# An Integrated Framework for Ethical and Sustainable Digitalization

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*Abstract*—Dynamically developing digitization initiatives among public institutions and private companies necessitate a balanced approach to digital ethics. Several frameworks and legal regulations have been adopted to clarify and define the various ethical challenges in digital contexts. These initiatives often accentuate one of three components: data security, data governance, or digital strategy. However, an integrated approach is required to meet the current demand for an ethical and sustainable approach to digitalization and address the growing number of challenges occurring in handling data and related peripheral components. This paper develops the concept of an integrated framework to incorporate all relevant aspects of digital ethics by combining three categories of digital contexts: law and regulations, ethics and justice, and environmental sustainability. The core of this integrated framework, the Fribourg sustainable digital ethics framework (FSDEF), consists of two boundary conditions of sustainable development: social thresholds of justice and ecological planetary boundaries. It also incorporates numerous other frameworks and standards, including value-based engineering and IEEE standards.

*Index Terms*—Digital ethics, sustainability, corporate digital responsibility

## I. INTRODUCTION

The Fribourg sustainable digital ethics framework (FSDEF), that is the core of this work, is setting out to address the ethical challenges from artificial intelligence and big data that are connected to concerns of justice, sustainability, and climate change. The vision of this framework is to develop a sustainable digitalization standard that connects three categories of digital contexts: law and regulations, ethics and justice, and environmental sustainability. The core of our integrated FSDEF consists of two boundary conditions of sustainable development: social thresholds of justice and planetary boundaries. It also incorporates numerous other frameworks and standards, including value-based engineering and IEEE standards. The goal is to assess digital services (i.e., their algorithms and data gathered) for their sustainability and ethical quality by

regularly applying algorithms or block-chain. Close collaboration between ethical research and computer science is needed to define planetary boundaries and sufficiency conditions of justice as evaluation standards for digital services. Ethics contributes by defining norms that can be used as standards of evaluation for digital services. Computer sciences are required to determine criteria and algorithms able to assess digital services.

This paper develops the basic concept of our sustainable digitalization standard and shows what research is needed for its completion. After that, it puts the FSDEF into the broader context of digitization and digital services and how they appear in society. Finally, this paper shortly discusses the benefits of the FSDEF and provides an outlook for the project development. The paper is structured as follows: Section II presents the background and motivation of the concept. Section III briefly analyses related works regarding digital ethics. Then, IV presents a non-exhaustive systematic literature review to support our claim that digital ethics concerns more than just data protection and privacy. Section V introduces a FSDEF stack model showing how our framework is integrated in wider contexts of digitalisation. Finally, concluding remarks are presented in Section VI providing an outlook on how we envisage to further develop and implement the FSDEF.

## II. THE BASIC CONCEPT

Our Fribourg sustainable digitalization framework's basic conceptual idea is that digital services should neither fall short of violating thresholds of social justice nor overshoot the planet's ecological boundaries (see Figure 1). By doing so, we will enhance the concept of a doughnut economy developed by Raworth [1] to assess digital services to help prevent them from contributing to social and environmental disasters. In its initial version, the concept of the doughnut defines two boundaries for a sustainable economy. Following the classical understanding of sustainability beyond economic development,
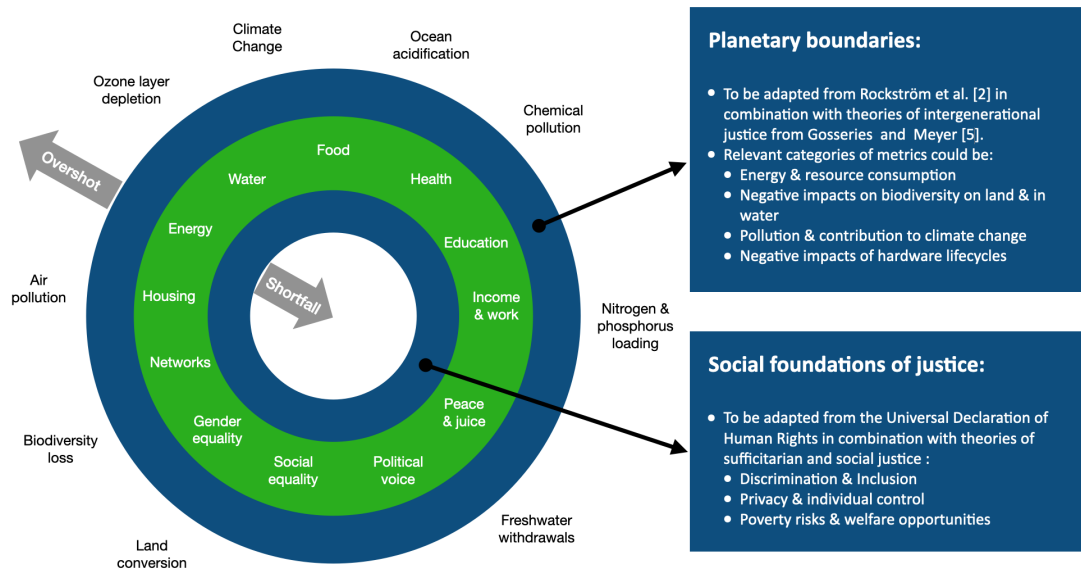
Fig. 1: Sustainable development layer of the FSDEF. Adapted from [1], [2].

it incorporates social and ecological conditions. While in the sustainability discourse, the economy is often seen as being of equal importance to social and ecological conditions, Raworth argues that the latter two must constrain economy. Sustainable economy must neither undermine the social foundations of human well-being nor breach the ecological ceiling of planetary boundaries.

The social foundation elements are defined by those sufficiency conditions of human life avoiding critical human deprivations. In Raworth's definition, they include, among other conditions, food security, appropriate income, water and sanitation, health care, and education. More generally speaking, they concern sufficiency levels of justice [3], [4]. Social conditions below these thresholds mean an injustice. On the other side, the planetary boundaries are defined by different ecological thresholds consisting of critical earth-system processes. Their overshoot leads to dangerous changes in earth systems, undermining critical levels of human well-being. They concern demands of inter-generational justice and ecological conditions fundamental for the possibility of global and social justice [5]–[8].

In this doughnut framework, sustainable economic development is a development that neither undermines sufficiency thresholds of justice nor overshoots ecological ceilings of planetary boundaries. The definition of both appropriate social foundations and ecological ceilings is a normative endeavor. What counts as a sufficiency level of justice for human well-being is a value judgment, as is the definition of when ecological changes become dangerous and thus conflicting with intergenerational, global, and social justice. However, once social foundations and ecological ceilings are defined, they spell out in what space just and save economic development is possible.

We argue that digital services can undermine sufficiency thresholds of justice and foster overshooting of planetary boundaries. They can only be sustainable if they operate within a just and ecologically safe space. Our framework defines both thresholds and, once realized, allows us to assess the sustainability of digital services. Digital services may increase air pollution, drive climate change, contribute to biodiversity loss as economic development is doing. At the same time, it is evident that digital services tend to violate the social foundations of justice, an issue often discussed in digital ethics [9]–[11]. It is often mentioned that digital services undermine autonomy or discriminate between different social groups and ethnicities unjustifiably. We believe that digital services are extremely valuable if they develop between the social foundations of justice and the ecological ceiling of planetary boundaries but that they significantly contribute to damage sustainable development if not (see Figure 1).

## III. Related Works

As businesses grow and become multinational, the number of people who can be hurt or affected by their practices increases. Scholars and professionals from diverse backgrounds put their collective efforts to develop ethically justified business and public relationships. The growing concern of unethical personal data usage and processing by algorithms necessitated the adoption and enforcement of international law. Citizens and governments tended to trust organizations with their processing of the data that they provided. However, numerous data privacy breaches and illegal processing of data made authorities adopt integrated laws and regulations to prevent unethical data processing.

### A. Laws and Regulations

The most popular and widely known of these regulations is the General Data Protection Regulation (GDPR) [12] adopted by the European Union member countries and the European

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TABLE I: Ethic principles and requirements

| GDPR | IEEE P7000 |
|---|---|
| 1) Lawfulness, fairness, and transparency | 1) Ecosystem Responsibility |
| 2) Purpose limitation | 2) Stakeholder Inclusiveness |
| 3) Limited storage period | 3) Contextual Wisdom & Continuous Foresight |
| 4) Data quality | 4) Ethicality Value Identification |
| 5) Data minimization | 5) Value Rationalization |
| 6) Information security | 6) Wise Leadership |
| 7) Privacy Impact Assessment | 7) Respect for Agreements and Laws |
| 8) Right of access | 8) Renunciation |
| 9) Right to be forgotten | 9) Openness and Transparency Value Mission |
| 10) Right to be informed | 10) Value-based Requirements in Engineering |

Economic Area. It addresses numerous concerns and ethical considerations related to the critical issues presented in Table I.

The regulation also incorporates the rules of processing and storing data related to/acquired from third countries (i.e., countries not included in the regulation's enforcement area), proper encryption, and email marketing. The regulation acts as a role model for many other national laws in South America, Africa, and Asia. The California Consumer Privacy Act [13] contains certain conceptual similarities to GDPR. A further significant development towards the proper acknowledgment and enforcement of digital ethics is the Digital Ethics Framework adopted by the United Kingdom [14]. Currently, this framework applies to public institutions as well as public service companies. It provides the criteria for these institutions for self-testing and identifies gaps in data handling or privacy.

However, even though these legal developments provide important steps forward to ensure ethically justified data handling and protection of privacy they only concern part of the relevant aspects defining the social foundations of societies. The FSDEF aims to incorporate these further aspects like trust, non-discrimination and fairness in distributing economic assets. Furthermore, no standard mentioned makes any relation to environmental and sustainability concerns. This is a key point to be incorporated by the FSDEF via defining the ecological ceiling of sustainable digitization. With this in mind, we suggest to start an ethical discourse in society to address the challenges and incorporate ethical innovation [15].

### B. Technical Frameworks and Standards

Provided the growing concern about the importance of digital ethics, numerous scientific labs started to address these concerns. The book, "Ethical IT Innovation," [11] embraces the innovations that seem to incorporate ethical intentions. Moreover, this book compellingly outlines that an ethical approach to technical problems and solutions motivates innovation and steers digital transformation towards how citizens/consumers expect it to be. Along with this, a value-based engineering approach like IEEE P7000 [16] presented in Table I has been established.

These IEEE P7000 principles are examples for an integrated approach to value engineering. They touch on four important categories that play an essential role in the success of engineering sustainability. The framework stresses ecosystem responsibility implying that the stakeholders in engineering processes should take responsibility for the data process's ethical and moral implications within the technological ecosystem [16]. Besides, these principles foster environmental awareness by inferring humanity's responsibility in front of the environment and planet. Additionally, they highlight stakeholder inclusiveness, leadership, and value-based engineering requirements. Finally, the remaining principles stand on the engineering process's ethical grounds and promote critical ethical and legal values such as respect for agreements and laws and the principle of openness and transparency.

The IEEE P7000 principles stimulated further progress in this direction. The IEEE body of standards published a draft of the "Model Process for Addressing Ethical Concerns During System Design," shortly referred as IEEE P7000 standard[1] [17]. This standard replicates the value-based engineering principles at some points, such as stakeholder inclusion. However, it also widens its scope towards human values and development concerns, and team competence. Furthermore, the standard introduces numerous processes or steps that help understand, set criteria, and follow proper ethical decisions in system design. Each process is outlined in detail and divided into the following parts: purpose, outcomes, activities and tasks, inputs, outputs.

However, even though relevant social foundations are mentioned in these approaches and environmental concerns are incorporated we think further developments are possible. Regarding the social foundations, ethical implications still need conceptual clarification and justification. At the same time, in these works environmental responsibility is defined too broadly and could be differentiated not only regarding normative implications but also regarding criteria to assess environmental impacts. The FSDEF sets out to provide these further specifications.

## IV. LITERATURE REVIEW

This section presents detailed results of a systematic literature review of over 44'107 articles on the IEEE Xplore Library, ACM Portal, and Springer Link from a technical perspective. Finally, the PhilPapers database was explored from a philosophical perspective of ethics (see Table II). Our

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[1]https://standards.ieee.org/project/7000.html

search makes clear in what direction our framework needs to be developed and shows why the legal regulations and technical frameworks discussed in section III are restricted in their scope.

TABLE II: Number of articles per library and stage of the PRISMA framework in [18].

| Library | Identification | Screening | Eligibility | Inclusion |
|---|---|---|---|---|
| IEEE Xplorer | 1'358 | 728 | 641 | 80 |
| ACM | 32'734 | 33'470 | 5'854 | 111 |
| Springer Link | 8'044 | 4'286 | 1'427 | 39 |
| PhilPapers | 1'971 | 1'971 | 1'574 | 48 |

Table III presents details about the number of articles per library and category of the systematic literature review conducted in this work. The following sections present insights per each category of the classification scheme according to the content focus. It should be considered that some articles could belong to more than one category, but for the sake of this work, they were assigned to the one the authors considered was most appropriated.

TABLE III: Number of articles per library and category.

| Library | Service | Technology/ Field | Sector | Reflections and Analyses |
|---|---|---|---|---|
| IEEE Xplorer | 6 | 47 | 11 | 16 |
| ACM | 28 | 50 | 11 | 23 |
| Springer Link | 5 | 9 | 10 | 15 |
| PhilPapers | 7 | 14 | 1 | 26 |

### A. Service

From the 278 reviewed articles, 46 (16%) focused on services. Articles in this group focused on ethical challenges when delivering means to satisfy people's needs in smart city solutions, healthcare, government, and law. FSDEF will be developed in a way to be applicable to all sorts of services, including what is defined as "conversations about ethics," presented in [19].

### B. Technology/Field

In total, 120 (43%) studies focused on ethical challenges with solutions developed in various technological fields. From the studied research initiatives, it was possible to identify that several authors have solutions under the spotlight in artificial intelligence (AI), gaming, social networks, information storage, and robotics. Incorporating these different technological fields will be the main challenge in further developing FSDEF.

### C. Sector

Digital ethics research has also attracted attention regarding the sector implementing digital solutions. It includes industrial, non-government organizations (NGOs), and public sectors. Thirty-three articles (12%) were found within this group. Hence, an integrated framework for assessment of digital services must be formulated in such a way as to be acceptable to the different social contexts of these various kinds of institutions.

### D. Reflections and Analyses

Lastly, eighty papers (29 %) were classified as reflections and analyses. Many authors had made their contribution by taking a more analytical perspective to unveil challenges and issues that are not being addressed and propose ideas and guidelines towards building fairer solutions. These will be crucial contributions for understanding what are the key parameters defining the two boundary conditions of the FSDEF.

### E. Ethical Concerns

Most of the studied articles (59%) address one main issue, being these justice, inequality, trust, responsibility, and privacy the ethical concerns most frequently addressed. This result hints about the direction that research is lately taking, considering that formerly the main concerns were around privacy.

Figure 2 presents a summary of the articles studied by ethical concern and the library. It should be highlighted that in some cases, a single article can address more than one central issue, and thus, some of the entries on the table depict two challenges separated by a comma.

This list shows that the social foundations in our framework are the main concern in current research in digital ethics. They justify our claim that an integrative framework must incorporate more aspects than only data protection and privacy. The list of ethical concerns is still missing environmental issues that are not really touched upon in current digital ethics research.

## V. CONTEXT OF THE DIGITAL ETHICS FRAMEWORK

This section explains the broader context of our framework and shows how our standard inter-plays with other standards and frameworks regulating data processing, algorithms and digitalization.

Figure 3 presents the elements of a stack ethical digital transformation model based on the literature review presented in Section IV. Our digital ethics framework is embedded in a broader social context. It aims to provide guidance in the gray zones where no existing regulatory legal framework provides guidance. Such guidance is necessary because in our contemporary world companies, public institutions, and citizens cannot avoid using digital services and processing data in some way or the other. Simultaneously, in democratic societies, it must be citizens defining data processing conditions, especially if it is their private data.

The foundation of any initiative to assess and manage digital services is the legal framework conditions that dictate basic rules for companies, institutions, and individuals. It is first and foremost the state law of a company's host country, its public institutions, and its citizens defining legal boundaries. Like in Europe, such national law is most often embedded in a broader legal framework such as the legal framework of the European Union. Besides, regulations of international law might become relevant as well. In the European Union and European Economic Area context, one of the leading legal improvements and significant steps towards diligent data handling consists of the GDPR.
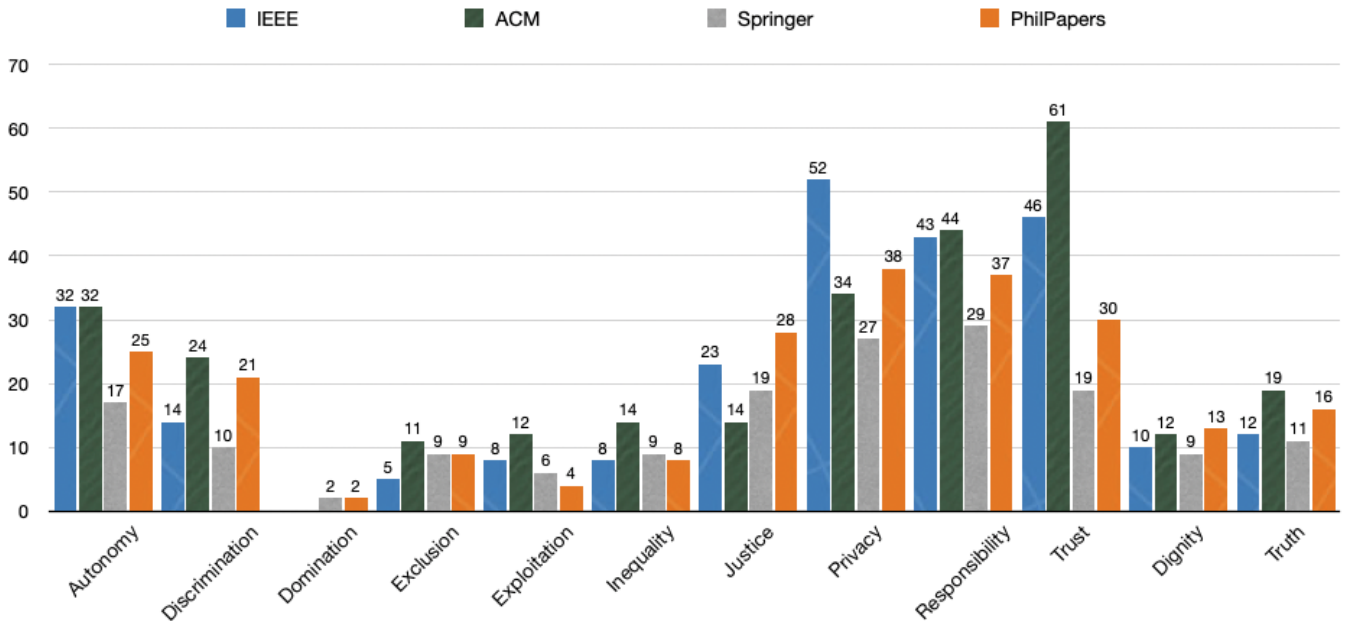
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Fig. 2: Results by ethical concern and by library

GDPR principles mainly focus on customer-centered services and the data they process. Our Digital Ethics Framework sides these legal framework conditions and GDPR or similar principles. Even though many ethical values and norms are already integrated into legal frameworks, many grey zones still exist, especially in principles like the GDPR principles. Grey zones exist regarding the social foundations of justice and even more so in the context of ecological sustainability. In our view, this is the case because data processing involves many more issues than those regulated in the GDPR or other data processing principles. It is not only protection of privacy and accurateness of data that is relevant for sustainable digitalization.

As mentioned in the GDPR principles, it is relevant that agreement to sharing minimal data is given and that this data is only stored for a specific time. What is also relevant to clarify, for example, are questions of hidden discrimination, unfair inequalities in treatment, or unintended side-effects of targeted search results. Furthermore, GDPR principles for example do not reflect any ecological advantages and negative ecological impacts of digital services. It is precisely concerning these aspects that we want to step in with our framework by enhancing and specifying existing legal regulation. Ideally, technological enablers and digital services reflect upon existing legal regulations. These services and enablers are manifold; they include, for example, eVoting, Smart Cities, Smart Health, or Smart Logistics. However, without customer and citizen needs and issues, neither services would be developed nor would any regulatory issues occur.

Especially in democratic societies, citizens and customers at least foster what services are developed and define what

regulations are necessary. A company's economic success and its services heavily depend on its ability to predict the citizen/customer needs and solve their data issues. A company's reputation heavily depends on how well it can anticipate customer and citizen issues and concerns [20].

As presented in Figure 3 digital transformation points towards the upper layers starting from legal frameworks. Customer needs cannot be met and identified if the company does not put in place and develops all previous layers. At the same time, it is customer and citizen issues that push towards specific legal regulations. The opposite arrow of stakeholder regulation shows this. Our ethical framework helps companies to anticipate such demands well in advance of coming legal regulation or in case of their total absence.

Digitalization is transforming information, documents, or processes into digital formats that machines can process. Digitization is often viewed as an opportunity to transform our old societal and city mechanisms into efficient services. The framework proposed incorporates vital pillars from the very bottom of understanding data management and data privacy and culminates on citizens/customer needs. The following sections describe each of the elements of the framework proposed.

### A. Legal Perspective

*1) Legal Framework:* The foundation of any initiative on data management and data privacy but also all other ethically sound handling of digital services is the legal implications of the companies' ground rules. For example, in Switzerland the fundamental legal framework for data handling are the legal regulations proposed and followed by the European Union (EU). They shape the legal regulations adopted by the Swiss
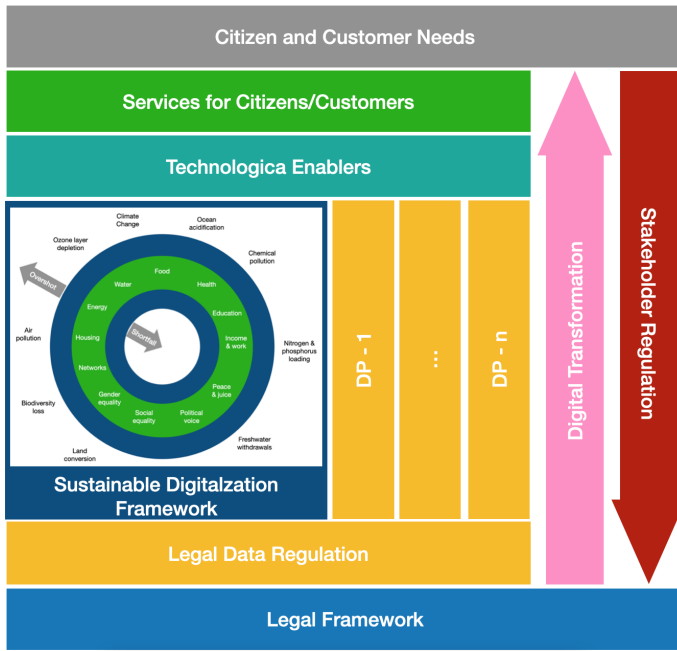
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Fig. 3: FSDEF stack model

Government and with that the ground rules of a company located in Switzerland.

### B. IT Perspective

*1) Data Principles:* The second layer of the model describes the different digital principles based on legal frameworks. An example of this layer could be the GDPR principles; in a European context, they include several constraints to be followed to provide digital services (see subsection III-A).

*2) FSDEF:* The third layer of the stack model also includes our framework and with that principles of social foundations and ecological ceilings. The objective of this set of principles is to guarantee that the services provided to citizens/customers comply with an ethical framework that respects social justice thresholds and environmental sustainability. The FSDEF relies on two boundary conditions of sustainable development: social thresholds of justice and planetary boundaries (see Figure 1).

*3) Technology Enablers:* The fourth layer of the stack model focuses on the various technological enablers (e.g., interactive machine learning, security, human-centered systems, explainable AI, federated learning, privacy by design, blockchain) of sustainable digital services for citizens and customers. The development of technological enablers must comply with the principles of lower layers, especially the principles set out by the FSDEF.

*4) Services:* The fifth layer reflects on the services provided to citizens and companies (e.g., eVoting, smart cities, smart gov, smart health, business intelligence, smart logistics, among others). This layer is significantly improved and better formulated by all previous layers of the stack model.

### C. Citizen Perspective

*1) Citizen and Customer Issues/Needs:* The sixth layer reflects on citizen and customer issues and needs. In a nutshell, the service provider's (i.e., public or private sector) success and its services heavily depend on its ability to predict the citizen/customer needs and to solve their issues. The long arrow of digital transformation points to the upper layers starting from the legal framework. Customer needs cannot be met and identified if the service provider does not put in place and develops all previous layers. In democratic societies at least, in the other direction citizens with their issues and needs shape all other layers. This is displayed by the other long arrow leading in the opposite direction.

## VI. CONCLUSIONS AND FUTURE WORK

Different authors refer to data as "the new oil of society," and it is becoming increasingly central. However, data does not drain; it grows. Hence, data and digital services should not be imagined as motionless machines but rather as living organisms representing developments of our societies and their negative side-effects. However, living organisms are very complex and must be viewed and investigated holistically. Ethical considerations play an increasingly leading role in this endeavor.

Our Fribourg digital ethics sustainability framework is meant not only as a theoretical endeavor but as a crucial development for business practice. Its development is planned in three phases. Phase 1: Development of the overall concept of a sustainable digitalization standard by employing sufficiency theories of justice to define social foundations and planetary boundary concepts as ecological ceilings, and how they can be linked to specific algorithms and digital services evaluated by algorithms or blockchain. Phase 2: Institutionalizing the standard for business use and assessment together with partners from industry and administration. Phase 3: provide education in institutions and companies to implement our standard. While phase 1 is advanced to the other two and demands comprehensive trans-disciplinary research, phases 2 & 3 might evolve together.

By institutionalizing the FSDEF with our business partners, we invite society to public deliberation about digital ethics. Key stakeholders include politicians, the public sector, companies, universities, and citizen organizations. This project is a transdisciplinary effort that deals holistically with ethical values and sustainable and responsible digitization. However, it is also a first effort of its kind and won't be the final word incorporating all ethical, social and economic challenges that are relevant in digitization. The project is already ambitious and hopefully will invite more of such endeavors.

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