

Data sharing concepts: a viable system model diagnosis

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Abstract

Purpose – Artificial intelligence (AI) reasoning is fuelled by high-quality, detailed behavioural data. These can usually be obtained by the biometrical sensors embedded in smart devices. The currently used data collecting approach, where data ownership and property rights are taken by the data scientists, designers of a device or a related application, delivers multiple ethical, sociological and governance concerns. In this paper, the author is opening a systemic examination of a data sharing concept in which data producers execute their data property rights.

Design/methodology/approach – Since data sharing concept delivers a substantially different alternative, it needs to be thoroughly examined from multiple perspectives, among them: the ethical, social and feasibility. At this stage, theoretical examination modes in the form of literature analysis and mental model development are being performed.

Findings – Data sharing concepts, framework, mechanisms and swift viability are examined. The author determined that data sharing could lead to virtuous data science by augmenting data producers' capacity to govern their data and regulators' capacity to interact in the process. Truly interdisciplinary research is proposed to follow up on this research.

Research limitations/implications – Since the research proposal is theoretical, the proposal may not provide direct applicative value but is largely focussed on fuelling the research directions.

Practical implications – For the researchers, data sharing concepts will provide an alternative approach and help resolve multiple ethical considerations related to the internet of things (IoT) data collecting approach. For the practitioners in data science, it will provide numerous new challenges, such as distributed data storing, distributed data analysis and intelligent data sharing protocols.

Social implications – Data sharing may post significant implications in research and development. Since ethical, legislative moral and trust-related issues are managed in the negotiation process, data can be shared freely, which in a practical sense expands the data pool for virtuous research in social sciences.

Originality/value – The paper opens new research directions of data sharing concepts and space for a new field of research.

Keywords Hybrid reality, Data sharing, Systems thinking, Cybernetics, Artificial intelligence

Paper type Conceptual paper

1. Introduction

Society's coexistence with artificial intelligence (AI) will start to transform into a Hybrid reality (HyR), where people and AI technology co-exist in real and digital worlds and affect each other's spheres of existence (Perko, 2020). Based on AI technology, interactions between technology and people are gaining complexity, with technology adapting to human experiences and expectations. To fuel AI reasoning, vast amounts of high-quality data are required – largely biometric, generated by the internet of things (IoT) sensors, from which personal behavioural patterns can be decoded. The current data science approach resides on the concept of collecting data into centralised data hubs for analysis. It combines the technologies of smart sensors streaming data through high-performance networks, storing



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vast amounts of data in data lakes and using reasoning on data with supercomputers. Data collecting concepts provide essential property rights in the hands of data collectors and put data producers in the passive role with only limited or no rights (Wagner, 2020). Research, based on data collecting raises significant ethical and social concerns (Letheren *et al.*, 2020; Mobilio, 2020; Nath and Sahu, 2020).

Data sharing concept, on the other hand, where individual data producers are provided with data ownership and property rights may have an important effect on the citizen-driven transformations. If designed correctly, it may provide active power for people to govern their data. Data sharing has the potential to radically modify data science processes by introducing distributed data storing and analysis concepts. It should be examined from multiple perspectives, especially on ethical backgrounds, regulatory frameworks, diverse society group perspectives and feasibility studies (High-Level Expert Group on AI, 2019; ISO, 2010).

Wide transdisciplinary research cooperation is to be established to gain a requisitely holistic elaboration to address the proposed research approaches. Even though transdisciplinary research can provide holistic results (Nicolescu, 2008), due to the complexity and risk of failed communication and conflict among researchers, it is exceedingly unstable and prone to fail to meet the task. An inventive, agile, cooperative research methodology is to be co-designed, supporting the knowledge co-development among research groups.

Highlights:

- (1) Providing a systemic examination of data sharing concept;
- (2) Providing a data sharing stakeholders' interaction model;
 - Proposing to grant data ownership rights to data producers;
 - Proposing AI technology-based agents to augment stakeholders' capacity to govern data;
- (3) Providing a data sharing swift viability diagnosis;
- (4) Providing an example of a data sharing instance to clarify the concept;
- (5) Creating new challenges in data science, focussing on distributed data analysis and data sharing negotiations; and
- (6) Opening an option of an environment where data sharing is systemically governed, thus enabling ubiquitous, ethical data science.

In the paper, we are following systems thinking concepts, where a requisitely holistic (Mulej and Dyck, 1998) understanding of the problem should be reached. The exploration starts by invoking a system dynamics related interaction model to examine the boundaries, stakeholders and interactions, comparing the existing data collecting model with the proposed data sharing model. A more in-depth data sharing main stakeholder's diagnosis is provided using the viable system model (VSM). This preliminary research is used to identify the potential data sharing implications and open the space for interdisciplinary research on the data sharing concept.

In the next chapter, existing hybrid reality data, collecting and data sharing concepts are elaborated, followed by backgrounds in the VSM. In the third chapter, the theoretical data collecting and data sharing models are compared. In the fourth chapter, the VSM-based diagnosis is provided. The paper concludes with a summary, a discussion and an experiment proposal.

2. Backgrounds

In HyR, AI models are considered a system of self-evolving algorithms for reasoning, thus extracting useful and nonobvious patterns from data sets (Martinez *et al.*, 2021), connected

with people by direct feedforward and feedback mechanisms (Guzman and Lewis, 2020). Currently, data collecting concept is formatted to fill the AI needs for detailed data, where IoT data are collected and stored in central data lakes, excluding data producers at the first step in the process (Perko, 2020). Even though data collecting is ethically highly problematic (Ioannou *et al.*, 2020), adequate proposals for addressing the issue have not been proposed until now.

Backgrounds are organised into three subchapters: *IoT Biometric data collecting* to explore the technological concepts, ethical considerations and AI technology development predictions; *Data sharing and related concepts* to identify the gap between state of the art and desired state; *The Viable System Model* to provide the readers with a link to some of the methodological backgrounds.

2.1 IoT biometric data collecting

Currently, data are collected in big data siloes, utilised by organisations capable of storing and analysing big data, such as governments, large companies and research organisations, following different goals from social control, profit-related activities and open research. Recent research highlights significant ethical issues with data collecting concepts, especially when collecting personal, biometric data vocalised not only by participants (Nieves-Lahaba and Ponjuan-Dante, 2022) but also by the researchers (Stieglitz *et al.*, 2020). In this work, we propose an alternative to data collecting, namely data sharing.

This paper examines the state where man-driven AI research is gradually replaced by autopoiesis of AI technology. In HyR, IoT devices produce constant data flows with data collecting systems. Data are collected using biometric sensors embedded in smart devices, such as sensors for recording heartbeat and skin moisture on mobile devices (Poongodi *et al.*, 2021). In virtual and augmented reality (VAR), these data can include eye-tracking and more. Collected data can assist in disclosing vital personal information, such as the person's state and behavioural patterns (Carter and Luke, 2020). These can be especially applicable in designing targeted digital experiences achieving a higher level of personalised control (Perko, 2021).

In social research, VR can be useful for facing groups of people with identical situations. Su *et al.* (2020) provide examples of how scientists and engineers can use advanced visualisation technologies to perform data analysis and assessment, thus transforming scientific discovery. Fricker (2019), on the other hand, researches new immersive co-design methodologies to introduce new meaningful trajectories for participatory processes. Additionally, Ameen *et al.* (2021) propose six main areas for future research in VR: rethinking consumer behaviour models, identifying behavioural differences among different generations, understanding consumer interactions with automated services, ethics, privacy and the black-box consumer security concerns.

Spiegel (2018) explores four areas of moral concern in VR: potential mental health risks, neglect of users' actual bodies, recorded personal data-based privacy threats and presents dangers related to manipulating users' beliefs, emotions and behaviour. He makes several recommendations for legal regulations of VR.

O'Brolchain *et al.* (2016) examine and categorise threats to privacy and autonomy in a VR environment: threats to informational privacy, physical privacy, associational privacy, freedom, knowledge and authenticity and provide recommendations to address those. Additionally, Henriksson (2018) address considerations under data protection regulations and not least the European Union (EU) General Data Protection Regulation (GDPR). Royakkers *et al.* (2018) expand the consideration by stating that the governance mechanisms have been developed for privacy and data protection, while less so for discrimination, autonomy, human dignity and unequal balance of power.

Even though the ethical perspective of data collecting is addressed, adequate research attention and proposals of alternate methodologies for data collecting are not found in the literature research.

2.2 Data sharing and related concepts

Data sharing is being researched from multiple perspectives. A conceptually similar approach to the presented one is being discussed by [Perko \(2020\)](#), where social effects of AI technology – including IoT devices data collecting were examined by multiple social responsibility concepts. Perko concluded that assigning data ownership rights to data producers and augmenting data producers to use the ownership-related rights may be necessary for designing an operational HyR society.

[Liu et al. \(2021a\)](#), [Lu et al. \(2020a\)](#) report strong implications of data sharing for communication exchange, society and the asynchronous and federated artificial intelligence learning processes. Nevertheless, a systemic examination of data sharing, related problems and concepts are not adequately reported in the literature.

Specific cases of data sharing are being examined. [Thoegersen and Borlund \(2021\)](#) explore data sharing definitions within the research community. [Savage and Vickers \(2009\)](#) report on the low researcher intentions to share data despite publication rules, [Tenopir et al. \(2011\)](#) put the reasons on insufficient time and lack of funding, while [Wallis et al. \(2013\)](#) claim that data sharing occurs only through interpersonal exchanges. Data sharing barriers exist inside national research communities, [Zhou et al. \(2020\)](#) report on barriers in China, while [Zhu \(2020\)](#) comments on the state in the United Kingdom.

Especially medical data are provided special attention. [Van Panhuis et al. \(2014\)](#) examine data sharing barriers in the health environment and identify technical, motivational, economic, political, legal and ethical ones, while [Kogetsu et al. \(2018\)](#) address the need for patient participation in health-related data sharing processes advancing the concept, [Xia et al. \(2017\)](#) propose a trust-less data sharing via blockchain. [Zou et al. \(2021\)](#) invoke the need for patient privacy and reason upon the ineffectiveness of blockchain technology.

Additionally, data sharing invokes smart cities ([Allam and Jones, 2020](#); [Makhdoom et al., 2020](#)), industry ([Qi et al., 2021](#)), vehicle communication ([Alharthi et al., 2021](#); [Lu et al., 2020b](#)), business, economy and logistics ([Li et al., 2018](#); [Liu et al., 2021b](#); [Perko et al., 2015](#)), democratic processes ([Leavitt, 2011](#)) and others.

Issues regarding biometric data, privacy concerns and AI learning are raising particular interest ([Alharthi et al., 2021](#); [Ioannou et al., 2020](#); [Ogiela and Takizawa, 2017](#)). The most common technical proposals invoke secure blockchains, but only in the work of [Li et al. \(2018\)](#) the concept of data ownership is addressed. Even though privacy is identified as a major issue, and some technological proposals were proposed, none provided a data sharing conceptual framework upon which social examinations could be performed, and technological solutions could be developed.

Data ownership and property rights are crucial to the data sharing concepts, questioning the ethics of sharing non-proprietary data. The notion of data ownership was developed over time, where [Anderson \(1990\)](#) discussed data ownership at the level of research groups, identifying the emergence of data monetisation. The GDPR provided mechanisms of a certain level of protection ([Tikkinen-Piri et al., 2018](#)) but did not invoke the concept of data ownership and property rights adequately. Data ownership and property rights are not thoroughly examined in the research communities ([Mirchev et al., 2020](#)). In the research environment, data usage is elaborated on in the ethical commission discussions on a case-to-case basis, while in the business environment, it is largely ignored ([Bataineh et al., 2020](#)).

Data sharing concepts elaboration, based on data ownership and property rights was not generalised and thus lacks a requisitely holistic perspective. From our perspective, only

conducting thorough systemic, transdisciplinary, agile research, which invokes ethical, law, society, policy and technological aspects of the sharing concepts will provide a viable systemic model of the HyR complex dynamic system.

2.3 The viable system model

The VSM (Beer, 1979) provides a model of a standard system structure capable of surviving in its environment. There are multiple variations in the VSM understanding and implementation (Espejo, 2020; Rios, 2004), but the general structure remains unchanged.

Systems 1 (multiple operational systems) perform multiple operational activities, focussed on achieving the system main goals, gaining resources from the environment and delivering its products to the environment.

System 2 (internal communication channels) enable optimised information interchange between System 1 and enable System 3 management activities.

System 3 (the coordinators) provide monitoring, coordination and scheduling activities for the operational systems, based on the communication with Systems 4 and 5. It holds the holistic perspective of the operational systems processes.

System 4 (external communication channels) monitor the environment feedforward and feedback important for the system's viability.

System 5 (the governors) develop the beliefs, norms and standards framework and communicates the policies application based on the system identity, capacities and external signals. It steers the organisation as a whole.

VSM is often used with other systemic research methods. Vahidi and Aliahmadi (2019), for instance, report of benefits of using VSM with system dynamics. Even though the VSM is usually applied in systems design, this paper uses it as a swift diagnostic tool (Schwaninger, 2006) in a single recursion level to examine the major subsystems of the selected stakeholders. In future research, VSM may be used to define the data sharing system's structure and processes.

3. Comparing data collecting and data sharing concepts

As could be deducted from the literature, the currently predominating data collecting concept faces multiple issues, while alternative concepts, such as data sharing, are not being conceptually formulated.

In this paragraph, the main conceptual concepts of data collecting and data sharing are formulated, pointing out the differences and examining if the data sharing provides solutions for the issues identified in the data collecting model.

3.1 Data collecting

In data collecting concept, data consumers, such as information communication technology (ICT) services providers, social media companies or security organisations and researchers, govern data-related processes, mostly due to their direct interest to utilise data for achieving their organisational goals, ranging from weather predictions, marketing, smart city management, drug development, selling data and analysis results, etc. They are optimising data collecting, storing, data analysis and data use with the premise to optimise the process and raise data quality properties. Since data are considered an asset for data consumers, the collected data are rarely shared, whereas data producers are excluded from the process. The processed information in the form of prediction, prescriptions or mental models is used in internal processes or shared with other stakeholders in HyR (see Figure 1).

The currently employed data collecting concept is focused on governing an efficient data preparation process for data consumers. Data producers: individuals, public spaces and

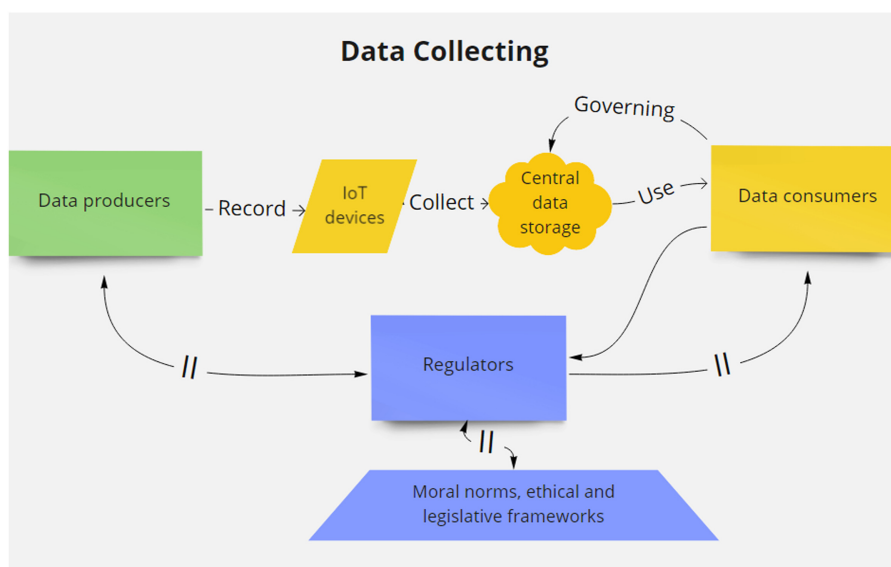


Figure 1.
Data collecting scheme

nature provide continuous (bio)metric data streams through IoT devices sensors, which may include: temperature, video, location, speed and direction, facial expressions, medical results, ground penetration data, etc.

IoT devices may be owned by data producers (mobile devices, home appliances etc.), by data consumers (smart cities sensors, industry IoT, network and wireless receivers and transmitters etc.), or by the regulators (traffic control sensors, public security cameras, etc.). Whereas device ownership and data collection paths may not correlate. Owning a device does not necessarily result in data ownership since the device you own may collect data for the device manufacturer and/or application developer.

Collected data are generally governed by data consumers. They decide on the storing locations (usually cloud-accessible data centres or lakes), storage rules, access rights, the time before deletion etc. Data producers are formally asked to comply with data governance policies but usually lack the capacity to access data, negotiate the terms of their use, or even actively participate in data governance processing.

The dynamics of data collecting goes well beyond the capacity of several HyR stakeholders and can therefore present a serious exposure point for them. The dynamics has two levels: the *governing dynamics*, where the digital processes and services are being agreed upon, and the *operational dynamics*, where data can be collected as fast as in milliseconds. We expect both dynamics to considerably increase by introducing self-developing AI services in the evolutionary process (Perko, 2020).

A *governing dynamics* example is the development of privacy rights agreements, which data producers usually agree upon without even reading them. More over, data producers are generally completely unaware of the *operational dynamics* of data collecting and are unable to actively participate in the HyR interactions.

Similarly, *regulators* lack the capacity to dynamically form the adapting frameworks for successful cooperation of all HyR stakeholders to changes in data collecting. With the lack of regulator capacity, data consumers take an active role in adapting moral norms and ethical and legislative frameworks, increasing the gap between the active and passive stakeholders in the HyR.

Data collecting differences in the stakeholder capacity for active interaction can result in several *data consumer pathological patterns*, such as data misuse, reluctance to compensate data producers, reluctance to share data, and, most importantly – the aspiration to control the HyR. The lack of digital privacy and systemic transparency creates an unsafe data environment for most HyR stakeholders.

Regulators have taken multiple data-related approaches: from ignoring the situation and letting the organisations exploit the system through data exploitation in redesigning society, in developing a new set of regulative frameworks (Tikkinen-Piri *et al.*, 2018). A holistic approach that would simultaneously integrate the digital environment with the ethical and legal frameworks and answer to the dynamics of digital development is still lacking.

Data collecting pathologies need to be addressed systemically, addressing current issues to design a system capable of reacting to the ones which will emerge in the future. Data sharing proposal is one of the conceptual frameworks that could be part of this system design and can act as an open invitation to invoke others or refine it adequately.

3.2 Data sharing concept

In data sharing concept, data producers take the active data sharing role. *Data producers own data and have the authority to share it under their terms*. Their data can only be used under negotiated conditions between data producers, data consumers and regulators represented by their agents. Data sharing introduces active governance on all levels of data interactions, from simple data interchange, through standardised negotiation protocols to social standards of data interactions.

To address the ethical issues regarding (mis)use of data, data sharing concept utilises several CyberSystemic concepts, requisite holism (Mulej and Potocan, 2007), the position and role of the observer in the system in second (Umpleby, 2016) and third (Espejo and Lepskiy, 2021) order of cybernetics, and social responsibility concepts (Mulej *et al.*, 2015) to name a few.

Data sharing concepts challenge the currently predominant data collecting methodologies and proposes a redefinition of the currently not adequately defined data ownership and property rights. It actively invokes the AI tools in the process of data sharing in multiple stages, *introducing intelligent data agents* as the process actuators and negotiators.

Data sharing concept additionally addresses the *limited data producer capacity* to cope with the excessive data sharing dynamics. People are overwhelmed by negotiating the sharing terms, let alone on the operational level, where the actual sharing decisions are to be taken on a real-time basis. In both cases, active negotiation assistance is required.

Data sharing concept complexity largely exceeds data collecting complexity and thus introduces major challenges which need to be addressed:

- (1) Lack of data producer capacity to govern and share data,
- (2) Lack of regulator capacity to design and introduce efficient regulative frameworks,
- (3) Lack of services supporting data producer active participation in HyR interactions.

In data sharing concept, two major modifications to data collecting concept are proposed:

- (1) *Producers* govern and share their data according to their preferences and comply with social, ethical and legislative frameworks.
 - *Data ownership* is clarified, and data property rights are invoked in the ethical and legislative frameworks enabling data sharing.
- (2) All HyR stakeholders are supported by intelligent *data agents* who work, reason on their behalf and comply with ethical and legislative frameworks.

Data sharing governance involves deciding where and how to store personal data, how to upkeep its quality level, how to share it, which data-related rights to transfer when sharing, how to get compensated for data sharing, and, among others, when and how to delete data.

All these decisions require the authority of a data owner. These can be designed as a new, independent part of the legislative framework protecting personal data (European Commission, 2021a; Henriksson, 2018) or can build upon the *common Right to property* “Everyone has the right to own, use, dispose of and bequeath his or her lawfully acquired possessions. No one may be deprived of his or her possessions, except in the public interest and in the cases and under the conditions provided for by law, subject to fair compensation being paid in good time for their loss. The use of property may be regulated by law in so far as is necessary for the general interest.” (European Commission, 2021b), thus integrating data property rights into the existing legislative framework (see Figure 2).

For data sharing concept to work, a whole new level of services and frameworks are to be designed and developed, especially the layer of intelligent agents, which help facilitate data interactions between the HyR stakeholders.

Negotiation: Producers, consumers and regulators data agents negotiate data sharing rules based on data producer preferences, the interests of data consumers, and following frameworks introduced by the regulators. On the negotiation level, the rights and responsibilities of all participants are defined. Data structure and contents are agreed upon, the rules of how data is to be employed by data consumers and the responsibilities of data consumers towards data producers – sharing the research results, providing reimbursement or others.

Data governance: Data producer agents govern the recorded data. This includes controlling the IoT device outputs and governing distributed data storage. Any communication between IoT devices and data consumers is controlled by Data producer agents, creating an active safety layer around data producers.

Data sharing itself is much faster. According to negotiated terms, data producers share data with data agents, providing access routes to data stores and registering data sharing occurrences. Data consumer agents check data quality and organise distributed data analysis protocols. Each data sharing instance is automatically recorded and stored.

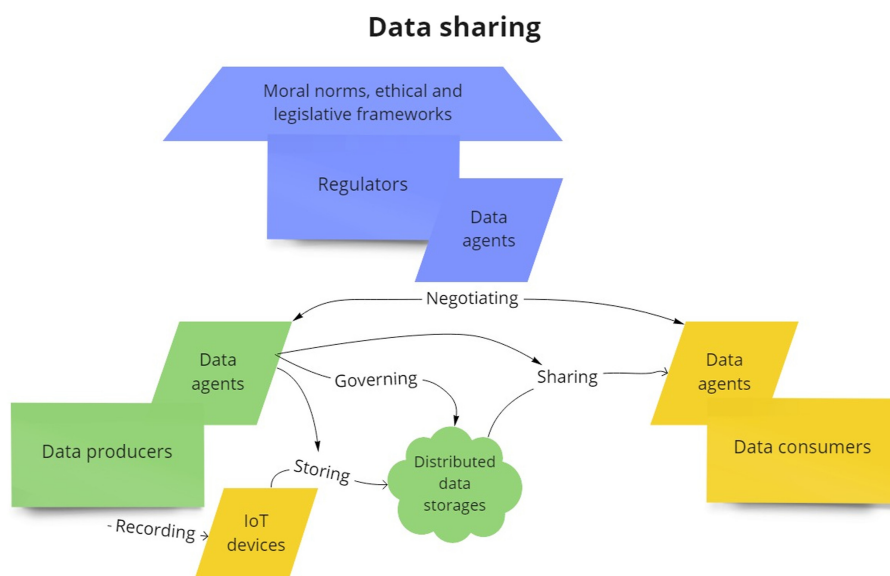


Figure 2.
Data sharing concept

Exceptions: exceptions are largely related to security issues. For instance, if personal data are required to provide safety measures for data providers or the community, data are shared, overriding the negotiation protocols. Each exception is recorded by data producer agent and is available for further examination in the future.

Requirements: on a technical level, several building blocks need to be developed and upgraded:

- (1) Intelligent data agent technology
- (2) Communication and negotiation protocols
- (3) Standardised metadata repositories
- (4) Distributed data storages
- (5) Distributed data science methods and tools

On a social and personal level, several concepts need to be developed and thoroughly examined:

- (1) Establishing holistic moral norms and ethical and legislative frameworks, *which can be reasoned upon*.
- (2) Establishing transparent and coherent trust and *reputation systems*.
- (3) Providing real value-added propositions for all participants, especially the data producers.
- (4) Addressing the risks of hijacking the sharing concept by the powerful stakeholders in the system.

Impact: Data sharing model will redefine interactions and thus relations in society. It will help digitally activate currently passive stakeholders, such as individuals, nature and small organisations, providing them with a safe environment for their development and empower the regulators to dynamically develop holistic governance frameworks and policies.

It will hugely increase the speed and volume of shared information by providing clear communication protocols and invoking intelligent governance mechanisms for personal data.

4. Data sharing VSM diagnosis

To diagnose the concept and to identify the particular points of interest for further examination, the VSM (Espejo, 2020) is applied to analyse active interactions within the five subsystems and interactions with the environment. Table 1 presents the mind experiment results, focussing on the vital parts of the HyR stakeholders under the premises of data sharing concept. These can provide a research map for a detailed examination of data sharing concept and its implications.

In Table 1, three stakeholder perspectives on five major VSM building blocks, formed as questions, provide a requisite holistic perspective on data sharing concepts. Through the complexity of the open questions, they disclose the current inadequacy of data collecting mechanism and post the need for a thorough examination and gradual development of data sharing concepts in HyR.

We start with the main goals of the three stakeholders, which differ considerably: data producers are interested in safely augmenting their capacities to perform actively in the HyR, data consumers are trying to use data to affect other stakeholders. At the same time, the regulators would like to form the behaviour in HyR by using executive policies.

System	Data producers	Data consumers	Regulators
Goal	Exist in HyR, augmenting their capacity to govern data interactions	Using interactions data to optimise their behaviour patterns and affect other HyR stakeholders	Developing behavioural frameworks and executing policies for their enforcement
1 Operational processes	How to address the need for privacy in HyR? Which are the effects of data analysis on their behaviour patterns? How to address the need for deleting data and preventing external analysis?	Which data are actually used in the data analysis processes? How to process data to produce information? How to react to the information?	How to optimise the behavioural frameworks design process? How to optimise policies implementation?
2 and 4 Internal and external communication channels	How to keep up with the sharing data dynamics? How to filter important information? How to share the (only) appropriate data?	How to acquire the needed data (negotiation, distributed data processing, transparency)? How to use behavioural insights in communication with the data producers?	How to develop and control communication protocols to ensure safety, transparency and feasibility?
3 The coordinators	How to behave, knowing of being measured?	How to organise data collecting process? How to act on the predictions and prescriptions? How to persuade other HyR stakeholders to act according to their goals?	How to design policies and frameworks? How to govern the policies' execution? How to reinforce frameworks use in HyR?
5 The governors	How to adapt behavioural patterns in the measured environment? How to manage my data sharing, protect my privacy and share my ideas? How to integrate external and internal mental models? How to contribute to the external mental model development?	How to develop predictions, prescriptions and mental models to guide internal processes? How to dynamically adapt organisation processes to utilise the collected knowledge? How to share predictions, prescriptions and mental models with other HyR stakeholders?	How to control data interactions? How to activate passive HyR stakeholders? How to maintain the power balance between HyR stakeholders? How to govern continuous frameworks and policy redesign?

Table 1.
The VSM-based examinations of data sharing concept by three stakeholders

According to the VSM structure, the goals are followed by questions subsystems 1–5 are trying to address. Subsystems 2 and 4 – internal and external communication systems are integrated. These questions can be particularly helpful for further examining the stakeholders' needs to participate in the HyR actively.

5. Discussion/experiment proposal

The open questions provide a set of exciting perspectives, which ought to be examined in a series of interactive situations monitored by a smart device. An obvious experimental environment is a Hybrid reality lab, where, with the use of biometrics in VR, multiple individuals with diverse backgrounds can be immersed in an identical situation, measuring their situational behaviour using biometrical devices, such as eye-tracking, facial expression, cardio and neuro signals examinations.

Let us provide every day's instance example: a pedestrian waits for the green signal to cross the road. The crossroad is monitored with a security camera, the café sign is in the visual field and the crossroad signal stays red throughout the situation (for a minute or two).

The research should address the questions in [Table 1](#) on two levels:

On the situation level, all stakeholder viability perspectives are to be considered using data sharing concepts. This means addressing the questions posted in [Table 1](#) for each of the VSM subsystems for data producer (the individual), the data consumer (the café shop marketing, the law enforcement units, the nearby vehicles), and the regulators (the smart city managers, and the data protection office).

In the experiment, data producer would like to cross the street and is (mostly) unaware of data collecting interests. The café shop marketing would like to know if the café sign is visible and if people react to it. The law enforcement units monitor security violations, while the nearby vehicle tries to identify potentially dangerous situations in its path. The smart city managers collect data on the road signalisation efficiency, while the data protection office is struggling to monitor the data flows in HyR.

We expect selective interest to try to receive data from the individual, where the decision to share data is related to a set of circumstantial properties. In all cases, we expect to face a severe lack of capacity to manage the negotiation processes and a need for invoking intelligent negotiation agents. Additionally, we expect that the results/expectations will change throughout the time after the stakeholders have the time to rethink data usage implications.

On the experiment level, the question of how the experiment data can be shared arises, again trying to answer the VSM-related questions in [Table 1](#). This puts the researchers in the role of data collectors, and the ethics commission in the role of the regulators.

We expect that individuals will change their attitudes towards data sharing. At the start of the experiment, they will not quite understand why selective data sharing is important. In the later phases, they may co-develop viable proposals on the sharing strategies. Researchers are expected to focus on the negotiation algorithms, distributed data storing and analysis-related process issues required to generate the research results. The ethical commission members will be confronted with a constant flow of arbitrary micro demands, exceeding their capacity to provide in-time, helpful perspectives. Similar to the level 1 experiment, we expect all stakeholders to face a severe lack of capacity to manage the negotiation processes, where one of the viable solutions is invoking intelligent negotiation agents.

6. Conclusions

The gap between the currently deployed data collecting and analysis processes using AI technology to augment the process for data collectors and the other HyR stakeholder data-related expectations are increasing and is leading to several pathologies. The situation is resulting in several HyR stakeholders becoming passive. This gap is becoming recognised, but currently, no clear conceptual proposal has been identified, providing a requisitely holistic solution on the systemic level.

The gap expands by invoking new types of data in the analysis processes: biometric data streams, continuously feeding AI technology with detailed biometrical data, opening the capacity for successful behaviour predictions and prescriptions.

In our attempts to preserve the activity of all HyR stakeholders, and to invoke the elements for a socially responsible data interchange, data sharing concept is proposed. On a conceptual level, we propose data sharing concepts aimed at actively supporting the activity of data producers and regulators, based on a wide moral, ethical and legislative base of support. AI technology is used to support Agents for each HyR stakeholder in constant dynamic negotiations on the sharing content.

The proposed data sharing concept provides additional complexity to data sharing processes. With the AI agents filtering and amplifying data interactions, the system's capacity to individually deal with each data interaction for all HyR stakeholders dramatically increases. The proposal aims to provide a higher level of safety for data producers and huge data pools for socially responsible data consumers.

Data sharing asks for developing a whole new range of frameworks and processes in data governance processes, which needs to be examined from multiple perspectives to generate a proposal viable for all HyR stakeholders.

Before the continuing data sharing conceptual modelling, the HyR stakeholders' perspectives are to be acquired. The VSM is employed to help us open the first set of research viability challenges, which might illuminate from the perspectives of HyR stakeholders. General questions arising on the VSM five subsystems for data producers, data consumers and regulators are proposed.

In the discussion, an instance of a VR situational analysis is examined on two levels: on the first level, the situation goals and data streams are explored from the HyR stakeholder viability challenges perspectives. On the second level, data sharing is analysed from multiple HyR stakeholder viability challenges perspectives. Interestingly, on both levels, HyR stakeholder challenges are expected to be quite similar: data privacy for data producers, analysis process for data consumers and performance in ethical deliberations for the regulators if we trivialise the proposal.

The examined data sharing concepts have the potential to fundamentally redesign interactions in the digitised society and can significantly affect HyR stakeholder interactions and thus their relations. The concepts address the risk of AI technology misuse by invoking data ownership rights to data producers and augmenting all HyR stakeholder data governance capacities by invoking supporting AI technology agents. Matching the complexity of an intelligent digital environment with AI technology-based agents.

The proposed work is theoretical in its nature and serves as a focal point for further interdisciplinary research invoking several fields, among them data science, social studies, governance and policy research, hopefully providing transdisciplinary results.

On the conceptual level, multiple HyR stakeholders' active participation in data sharing conceptual model is vital. This calls for inclusive social participative discussions where participants from diverse social groups co-develop the notion of interactions and help define the framework and processes in data sharing. More clearly, in these social research, participants are examined, are examining and are designing the rules of examination.

Data sharing may post significant implications in research and development. Since ethical, legislative moral and trust-related issues are managed in the negotiation process, data can be shared freely, which in a practical sense significantly expands the data pool for virtuous research. For instance, sharing medical data for treatment of diseases, urban planning, nature examinations, social research of marginalised individuals and communities and traffic safety, to name a few. On the other hand, control over potentially unethical, immoral or unlawful research can be provided, such as marketing, secret societies, criminal organisations, citizens' observations and nature exploitation-related research by restricting access to data.

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