Ortwin Renn, Roland W. Scholz and Verena van Zyl-Bulitta

The objectives of the DiDaT project can be found in the brochure of October 2018. Newsletter 01 is dedicated to the transdisciplinary methodology underlying the Di-Dat project. This Newsletter 02 informs about the status of the project at the end of the initiation phase (see Figure 1, p. 4). The first two articles discuss the central vulnerabilities and “unseens”, in particular the question why from the point of view of sustainability and from the perspective of systemic risks the treatment of vulnerabilities and opportunities are inextricably linked.

Readers will also find contributions on the results of a project on the treatment of digital data in different legal systems (EU, USA, Hong Kong; Gabriel Lentner) and two contributions that place DiDaT within the framework of an international discussion on sustainability transformations and address critical aspects of global development (Alan Borning and Lance Bennett; Dirk Helbing).

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Drafts of the rough plans and about half of all participants determined

The initial project phase of DiDaT will conclude with the 1st Stakeholder Conference on 25 June 2019. The main topics here are the conception of the key questions, the definition of the system boundaries, the identification of the vulnerabilities of sensitive stakeholders and sub-systems to be considered with regard to Germany in the course of the digital transformation as well as a rationale for the selection of the stakeholders and the deepening research based on this (in the main phase).

All these tasks and performances are performed in a transdisciplinary process with science and practice. In a booklet, about 30 scientists and 30 practitioners have drawn up *concept sketches*¹ in a first step and then (first versions of) *rough plans*. Following a detailed discussion at the stakeholder conference, these will be revised, made accessible to the public and translated into *detailed plans* by the end of this year. At the end of the initiation phase, half of the participants in the transdisciplinary process are designated (see Figure 2). The other half is to follow by the end of the year.

Co-construction of the guiding question

The joint search, negotiation and definition of key questions by key actors in practice and representatives of science is an essential component of a transdisciplinary process. Initial assessments were based on the central message of the European Expert Panel (Roundtable) that the largely misunderstood interrelations between “ownership, economic value, access, and use of data”

¹ <https://www.iass-potsdam.de/sites/default/files/2019-06/Booklet%20Konzeptskizzen%20Mai%202019%20V14.pdf>

are the main cause of Unseens². The idea was to pay particular attention to those stakeholders and subsystems (such as the health care system or SMEs as an essential component of the German economy and society) that are exposed to particular vulnerabilities (e.g. as a result of disruptive processes) from the point of view of the resilience and sustainability of systems. At the end of the initialisation phase, we can describe DiDaT's objectives as follows:

DiDaT aims to increase the adaptive capacity of sensitive stakeholders and sub-systems in Germany when using digital data with regard to the intended and undesirable side effects (unseens) in order to develop a safe, positive and ultimately more sustainable use of the potentials of digital data and technologies. The aim is to develop social and technological innovations, to identify the vulnerabilities that arise and to transform them into opportunities by actively shaping them.

Vulnerability and sustainability

The concept of *adaptive capacity* is a central component of the concept of vulnerability. It is not just a matter of a priori *risk management* for highly unknowable unseens (if one considers the high number of possible developments) and for negative events whose effects cannot be easily assessed. It is (also) about putting affected stakeholders (anticipatively) in a position to be able to react appropriately to these challenges in the event of significant changes in order to maintain their viability and their creative capacity. In this context, we also speak of sustainability or future viability.

The relationship between vulnerability and opportunity

In the field of technology assessment, it is common practice to divide the calculated or assumed effects of the introduction and dissemination of technologies into opportunities and risks. Opportunities indicate intended and unintended, but readily accepted positive

side effects, risks indicate accepted or unintended (often not foreseen) negative effects. In both cases, for opportunities and risks, it is usually a matter of estimating the probabilities that these effects, which have been identified as positive or negative, will or will not occur under certain conditions.

In the case of digital technologies, this structuring, as obvious as it may seem at first glance, is problematic. For here the scope for design is so large that the architecture chosen and implemented in each case generates opportunities and risks already at the onset. In contrast to traditional technologies, such as nuclear power plants or genetically modified foods, we do not assume a technical innovation and ask what opportunities and risks it can entail in order to introduce modifications that reduce the negative side effects. With digital techniques, the consequences already manifest themselves in the development process. To speak of side effects here is problematic in the term itself, since many complex technological innovations already create risks and opportunities on the drawing board: they are an unavoidable part of the design process. Many opportunities only arise when it is clear how possible risks can be tackled, and vice versa. Therefore, it makes sense here to first identify the possible risks and the possible negative effects and vulnerabilities that need to be addressed in order to realize any of the opportunities. One could also speak here of "opportunities and risks by design". This means that - from a sustainability perspective - the ability of stakeholders to deal appropriately with risks, uncertainties and vulnerabilities is part of innovation management for every digital innovation.

To take this into account, we at DiDaT do not speak of opportunities and risks, but of vulnerabilities and opportunities. Both are closely related and mutually dependent. The logic of this approach is that it makes sense to first determine vulnerabilities in order to gain design features for opportunities. For example, vulnerability to privacy violations can create opportunities for the development of products for encryption, data tracking and protection against unauthorized access. In

² Scholz, R. W., Bartelsman, E. J., Diefenbach, S., Franke, L., Grunwald, A., Helbing, D., . . . Viale Pereira, G. (2018). Unintended side effects of the digital transition: European

scientists' messages from a proposition-based expert round table. *Sustainability*, 10(6), 2001; <https://doi.org/10.3390/su10062001>.

¹ Scholz, R. W., & Kley, M. (2019). *Stocks and Flows-based Stakeholder Analysis of Digital Data – Basic concepts, tools for analysis, data, and the role of digital data infrastructure providers*. Kreuzlingen: STTM. This paper results from a cooperation with the ÖFIT, Fraunhofer Fokus, Berlin.

an international context with different sensitivities for this vulnerability, regionally specific markets can also emerge in order to optimally meet the different security needs (e.g. Europe versus the USA or China).

All vulnerability spaces dealt with by DiDaT thus also deal with opportunities; it is even one of the essential goals of the transdisciplinary process to generate opportunity spaces from vulnerability spaces as far as possible with the help of the creative power of all actors involved.

Which stakeholders are exposed to which vulnerabilities through the irresponsible use of data?

Answers to this question and the related question of which social and technological innovations can contribute to the best possible use of digital systems still have to be worked out and will be reflected in the planned White Paper in mid-2020.

The working groups on vulnerability spaces are currently drawing up initial lists and structures of vulnerabilities and the underlying processes. We can see that a large number of critical effects have to do with the question of who is allowed to use which data when and how (i.e. the allocation of data sovereignty). This gives rise to the following questions with regard to use;

- Who has access to the economic data of consumers and who may use them when and how (e.g. for personalised advertising, consumer nudging, risk management of insurance companies)?

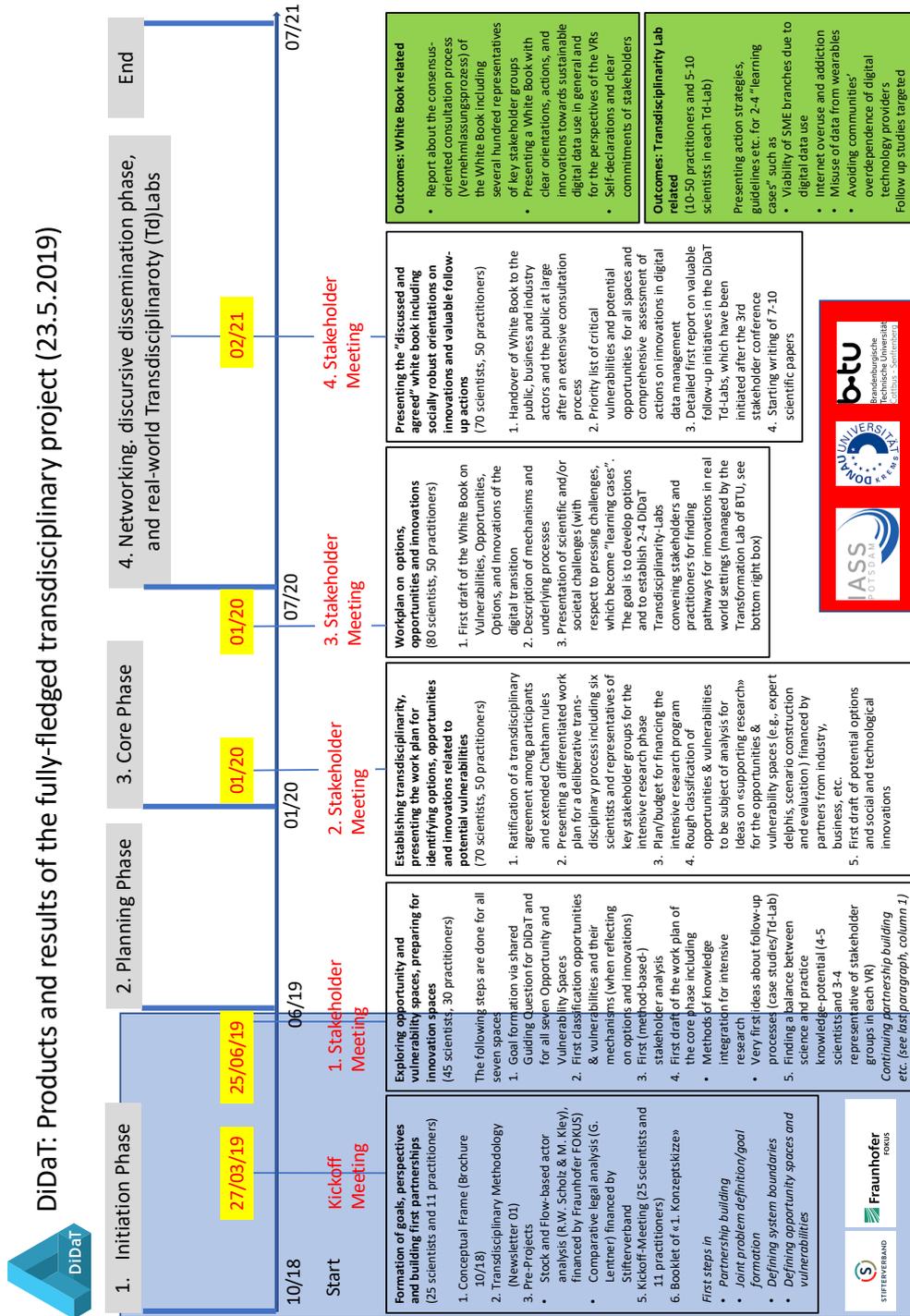
- According to which principles are which medical data collected? When are they made available to which actors and under what conditions?
- Political Surveillance: Is it permissible to collect and sell the political behaviour of the (state) citizen, which is derived from the behaviour in search engines (which can be regarded as a digital infrastructure)?
- What access do trade platforms have to the activities of companies? Are they allowed to use this to develop competitive business strategies (e.g. to better estimate the value of a company, etc.)?
- Which technological or behavioural changes help to protect against criminal or destructive motives (e.g. cyberstalking, blackmailing, psychologically disturbed attacks on critical infrastructures)?

These points should be considered in particular from the point of view that the data come into the possession of global software companies that are based in countries (such as the USA) that do not have comparable data protection rights to Europe (see the article on p. 10). There are many other aspects that open up a wide range of risks and/or vulnerabilities. The aim is to identify the specific and generic aspects of these vulnerabilities in order to develop strategies for the responsible use of digital data.

Since the digital infrastructures and access to a large part of digital data are in the hands of a few large infrastructure providers, the information technology control systems (e.g. which form of encryption forms the basis) and the behaviour of Internet users with regard to security play a major role³.

¹ Scholz, R. W., & Kley, M. (2019). *Stocks and Flows-based Stakeholder Analysis of Digital Data – Basic concepts, tools for analysis, data, and the role of digital data infrastructure providers*. Kreuzlingen: STTM. This paper results from a cooperation with the ÖFIT, Fraunhofer Fokus, Berlin.

Figure 1: Overall view of the DiDaT project



Organigramm / DiDaT: Organizational Chart

Figure 2. Organigram of the DiDaT project (slightly less than half of all participants are currently determined).

Science		Practice	
Facilitators and project leaders			
O. Renn (IASS) und R.W. Scholz (IASS und Donau Uni Krems)* / N.N- N.N. Practice			
Steering Board			
Speakers		Speakers	
C. Eckert (LMU, Fraunhofer AISEC) M. Mißler-Behr (BTU)		N.N. N.N.	
Members		Members	
D. Helbing (ETH Zürich), G. Gigerenzer (MPI für Bildungsforschung, Berlin), J. Hofmann (Wissenschaftszentrum Berlin), M. Latzer (Uni Zürich), R. Neuburger (Münchner Kreis), P. Parycek (Fraunhofer Fokus, Donau Uni Krems, Deutscher Digitalrat), C. Woopen*/M. Friele (Uni Düsseldorf; *Deutscher Ethikrat)		T. Clausen (Edelmann Media), H. Gleiss (Netz, tbc), S. Ober (NABU), T. Thiele (DB), H.-J. Sippel (Stiftung Mitarbeit), N.N., N.N.	
Project Team			
<ol style="list-style-type: none"> Project management: V. v. Zyl-Bulitta (IASS), D. Marx (BTU), G. Lentner (DUK, Deputy Facility) Administrative staff: J. Weissbrich (IASS), K. Schuster (Donau Uni Krems) 			
Vulnerability Spaces			
Impact-oriented vulnerability impacts			
Science	Topics/Facilitators	Practice	
Mobility			
W. Canzler, (WZB), T. Kessel (EICT Berlin), J. Maesse (Uni Siegen), W. Palmethofer, (Open Knowledge Foundation), L. Schebek (TU Darmstadt, tbc)	K. M. Hofmann (Network Institute)	D. Beilschmidt (DB), Teille (VW), F. Krummheuer, (Detecon/Telekom), I. Gerhäuser (Städtetag, BW) E. Fischer (VDV)	
Health			
G. Antes (Uni Freiburg), G. Glaeske (Uni Bremen), F. Tretter (LMU)	H. Köckler (HSG Gesundheit Bochum), L.A. Rosenberger (Uni Wien)	M. Friele (UK Köln), M. Weigand (APS) M. Weller (Spitzenverband der Krankenkasse)	
SME and digitalization			
D. Baier (Uni Bayreuth), G. Müller-Christ (Uni Bremen), A. Reichel (Zukunftsinstitut, Karlsruhe)	R. Czichos (DUK, CTN); interim R.W. Scholz (DUK/IASS)	W. Hofmann (TMG) L. Probst (IHK Erfurt)	
Agro-food chain			
R. Brunsch (Leibnitz ATB Potsdam), Christian Reichel (Leibniz IBZ)	J. Zscheischler (Leibniz ZALF)	H. Buitkamp (VDMA Landtechnik), H.-W. Griepentrog (DLG, Digitalisierungsausschuss, Uni Hohenheim, DLG, tbc), W. Haefeker (DBIB)	
Value- and impact-oriented			
Social media			
C. Montag (Uni Ulm), C. Sindermann (Uni Ulm)	P. Sellke (IASS)	F. Ebner (Mecodia), H. Gleiss (Netz), B. Thull (LFK Stuttgart) L. Simon (Cyberstalking)	
Institution- and regulation oriented			
Reliable and trustworthy ecosystems			
R. Jaster (HU Berlin), A. Kaminski (Uni Stuttgart)	K.H. Simon (Uni Kassel)	S. Hallensleben (VDE), M. Fuchs (Blogger und Politikberater), S. Thürmel (München)	
Cybercrime			
A. Panchenko (BTU), D. Labudde (HS Mittweida)	E. Albrecht (BTU); V. Hagen (BTU), D. Marx (BTU),	H. Wu (Huawei), H. Voelker (Deutsche Bank), M. Fröhlich (IT Compliance Solutions)	

2. DiDaT: Transdisciplinary sustainability research on the use of digital data: Goals, key concepts and methodology of the DiDaT project

Roland W. Scholz & Ortwin Renn

Suggestions for defining key concepts

To fully understand *unintended side effects* (UNSEENs) of digitalization, DiDaT has to deal with the broader and structural issues with regard to the underlying economic system, the effects on the natural environment, and its connection with politics and democracy. As the theory discussion will show, it seems that certain problems and vulnerabilities discussed within DiDaT are, in fact, deeply rooted in the present legal and economic system and will require structural change to be adequately addressed. We should think about not only treating the symptoms but getting at the roots of causalities of unintended side effects. The theory discussion thus opens up a space for a more critical engagement with very unsustainable systems we sought to change.

This working paper is written to support a coordinated and harmonized preparation of the Grobkonzept (rough concept) of the seven Vulnerability Spaces and to suggest definitions, which are used by all vulnerability spaces. It provides also some information (1) about **subject, goals, and guiding question**; (2) the definition of *core concepts* (such as **vulnerability** or **UNSEENs**) and ideas about a transparent, traceable, reasoned identification and selection of representatives of stakeholder groups.

What are the goals of DiDaT

As indicated by the phrasing “Responsible use of **Digital Data** as subject of a **Transdisciplinary Process**” (**DiDaT**), the project deals with the generation, transfer, (technical) operation, storage, retrieval and social use of digital data. The project takes a systemic sustainability perspective and starts from the key message of a European science expert roundtable on **unintended side effects** (UNSEENs). The message stated that main perils on sustainable

development emerge from the insufficient understanding and management of the interaction among “ownership, economic value, use and access of data” [1]. DiDaT is a follow-up process of the European Expert Round Table.⁴

DiDaT is constructing and describing social and technological innovations that increase the ability of sensitive and responsive stakeholders and subsystems (of Germany) to cope with unintended and unwanted side effects (UNSEENs) of the ongoing digital transition.

The goals of **DiDaT** may be phrased by the following (version⁵) of the guiding question.

DiDaT is contributing to sustainability research. The project is following a systemic definition of sustainability and sustainable development [2]. In this definition, sustainability is conceived as an **ongoing inquiry**⁶ on systems of management in the frame of **inter- and intragenerational justice** (or other normative criteria) and ecological boundaries.

Ongoing inquiry means that sustainability is a process in which what is conceived as (un)sustainable is continually (re)defined depending on the (**scientific**) **knowledge** about whether critical boundaries causing system vulnerability and resilience are exceeded and whether the societal normative values, standards, ideals, goals of a humane development process within the respective governance level (i.e., community, society or nation state⁷ or the global world community) are violated.

⁴ The European Expert Roundtable was cofunded by the German Ministry of Education and Research and of Danube University of Krems.

⁵ As DiDaT is a transdisciplinary process, the construction of the guiding question is subject of a theory-practice dialogue, which started with the initiation phase in 10/2018 and will be finalized with the end of the planning phase.

⁶ This definition emerged out of an inquiry of the understanding of 21 project leaders of scientists from MIT, Harvard University, ETH Zurich and Chalmers University in the frame of the Alliance of Global Sustainability initiative.
⁷ Relevant system boundaries of DiDaT are Germany, Europe, and the global world. In some questions, subsystems of Germany (e.g. Alte und Neue Bundesländer –

Why do we use the vulnerabilities and not the risk concept?

We refer to a technical concept of vulnerability as it emerged in risk research.

Risk can be defined as a function of **exposure** and **sensitivity**.

Exposure is the likelihood that a target such as person or an ecosystem is affected by the risk. Exposure is usually operationalized by the probability that a negative event or threat T_i happens to a specific target.

Sensitivity is operationalized by the extent of loss, harm, damage, peril, injure etc. resulting from the manifestations of possible threats T_i ($i \in I$). Usually, sensitivity is operationalized by a loss of a utility (or value) function.

In general, risk assessment and risk judgments are provided before a negative event takes place. We speak about **a priori** judgments or assessments.

There are many ways to calculate risk scores. One common option is to assess the probability that a certain “unacceptable damage” is going to occur. There are many quantitative and (semi)qualitative ways to construct, calculate, assess, etc. risk scores. An “unacceptable risk” is a potential damage that is deemed unacceptable. There is no objective threshold for setting the boundary between acceptable and unacceptable risks. It always relies on a normative judgment.

When looking at future negative events on the system level or on a stakeholder group S , not only the prior judgment about the riskiness (or harmfulness, destructiveness, etc.) of a threat T_i is of interest. From a practical perspective, it is of interest that a system shows **adaptive capacity** to cope with the negative impacts of a threat T_i when it actually has taken place. Adaptive capacity takes an **a posteriori** perspective.

Vulnerability describes the degree to which a risk agent can cause damage to the target system. It is a composite assessment of the **adaptive capacity**.

Whose UNSEEs, vulnerabilities, and sensitive stakeholder groups and subsystems

An **unintended side effect** (UNSEE) is a positive or negative outcome resulting from a decision maker’s (D_j) action of a decision A_j . This UNSEE differs from

province level separating Germany into two parts) may be considered.

the (planned) intended action. The UNSEE is often known (and sometimes unknown). If the UNSEE is known, we often find a tendency to overlook or discount it, because it is not part of an “actor’s primary business model.”

From systems theory, UNSEEs are secondary feedback loops. They could also be termed rebound, boomerang, or backfire effects (see Figure 1). DiDaT focusses on negative UNSEEs.

What is **intended, unwanted**, negative or positive depends on the decision maker and on the perspective taken. Digital innovation, such as all or most technological innovations, are Janus-faced in the sense that they may include ambivalent and uncertain impacts (i.e., be ambiguous). This becomes even more valid if more than one decision maker or stakeholder is involved.

Unintended side effects by example: If a farmer is cropping, the primary goal is to produce cereals, beans etc. From a farmer’s perspective, the harvesting is causing an unintended negative effect. The nutrient content of the soil system is reduced and the next year, yield will decrease unless proper interventions (I) such as fertilization are introduced to the system.

The term **stakeholder** emerged from business science [3]. In other contexts, one can also speak about interest groups (German: Interessens- oder Anspruchsgruppen). In the context of DiDaT we suggest the following definition: “A stakeholder is ... any individual, group, organization or other human system, who/which can affect or is affected by the access and use of digital data in the frame of the guiding question.”

Who and what is considered as a stakeholder (and a sensitive stakeholder group) in the frame of DiDaT is determined by the German constitution and the Charta of human rights. Interests which are not coherent with these legal reference systems, such as groups, which construct malware by criminal economic activities, are not considered stakeholders.

When talking about “**sensitive stakeholders**”, professions (such as industrial branches or professions such as interpreters) or **subsystems of society** (such as critical infrastructures, the gambling business) are included, which are facing disruptive innovation and potential losses. Also components of cultural patterns [4], such as values, norms, rules of interaction and verbal and nonverbal language (such as hate speech), may be viewed as subsystems.

Another critical issue in this context is the **change of power relations**. The turn from the industrial to the digital society is linked to fundamental changes of

the system of social, political, and economic structures. As in any system transition, winners and losers will emerge. Whether losers will be protected (e.g., by mitigation, subsidizing, public programs, etc.) is widely a matter of the social values and legal requirements.

The term UNSEEN and the attributes unintended and unwanted are coined from a societal perspective of technology innovation. This is done from a positive and anthropocentric conception of human systems. We postulate that from a **societal perspective** the digital transition (and the technologies for using digital data) are designed, constructed, and implemented to serve societal needs (such as welfare⁸, wealth, convenience, etc.). Thus, the construction of a genuine malware interpreted as a product of criminal, destructive, or pathological malware is not seen as a primary function of societal activities.⁹

The notion of **sensitivity** is applied in the DiDaT project in two ways. One is a **descriptive** way which may be viewed as being (widely) free of values. It refers to the dynamics in degree and speed to which a stakeholder group may be exposed to major vulnerabilities that may threaten the existence of stakeholder groups or the services of a (sub-)system unless timely and effective adaptations are initiated. The other is a normative use of the term sensitivity, which refers to structures that society wants to maintain. The concept of “cultural landscape preservation” in the field of environmental science may be taken as an example.

2. Main results of the comparative analysis of the treatment of “digital data” in the legal systems of the European Union, the United States of America and Hong Kong

Gabriel Lentner

EU (incl. Austria and Germany)

The much-discussed new Regulation (EU) 679/2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation, GDPR) provides for a prohibition principle, i.e. the processing of personal data is prohibited unless it is expressly permitted. It contains seven general principles which mainly address consent, transparency and processing of data. This

⁸ Warfare, secret services, and public services are excluded from DiDaT (by different reasons).

⁹ Highly simplified, e.g., the construction of malware as warfare means (e.g., by the secret service as a decision

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concerns principles for the processing of personal data (Art.5 GDPR), the lawfulness of the processing of personal data (Art.6 GDPR), conditions for consent (Art.7 GDPR) and conditions for a child's consent in relation to information society services (Art.8 GDPR).

Special provisions exist for the processing of special categories of personal data (Art.9 GDPR), the processing of personal data relating to criminal prosecution (Art.10 GDPR) and processing for which

maker) is considered in a frame of societal protection and not seen in the frame of societal aggression

identification of the data subject is not necessary (Art.11 GDPR).

The GDPR only applies to personal data. This means that, under certain conditions, the anonymisation of data offers the possibility of avoiding the scope of data protection law (and thus also the GDPR). However, in each individual case it must be critically questioned whether sufficient anonymisation or pseudonymisation actually exists or not. In practice, it is becoming increasingly important to have procedures that ensure anonymisation with sufficient reliability so that no one is able to assign the information processed to a specific person. Thus, anonymisation/pseudonymisation is also an important building block in the planning and implementation of Big Data and Industry 4.0 processes that conform to data protection regulations and are user-friendly.

Regulatory gaps that the EU Commission intends to fill with a new legal instrument are a data producer right and a concept for data access rights by means of compulsory licences.

The Regulation on the free movement of non-personal data in the EU (14 November 2018), which entered into force in May 2019, is intended to remove obstacles such as restrictions on data localisation and thus promote the development of a European data economy.

Currently, there is still data localisation by authorities in Member States in some areas and legal uncertainty in cross-border data spying and processing as well as difficulties in switching service providers (e.g. cloud) due to vendor lock-in practices.

In general, the EU has created a space for the strong protection of personal data with the GDPR, which in part also influences other legal systems (such as the USA or even Hong Kong). In contrast, the space for a data economy (in particular the trade in non-personal data) only appears to be at a developmental stage.

USA

Despite many efforts on the part of the US government, there is still no data protection law at federal level that is comparable with the data protection level of the EU. A wide variety of regulations at state and federal level (especially California, see more information below) as well as court rulings and company-internal data protection regulations make it difficult to make a conclusive assessment of the legal situation in the USA.

With the publication of the surveillance practices of the US National Security Agency (NSA) and the PRISM system, the extent of the surveillance became clear. This was particularly evident in the monitoring of worldwide online communication.

To protect personal data, California passed the most comprehensive of all data protection laws in the USA in July 2018, the California Consumer Privacy Act of 2018 (valid from January 1, 2020). This law is based on the GDPR of the EU.

Hongkong

In Hong Kong, the central data protection legislation is the Personal Data (Privacy) Ordinance (Cap. 486 of the Laws of Hong Kong). This standard regulates the collection, use and handling of personal data and is based on a number of data protection principles. It was issued in 1996 in response to the EU Directive 95/46/EC (Data Protection Directive) and largely covers the same area as this one, albeit with some significant limitations. The Regulation was fundamentally reformed in 2012, mainly to add specific provisions and restrictions for the use and provision of personal data in direct marketing. State supervision was not further examined for this report. However, it is important to note reports of Chinese surveillance practices in Hong Kong.

Vulnerabilities

In summary, the study identified the following vulnerabilities: national and international governance (with regard to territoriality of legal systems, access to data, data-supported decision-making processes, rule of law and democracy); data protection and big data; consumer protection; competition law.

Comments and Interaction

Section

The DiDaT Project and Integrated, Systemic Problems in Sustainability: A Commentary and Collegial Suggestions

Alan Borning¹⁰ and Lance Bennett¹¹

The DiDaT project, with its focus on both the opportunities and the undesired consequences of digitalization, concerns a core topic in the overall study of sustainability. We make three suggestions for the DiDaT project evolution in this commentary: first, to situate the project in an overall view of what is really needed to move toward sustainability; second, to put additional emphasis on questions of democracy and digital data, in particular with respect to social media; and third, to broaden the topics concerning the economy.

Our starting point is the observation that quality of life for growing numbers of people on the planet is threatened by a set of integrated, systemic problems in the environment and our economic and political systems. These problems are deep-rooted and will require major change to be addressed. For example, the defining environmental issue of our time is climate change. Addressing it effectively will require a different economic system, one that is fundamentally shaped by recognizing the limits of our natural world. But even touching the issue of fundamental economic change seems to be politically impossible for mainstream parties and organizations at present – hence the connection with politics and democracy.

We are two of the founders of the SEED project (Solutions for Environment, Economy, and Democracy), which is an evolving international network of scholar/activists, advocates, and practitioners who seek to address these integrated, systemic problems in a similarly integrated fashion. For more information please see the SEED website at <https://seed.uw.edu> or the SEED Manifesto [1]. We are working at multiple levels in SEED. One is a high level: seeking to develop simple communication strategies, focused on basic

and enduring questions such as “how can we live within the limits of the planet” and “what kind of democracy do we want.” Another, more specific, level involves working through the details of policy and exploring how this vision could actually unfold in terms of economics, laws, and so forth. The projects at the different levels mutually inform each other: keeping the basic, enduring questions in mind focuses the policy work and gives it a chance of being relevant, while doing the policy investigations keeps the basic questions grounded in ones that have a larger chance of making societal impacts and helps make the visions more concrete.

In terms of current activities, Lance is writing a book entitled *Communicating the Future: How Societies Can Create Better Solutions for Environment, Economy and Democracy*, as part of his current activities as a fellow at IASS. This book looks at the SEED themes at a high level: understanding how communication (and politics) helped get us in the current troubles, and how to better communicate realistic political solutions to them. Another activity involves investigating how the SEED ideas play out in the Information Technology sector, in particular looking at the current business model (“surveillance capitalism”) of companies such as Google, Facebook, and Twitter, which involves intensive gathering and cross correlation of personal information, and increasingly manipulation of behavior as well, in providing “free” services to the end users at a steep price for society; and investigating alternatives. Reference [2] is a workshop paper that describes some of our current thinking on this.

We suggest that these SEED ideas can provide a useful framing for the work of DiDaT and its working groups. For example, the Digitalisation and Impacts on Sustainability page at IASS (<https://www.iass-potsdam.de/en/research/digitalisation-and-impacts-sustainability>) asks two questions:

1. Can digitalisation create sustainable economies?
2. Does e-governance foster participation?

As they stand, these are worthwhile research questions. But we suggest reframing them as:

1. Suppose we have an overall vision for a sustainable economy that works for the planet and people. What are good roles for

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digitalization in this new economy? What happens to the nature of work?

2. In a world of this sort, what kind of democracy and governance do we want? And what is a good role for online communication in that?

This reframing thus starts with the idea that fundamental change in our economy and politics is needed, and then explores how this plays out for specific topics. This mirrors the logic of working between a higher-level vision of sustainability and the more specific policy levels for the SEED project described above.

We could develop a similar reframing for each of the seven focus areas (vulnerability spaces) in the current DiDaT research program. For all of these we start from the standpoint “Suppose we have an overall vision for a sustainable economy that works for the planet and people.” Then for example for Agroecosystems, we could ask “In such an agricultural sector, which has at its core the values of respecting and living within the natural world, what are good roles for digital data and information technology to help support it?” And similarly for SMEs – here we would also draw on the ethos and values of the Mittelstand enterprises in the German-speaking countries and how they might evolve within this broader framing, not just the statistical characteristics of SMEs.

Our second suggestion is to put additional emphasis on questions of democracy and digital data, in particular with respect to social media. The current “social media and values” space includes a number of different topics that arguably are too important to lump together in what could easily become a “catch all” or “other” category. Minimally, we suggest adding another focus area on “Democracy and IT.” Here the focus would be on good roles for IT and social media in moving toward democracies that actually function to represent the interests of their citizens, and that are capable of tackling the enormous challenges we face. With the exception of the radical right, which is often critical of the climate science that underlies much of the sustainability work, most conventional parties are far behind in uses of social media to mobilize and shape the thinking of their potential supporters. For example, it seems important to explore what can be done in the area of party attention to sustainability, and better interactive communication with voters. Another potential focus of this space would be on “alternatives to surveillance capitalism” – investigating ways to rein in the forces of surveillance capitalism and to develop alternatives, since the current

business model has such disastrous and wide-reaching implications for privacy, democracy, and individual freedom and dignity.

Our third suggestion is to configure the economic category of DiDaT to include economic issues beyond the Mittelstand. That is certainly important, but the technology-driven economy represents far broader economic challenges, including: unrealistic growth levels, promoting the illusion of clean consumerism, inequitable distribution of economic dividends, and underpublicized levels of energy and material consumption (witness the current Silicon Valley speculation frenzy over blockchain technologies or Internet of Things). These and other features of the digitalized economy also merit our consideration, whether as a separate category, or a broadening of the current focus on small and medium enterprises.

Finally, we can relate these suggestions to DiDaT’s concern with vulnerability and risk. It is possible that we are incorrect regarding the need for fundamental restructuring of our economic system, or the need to change the ways in which democracies engage citizens in thinking about the future. Perhaps the problems related to future sustainability can be addressed by more modest moves, involving some additional laws and regulations that do not require basic restructuring. However, we believe that there is a significant risk of catastrophic failure unless we at least can imagine more basic economic and political restructuring. So the risk assessment and mitigation perspective at the core of DiDaT argues for doing just that.

Our overriding question about DiDaT is whether it is aimed at modest examination of how digitalization can work better within existing social, economic and political paths, or whether there is also room for some re-visioning of those paths. Our sense is that DiDaT may make a bigger impact if it can do both.

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Mastering Humanity's Grand Challenges¹²

A note by

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Since about “The Limits to Growth” report in the early 70ies, we know that our economy is not sustainable and that societal and economic collapse in the 21st century is a realistic possibility, at least according to a large number of experts (even though the discussion is still on-going and controversial). The proposal of the business world to handle the sustainability problem was largely based on globalization, liberalization, and free global trade. However, those measures have almost reached their limits, and sustainability challenges are still huge, as the debates on climate change and water scarcity show. Moreover, there is a serious distribution problem of resources. Some countries suffer from obesity, while others suffer from hunger. Hence, the United Nations has called for urgent action under labels such as “Agenda 2030” and “Sustainable Development Goals”.

To achieve these goals, many have proposed a data-driven and AI-controlled approach. When resources are expected to fall short, it is proposed that one needs to know exactly where all resources are located and who is using them. Furthermore, one should be able to steer the use of all these resources. The data would be centrally collected and an optimal plan worked out by means of a “world simulator”, which is based on detailed digital doubles of everyone (an example is the “Sentient World” simulation). Moreover, people’s behavior would then be steered by nudging

or neural manipulation, and deviations from the desired behavior would be punished, as known from the “Chinese” Social Credit System or Citizen Score. (Note that the British secret services CHGQ has developed a similar program under the name “Karma Police”, an extension of Predictive Policing approaches.)

This approach has been widely criticized as totalitarian. Not only does mass surveillance violate the human rights of privacy and human dignity. Behavioral experiments with humans and social engineering without well-informed consent is as problematic as most digital methods of propaganda and censorship. An AI system that proposedly acts like a “benevolent dictator” and applies predictive policing to punish deviations from imposed conformity shares elements of fascist systems. Moreover, by means of constructed dilemma situations such as “trolley problems”, some experts are trying to establish new ethical principles for “moral machines”, which undermine the equality principle on which many societies are based. Research shows that autonomous systems judging over humans might discriminate certain people (e.g. women or people of color, elderly, poor or ill people), and they may relativize human rights. Some researchers have even started thinking about AI systems for euthanasia in an unsustainable world. In other words, something like a digital holocaust is conceivable, if autonomous systems are used against people.

As an alternative approach, we have recently developed concepts that go beyond open data, open source, open access, open innovation, making, crowd sourcing and citizen science. These concepts include global systems science and a network of digital hubs (“digital lab”), peace rooms, digital empowerment, data platforms enabling informational self-determination, democratic capitalism, digital democracy, City Olympics, participatory resilience, socio-ecological finance, participatory sustainability, and open source urbanism. Here, co-learning, co-ordination, co-

¹² The complete text can be found here: <http://fu-turict.blogspot.com/2019/04/mastering-humanitys-grand-challenges.html>

operation, and co-evolution are the expected success principles to benefit our economy and society. Unleashing collective intelligence would boost societies, combinatorial innovation would fuel the economy, and digital assistants would empower people. Most of these concepts are shortly described in some detail below, and links to articles are provided.

1. Global Systems Science

Today's strongly connected, global networks have produced highly interdependent systems that we do not understand and cannot control well. These systems are vulnerable to failure at all scales, posing serious threats to society, even when external shocks are absent. As the complexity and interaction strengths in our networked world increase, man-made systems can become unstable, creating uncontrollable situations even when decision-makers are well-skilled, have all data and technology at their disposal, and do their best. To make these systems manageable, a fundamental redesign is needed. A 'Global Systems Science' should create the required knowledge and paradigm shift in thinking.¹³

2. Inspired by the MIT Media Lab, it is suggested to create a European Digital Lab

In order to prepare the tools to counter our societies' existential threats, a large-scale initiative, a kind of Apollo project, is urgently needed. We propose to establish a Digital Lab – a European MediaLab, such that a sizeable progress can be made on a short time scale. The Digital Lab could be staffed with leading international experts (many would even return from the USA, if working conditions were competitive). It is a matter of political will and action to kick-start and support the activities that would foster and integrate cutting-edge research in various specialized digital hubs all over Europe and form a scientific collaboration network, the European Digital Lab.

Informational self-determination should be or is a human right. The slide below proposes a platform for informational self-determination, which would give control over our digital doubles back to the people. With this, all personalized services and products would be possible, but companies would have to convince us to share some of our data with them for a specific purpose. The resulting competition for

¹³ Dirk Helbing (2013), Globally networked risks and how to respond, Nature volume 497, pages 51–59, <https://www.nature.com/articles/nature12047>

¹⁴ <https://www.morgenpost.de/web-wissen/web-technik/article213868509/Facebook-Skandal-Experte-raet-zu-digitalem-Datenassistenten.html> ;

consumer trust would eventually promote a trustable digital society.

The platform would also create a level playing field: not only big business, but also SMEs, spinoffs, NGOs, scientific institutions and civil society could work with the data treasure, if they would get data access approved by the people (but many people may actually select this as a default). Overall, such a platform for informational self-determination would promote a thriving information ecosystem.

Data management would be done by means of a personalized AI system running on our own devices, i.e. digital assistants that learn our privacy preferences and the companies and institutions we trust or don't trust. Our digital assistants would comfortably pre-configure personal data access, and we could always adapt it.

Over time, if implemented well, such an approach could establish a thriving, trustable digital age that empowers people, companies and governments alike, while making quick progress towards a sustainable and peaceful world. The concept fits the concept of a European Science Cloud well.¹⁴

4. Creation of "Peace Rooms" to address the world's grand challenges better

The resurgence of terms such as 'cold war' and 'clash of cultures' in the media reflects a dangerous social dynamic that could drive societies to the brink of recession, civil war and societal collapse. We suggest that a more modern, open and scientific strategy might help to prevent history from repeating itself.

Today's strategic 'war rooms' use big data, artificial intelligence and cognitive environments to manage conflicts and crises or run big business. Recasting them as 'peace rooms' would be better in tomorrow's world — they would then be more democratic and would operate with greater transparency for legitimacy. This would help to build trust and expose flaws in the system.

Peace rooms could be run by interdisciplinary, international scientific teams to integrate the best available knowledge. They would rely on input from multiple stakeholders — including cities, civil society, non-governmental organizations, citizen scientists and crowdsourcing — to find solutions that work for as

<http://futurict.blogspot.com/2018/04/nudging-tool-of-choice-to-steer.html> ; <https://www.japantimes.co.jp/opinion/2018/04/30/commentary/world-commentary/stop-surveillance-capitalism/> ; <https://www.theglobalist.com/capitalism-democracy-technology-surveillance-privacy/>

many people as possible. The rooms would be supervised by ethics experts to ensure that innovative outcomes are used responsibly.

This is in line with approaches such as democratic capitalism and digital democracy. Peace rooms could change how strategic decisions are made in crisis situations, guiding us from uncontrollable conflict to the sustainable development that the world needs now.¹⁵

5. Creation of a platform for participatory, digital democracy, i.e. a digital upgrade of democracy to foster collective intelligence

Digital democracy is aiming to foster collective intelligence to find solutions to complex societal issues that result in better outcomes by integrating different perspectives and solutions. On a digital platform, the various arguments on the subject would be collected, structured and summarized in different perspectives. After that, the main representatives of the various perspectives would come together at a roundtable and deliberate on innovative, integrated solutions that would work for as many different groups of people as possible. Only then one would vote – namely on the set of best integrated solutions.¹⁶

6. Development of a "design for values" and "responsible innovation" approach

Responsible innovation is needed to address the grand challenges of the 21st century. It requires proactively addressing relevant moral and social values already in the design phase of new technologies, products, services, spaces, systems, and institutions.

There are several reasons for adopting a design for values approach:

- (1) the avoidance of technology rejection due to a mismatch with the values of users or society,
- (2) the improvement of technologies/design by better embodying these values, and
- (3) the generation or stimulation of values in users and society through design.¹⁷

¹⁵ Dirk Helbing & Peter Seele (2017). Turn war rooms into peace rooms, *Nature* volume 549, page 458, <https://www.nature.com/articles/549458c>; <https://www.theglobalist.com/technology-big-data-artificial-intelligence-future-peace-rooms/>

¹⁶ https://www.huffingtonpost.com/entry/how-to-make-democracy-work-in-the-digital-age_us_57a2f488e4b0456cb7e17e0f; <https://www.nature.com/news/society-build-digital-democracy-1.18690>

7. Creation of the framework for a real-time feedback and coordination system for a sustainable management of complex systems (socio-ecological finance system)

Using the Internet of Things, one could now quantify the impact of human action on the environment and others in a multi-dimensional way. Noise, stress, CO₂, waste and other effects that one would like to reduce would be measured by various sensors. The same applies to effects one would like to promote, such as the recycling of resources. Such a multi-dimensional real-time measurement and feedback system would be able to incorporate the values and goals of our society. For example, environmentally-friendly and social production methods could be made profitable and attractive. In this way, the emergence of a sustainable circular economy and a sharing economy could be promoted by a novel socio-ecological finance system, which one may call "Finance 4.0+". Such a system would bring the Internet of Things and Blockchain technology together to reach the UN 2030 Sustainable Development Goals more quickly, in a participatory way.¹⁸

8. Development of a City Olympics concept as participatory format to address global challenges

"City Olympics" or "City Challenges" could boost innovation on a cross-city level involving all stakeholders. They would be national, international or even global competitions to find innovative solutions to important challenges. Competitive disciplines could, for example, be the reduction of climate change, the development of new, energy-efficient systems, sustainability, resilience, social integration, and peace. The solutions would be publicly funded and should be Open Source (for example, under a Creative Commons license) in order to be reused and developed further by a multitude of actors in all cities i.e. by corporations, SMEs and spin-offs, researchers, NGOs and civil society. In this way, the potential of trends such as Open Source Movement, Hackathons, Fablabs, MakerSpaces, Gov Labs and Citizen Science would be raised to an entirely new level, creating the potential for civil society solutions. The new success principles would be collaborative practices such as co-learning,

¹⁷ <http://designforvalues.tudelft.nl/>; <https://www.weforum.org/agenda/2018/03/engineering-a-more-responsible-digital-future>; <https://www.tudelft.nl/en/tpm/research/projects/engineering-social-technologies-for-a-responsible-digital-future/>; <https://standards.ieee.org/industry-connections/ec/ead-v1.html>; <https://ethicsinaction.ieee.org>

co-creation, combinatorial innovation, co-ordination, co-operation, co-evolution, and collective intelligence.

Increasing the role of cities and regions as drivers of innovation would allow innovative solutions and initiatives to be launched in a bottom-up way. All interested circles could contribute to City Challenges. Scientists and engineers would come up with new solutions and citizens would be invited to participate as well, e.g. through Citizen Science. Media would continuously feature the efforts and progress made in the various projects. Companies could try to sell better products and services. Politicians would mobilize the society. Overall, this would create a positive, playful and forward-looking spirit, which could largely promote the transformation towards a digital and sustainable society. In the short time available, the ecological transformation of our society can only succeed if the majority of our society is taken on board, and if everyone can participate and profit.¹⁹

¹⁹ <http://www.coss.ethz.ch/education/BETH.html>

¹⁹ <https://www.csh.ac.at/event/csh-workshop-city-games/> ; <https://www.csh.ac.at/event/csh-eth-workshop-1st-city-olympics/> ; <https://www.bloomberg.org/program/environment/climatechallenge/> ; <http://www.eib.org/en/projects/sectors/urban-development/city-call-for-proposal/index.htm> ; https://wwf.panda.org/our_work/projects/one_planet_cities/one_planet_city_challenge/ ; <https://www.youtube.com/watch?v=SEsga1ZKsw4> ;

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Verantwortungsvoller Umgang mit digitalen Daten: Digitale Daten als Gegenstand eines Transdisziplinären Projekts (DiDaT)

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