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Investigating the Social, Political, Economic and Cultural Implications of Data Trading

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Abstract. Data market initiatives have, by assigning monetary value to data, and connecting the various actors responsible for its efficient production and consumption, far reaching consequences for national economies. The Data Market Austria (DMA) project represents a unique opportunity for Austria to leverage the enormous potential socio-economic benefits accruing from increased trade of data. At the same time, however, a number of key challenges to the successful uptake of the project needs to be considered, and new problems emerging from this new form of digital commercial infrastructure need to be anticipated and addressed. This study aims to examine how the benefits accruing to increased participation in a data-driven ecosystem can be applied to tackle the long-standing socio-cultural challenges and the possible societal and cultural impediments to the successful unfolding out of a data market. Theoretical discussions framed from arguments obtained through a systematic review of academic and scholarly literature are juxtaposed with empirical data obtained from data science experts and DMA project personnel to test whether they stand up to real-world practicalities and to narrow the focus onto the Austria-specific context. Our findings reveal that data is a dual-purpose commodity that has both commercial value and social application. To amplify the benefits accruing from increased data trading, it is vital that a country establishes a sound open data strategy and a balanced regulatory framework for data trading.

Keywords: data market, data trading, social and cultural aspects.

1 Introduction

A flood of structured information or data [1] is created every day through the interactions of people using computers, mobile phones, GPS, and other Internet-enabled devices. This all-pervasive data has become the life-blood of the modern global economy [2], and it is widely accepted that, if harnessed appropriately, such open data – obtained from both public and private sources – can add a new dimension to existing business analytics and give rise to novel, data-focused innovations [3]. Data is often also placed at the heart of strategic decision-making; be it in business firms or within government organisations [4]. The buying and selling of data generally occurs in what

is commonly known as a data marketplace [5], a specific ecosystem created for the purpose by either vendors or consumers of large quantities of information or by third party organisations. A succinct definition of the concept is provided by [6], who define a data marketplace as “...a platform on which anybody (or at least a great number of potentially registered clients) can upload and maintain data sets. Access to and use of the data is regulated through varying licensing models.” Further, a ‘data marketplace’ or a ‘data market’ may be considered as the virtual space where high quality digital data is offered by data producers as “products” or “services” to potential consumers for payment or for free [7]. Strategically using insights from big data to address many of the challenges that face societies has become an integral part of European Union policy in recent years [8]. The approach developed by the European Commission emphasizes the importance of addressing relevant socio-economic implications of big data processing and analytics, such as respect of ethical principles and related legislation during the implementation of flagship policies (cf. personal data protection and privacy, ensuring informed consent, dual use and potential misuse of the research results, fair benefit sharing when developing countries are involved, and environment protection) [9]. It is vital, therefore, that the benefits and challenges associated with the trade of big data and the degree to which the concept has meaning for the general public are better understood. Key questions to pose in this context are: What impact will the trade of big data have on society, the polity, the economy, and on culture? And who are the winners and losers of the modern knowledge economy?

This study aims to critically examine, within the context of the Data Market Austria (DMA) project, how the benefits accruing to increased participation in a data-driven ecosystem can be applied to tackle the long-standing socio-cultural challenges and the possible societal and cultural impediments to the successful unfolding out of a data market. The research paper is structured sequentially in five parts. The first chapter introduces the relevant fundamentals of data trading. Section 2 describes the findings of a systematic literature review. Section 3 then presents and discusses empirical data obtained from two qualitative research tools, a research workshop and a semi-structured research questionnaire. The results are subsequently synthesised and analysed in Section 4. The final section brings together the key observations, lessons learned, and recommendations arising from these and earlier discussions.

2 Research Design

In order to identify and better understand the benefits resulting from the trade of digital data and the potential challenges that could hinder the successful development of a data market, with a focus on the Austrian context, this study adopted a three-part research design to collect research data: a systematic literature review, followed by a pre-conference workshop, and finally a questionnaire.

Context of the Project. The Data Market Austria (DMA) project seeks to establish a data services ecosystem in Austria through the creation of a significantly improved technology base for secure data markets and cloud interoperability, and through the development of a data innovation environment [10]. The DMA does not host data, but

instead is a facilitator platform that provides a catalogue for registered data sources. Developers currently work with open data sets from Kaggle and the European Data Portal. Use of industry data is currently minimal for - besides those obtained from the pilots – these are not currently publicly available. Main DMA stakeholder groups can be classified as data providers; service providers; infrastructure providers; brokers; data market customers; research, education and development; and end-users [11]. The target groups of DMA comprise several different categories of data driven organisations and individuals, each with differing requirements for data. These have been broadly identified through initial research as Government, Industry, Research, Academia, the Public, the Media, and the Community [11]. The DMA research project is funded by the Austrian Ministry for Transport, Innovation and Technology via the Austria Research Promotion Agency (FFG). A Beta working version is expected to be ready at the end of the project, in September 2019.

Systematic Literature Review. A systematic literature review [12] was conducted to identify and discuss the benefits accruing and challenges posed to successful data trading. The Scopus database was selected as the primary source of research material, as it was noticed that this database encompasses many relevant papers in the fields Business, Economics, Political Science, and Information Science. Based on the research questions and after discussing about the keywords, it was decided to use <data market> OR <data-driven> OR <open data> OR <digital data> AND <social impact> OR <societal impact> OR <social implications> OR <societal implications> OR <society> to conduct the search in the title, abstract, keywords and full-text of publications. Specific keywords for each topic were also combined with the aforementioned ones to find related and relevant sources. It was decided to mainly focus on publications of the past ten years.

Workshop. An interim report on the socio-economic, political and cultural implications of data trading showed the need for a deeper, evidenced-based study of how the impacts of a data market are perceived from a variety of perspectives worldwide. In order to determine the prevailing global attitude towards the data market concept, and to deepen our evidence-based investigation of the socio-economic, political and cultural implications of data trading, a workshop was organised under the auspices of a major international conference [13]. Guided by a semi-structured protocol, three moderators from the project under study conducted and reported the discussion. In recognising that a workshop is a form of focus group, the design of proceedings was based on [14], as a research technique that uses group interaction for collecting data on a specific topic. The design can be considered as a mixed structured and unstructured approach as two overarching questions were discussed over the course of one hour, which allowed the participants to get deeper into each discussion.

Questionnaire. To obtain deeper insight into the central research problem, and to validate the findings of the pre-conference workshop, primary data in the form of attitudes, opinions, and perspectives was gathered from individual members of the Austrian Data Market Austria (DMA) project partners. The questionnaire method was selected for data collection as it facilitates the thorough exploration of existing patterns and trends required to effectively describe the social, economic, and political impacts of the DMA project. A self-administered [15] and semi-structured questionnaire [16]

consisting of a mix of closed questions and open questions ordered in a structured sequence and with a pre-determined focus was used. In order to maximize coverage within the shortest period of time, we chose to administer the questionnaire online [17]. The questionnaire was developed by this research team following conventional best practices [17], and the finished survey was hosted on Google Forms. An invitation containing a link to the questionnaire was e-mailed to potential participants, and the number of responses tracked through the in-built counter.

3 Systematic Literature Review

This chapter summarises the key results of the systematic literature review, outlining the potential socio-economic, political and cultural implications of data markets and data trading. From available scholarly and practitioner literature, six key domains have been derived: *economic growth, employment and job creation, ageing populations, migration, climate change, and small- and medium-sized enterprises (SMEs)*. From further examination of the literature, four critical societal and cultural impediments to the successful unfolding out of the DMA were identified: *privacy and trust, public decision making structures, social exclusion, and gender inequality*.

3.1 Benefits of Data Trading to Society

Economic Growth. A wide range of positive economic impacts result from the free flow of digital data across borders. A report by the Strategic Policy Forum on Digital Entrepreneurship [18] predicts that big data and digital platforms will bring enormous benefits to the European economy, as firms across many industries experiment with data-driven business models and use these as tools to drive product innovation. Further literature suggests that a unified digital market platform that facilitates the trade of data may revolutionize the way in which different forms of digital data are accessed by a wide range of stakeholders from across different sectors of the national and global economies; thus fostering increased business activity [19, 20], supporting streamlined business operations [21, 22], spurring data-driven innovation [23, 24], enhancing the competitiveness of individual entrepreneurs and SMEs [25, 26] and by connecting market participants otherwise separated by physical distance [27, 28].

Employment and Job Creation. The participation of businesses in a data-rich environment wherein knowledge and information are easily obtained can affect a labour market in several ways. Data analytics and related capabilities can improve business competitiveness and become an engine of labour productivity and job creation [29]; either by facilitating strategic business decision-making that improves firm performance in increasingly competitive national and global markets [30], or directly improving labour productivity by making available a variety of relevant information and knowledge accessible to employees at all levels via a dedicated portal [31]. Increased focus on labour productivity through data-driven value creation – a direct result of the commodification of data via regular trading across the data market – could also result in a direct reduction of the number of blue-collar or manual jobs needed within a par-

ticular industry [32]. As more economic actors choose to operate in the data marketplace, the demand for so-called high-income ‘knowledge workers’ capable of taking advantage of the available resources would outstrip that for manual labour. Similarly, highly-skilled workers capable of manipulating data using ‘smart’ machines and artificial intelligence systems would, in the future, be in demand, while those lacking the necessary skills would be left behind [33].

Ageing Populations. Nowadays, people over the age of 60 constitute the fastest growing population group with their numbers set to increase from 164m to 222m by 2030 [34]. In rich countries like Austria, older consumers are also amongst the most affluent in society, are more educated than previous generations, and are expected to become one of the few engines of growth driving an otherwise sluggish global economy [35]. This reflects a significant business opportunity for those companies willing to address the needs of people in later life. Further, ageing people require sustained access to a wide variety of highly specialised goods and services [36]. The growth in the number and proportion of older people is likely, therefore, to strongly impact and change the focus of business activity [37]. Finally, as younger employees become required to care for their ageing relatives, companies need to both understand how to compensate for employee absenteeism and target this emerging segment of specialised consumers [38]. Better product insight as a direct consequence of increases in the collection of data on what the elderly and their caregivers need, want, and are using by way of goods and services would also result in greater returns to scope [32], as the data market platform would begin to facilitate data linkages between various suppliers of information and knowledge. The elderly and those who care for them would therefore benefit from network effects [32] generated by the frequent trading of information and knowledge: as the providers of goods and services to the elderly connect with the data market network, they by default connect their client base of users to the data market community.

Migration. Migration is a complex global phenomenon with important policy ramifications for both Europe and for Austria. General consensus in policy and academic circles is that robust and accurate data is key to effective migration governance, and can positively impact both governments and individual migrants [39]. On the one hand, reliable migration data can support decision-making by informing policy makers on the impact that migration has on society and the economy [40]. For the individual migrant, on the other hand, timely access to relevant data, coupled with appropriate policy interventions based on such information, can mitigate the vulnerabilities and risks associated with emigration and integration [39]. Despite the great potential of reliable migration data to deliver insights into complex societal and economic problems, its current availability is still recognized as being very limited [41]. Therefore, a centralised data platform can help interested stakeholders to manage existing data, and to make better use of it [39].

Climate Change. Global warming has a range of potential ecological, societal and health impacts. Big climate data is, therefore, an essential resource for climate change estimates, which are a valuable input for policy makers, aid agencies, and industry representatives involved with building national resilience to climate change and developing adaptation strategies [42]. [43] identifies three ways in which climate-related big data can be used to fight climate change. The business case for climate-related data is

made by [44], who argues that financial markets have the potential to help in the fight against climate change in situations where investors have access to accurate information on how companies are anticipating and responding (or not) to climate risks and opportunities. Climate change data, especially when mixed/overlaid with other data sets, is an important source for data-driven decision making [45, 46]. A number of data portals exist in the climate change domain – leading examples being the World Bank’s Climate Change Knowledge Portal [47] and NASA’s Climate Change Portal [48].

Small- and Medium-scale Enterprises (SMEs). The importance of big data for economic growth is already widely recognised within the European Union [49]. According to [50], however, SMEs often fail to successfully implement big data technology and analysis frameworks. Small- and medium sized enterprises are often slow adopters of big data analytics technologies, and it is essential to ease the adoption of such technologies by SMEs in order to support economic growth through big data. A data market infrastructure addressing the challenges to SME uptake of big data analytics has the potential to become an important instrument for fostering a sustainable, inclusive and growing data-driven economy [51]. [52] argues that big data for SMEs is all about identifying, joining up and consolidating the various available sources of data, and then facilitating the analysis of that information to extract business value. Next to this, it is important to create the right framework and conditions for realising inclusive growth of the digital economy [53]. Industry representatives have echoed these findings [54].

3.2 Potential Impediments to the Successful Uptake of a Data Market

Privacy and Trust. Privacy and security can be considered among the main challenges when dealing with the digital ecosystem. In particular, the sharing of data in a data marketplace, particularly personal data that is tied to individuals, raises legitimate concerns that must be addressed [55]. [56] affirm that, in the case of open data, only when private elements are added to the data sets does open data become private data. The management of data privacy thus is an important element, considering that private data are very often the case available in ecosystems such as the data market. There is also an identified risk of violating legislation (for instance the data protection law) by sharing and releasing data that could not be otherwise made available [57]. This scenario includes, for example, datasets which contain privacy identifying variables, sensitive variables; or have been created by multiple organizations that have different levels of security, policies, and comply with different laws [57]. According to [58], trustworthiness of vendors is an important dimension of the data market, which can be assessed based on the origin of the data and on how it is processed.

Public Decision-making Structures and Social Exclusion. To create transparent public decision-making structures and enable active citizenship in a data market it is crucial to release information, data, and services that are usable for, and can be applied by all relevant stakeholders, including citizens (e.g. data related to social justice, public safety, and health). If the data market should be inclusive and not exclude any member of the society, going “beyond [the] rationales of increased efficiency, reduced costs, increased productivity, and economic growth” is essential [59]. In recognising the social aspects of the data economy, the European Commission aims to create a whole

“digital society” founded on the training of citizens in digital skills, and the promotion of concrete actions to support projects related to jobs, employability, training, and social issues [60]. The NGO and charitable sectors are, thus, also important players in a data market wherein Big data offers many opportunities for social enterprises [61] (e.g. see the Nominet Trust 100 Social Tech Guide).

Gender Inequality. Usually, the choices of women are restricted by not only their educational pathways but also social factors, such as starting a family and the workplace environment [62], cultural barriers, gender stereotype, or misinformation [63]. Quantitative numbers show the underrepresentation of women in science, technology, engineering and mathematics (STEM) worldwide, and there is a need to identify the qualitative factors that shape women’s decisions to pursue STEM careers. Socio-cultural factors like societal beliefs and expectations of male/female differences in ability, and cultural pressures to pursue traditionally masculine or feminine interests, are shown to have a significant impact on career decisions [63]. The fact that sociocultural factors have such a strong influence over individual career decisions also means that we may intervene to alter these outcomes [63].

4 Discussion of Findings

This section presents a synthesis of the salient points of the research findings obtained with empirical research tools. The workshop took place in 2018, as part of a conference on Digital Government. Nine participants from eight countries and three moderators attended. The participants comprised of researchers, students, and practitioners from the e-government field, none of them specialists of data trading or related domains. The data was registered by the moderators and crosschecked for analysis, and the findings are presented in a narrative form [64]. The questionnaire was administered online over the period of March - July 2018. Potential respondents were initially invited to participate by e-mail, and contacted via the DMA project mailing list. To increase response rates, organization team leaders were contacted individually and were encouraged to circulate the questionnaire amongst members of their team. It is estimated that 80 people were invited to participate in the activity, out of which 21 responded.

4.1 Benefits of Data Trading to Society

Economic Growth. Empirical data indicates that research subjects not only endorsed this view, but also considered economic growth to be the primary benefit to Austria as a direct consequence of the DMA initiative. However, respondents did not believe that any industry or sector stood to gain advantage from increased data trading. Questionnaire respondents argue instead that the benefits arising from business participation in the DMA would be distributed evenly across different sectors of the Austrian economy.

Employment and Job Creation. Although the responses of practitioner and experts underline the fact that increased data trading can boost employment and create new jobs, respondents indicate that only modest benefits will result from participation in the Austrian data market. A large number of research subjects were confident that the DMA

would result in the creation of new types of jobs in Austria, and a rise in the number of people employed in data science and data protection-related fields, as businesses participating in the project become encouraged to adopt data-driven business models.

Ageing Populations. A large majority of project partners surveyed do not feel that the Austrian DMA project would substantially impact the lives of the elderly in Austria at all. This is because the current format of the DMA is not structured to target directly to the needs of this target population. Empirical research data further suggests that the DMA is not perceived as being as mechanism that affects the nature and supply of goods and services catering to an elderly population. This does not, however, foreclose for some respondents the potential for the platform to facilitate the provision of goods and services for senior citizens, provided that the current structure of the system is sufficiently altered.

Migration. Empirical research data indicates that research subjects do not believe that significant benefits will arise from the DMA project in the domain of migration. Responses suggest that migrant populations stand to receive almost no direct benefit from the platform in its current format. Most questionnaire respondents indicated that serving migrant communities did not fall within the current purview of the project. Some research subjects did signal, however, that this was a desirable objective in the long run, and that targeted relevant information in the form of aggregated data and visualisations on pertinent topics could be made available.

Climate Change. Evidence suggests that research subjects appear optimistic that the DMA project will result in a significant positive impact within the climate change domain. This sentiment was underlined by workshop and questionnaire participant responses, wherein individuals identified and deliberated upon how the current DMA structure and format could be improved to make climate change data more easily available. Research subjects also discussed in-depth the data analytics tools and methods that could be incorporated into the DMA portal to aid in better climate change governance. The role of the DMA as a data market in this context was also underlined.

Small and Medium-sized Enterprises (SMEs). Empirical data suggests that participation in a unified data market project like the DMA will greatly improve the competitiveness of SMEs and individual entrepreneurs. Research subjects see the platform as making available data previously held by larger firms, lowering cost barriers to data access, and connecting small players to other like-minded market participants. However, it was felt that the DMA needs to be restructured to be more “small company-friendly”, and to be geared towards offering small businesses more comprehensive access to data products and services. The role of the Data Broker was highlighted as being central to the effective mapping of SME data requirements with appropriate data sources.

4.2 Challenges to Effective Data Trading

Privacy and Trust. Empirical research suggests that issues surrounding privacy and trust are considered by experts and practitioners to pose the most significant threat to the success of the DMA. Better internal regulation of market participants, and the provision of robust and stable basic system functionalities, emerged from responses as the

key means by which the perceived trustworthiness of DMA data providers can be improved and incentives for increased participation can be created. System process transparency as a means of improving project trustworthiness was also highlighted.

Public Decision-making Structures. While research subjects did not believe that a lack of citizen engagement in data trading initiatives posed a significant threat to the success of the DMA, they were categorical in their opinion that a lack of public sector involvement was a very serious problem. The role of government as a catalyst, preserver, and vital link in the data trading infrastructure was repeatedly emphasised. The initiative, it was felt, would support the Austrian national open data strategy. However, questionnaire respondents were sceptical of whether the DMA would make a significant contribution to the opening of previously closed public sector data, as they felt the current format does not support the enforcement of public sector openness.

Social Exclusion. Empirical results suggest that social exclusion is not considered a serious risk to the success of the DMA project. Research subjects involved with the project argued that, as a business-to-business platform, the DMA was not structured to directly involve particular individuals or groups in society, and that firms and entrepreneurs would drive the platform's success by using its resources to fuel data-driven innovation. However, it was noted that the third sector could and would benefit significantly if NGOs chose to participate as business actors over the platform.

Gender Inequality. Results from the empirical studies suggest that gender inequality is not considered a significant threat to the successful roll-out of the DMA in practice. But can the DMA be used as a mechanism to correct prevailing gender inequalities in Austria? Research subjects seem to think not – in its current format the DMA is not perceived to promote indiscriminate, gender-neutral access to data. Responses to the questionnaire indicate that the DMA format could be restructured to promote affirmative gender-related action. From a technical standpoint, too, system design elements could be incorporated to analyse and rectify gender bias in traded datasets.

4.3 Emerging Themes and Issues

A fundamental idea emerging from our research is that data is no longer just an economic asset, it has also become a social good. When traded over a data market platform, being ascribed with a definite monetary value and possessing definite pecuniary advantages for those business entities that use it effectively, there is no doubt that data has substantial economic value. However, this same commodity often loses its free-market value when applied to tackle long-standing social problems and empower the vulnerable within a society. Conflict has already emerged between business priorities and the social imperative, and the success of a data market will hinge on whether or not data producers can look beyond monetary incentives and share their data for the benefit of society. Questions also arise about how value generated from the trade of data can be distributed within society. Evidence suggests that the nature and extent of economic and social value created through data trading is largely dependent on the actors within the ecosystem themselves, and the manner in which they interact. Co-creation, sharing, and collaboration are three mechanisms by which significant value can be extracted

from data. Sectoral differences also determine the manner in which different businesses respond to, and generate value out of, traded datasets.

The role of Government within the context of a national data ecosystem, therefore, becomes critical on a number of levels. First, as government policy forms the backbone of any national open data strategy or digital innovation agenda, public agencies can be instrumental in encouraging market participants to open and share data. Second, the role of the public sector can be considered central to the diffusion within society of the benefits arising from data trading: this may occur largely through Government taking the lead in the regulation of data trading spaces; it may result from policies that promote the empowerment of marginalized or vulnerable groups of people – the elderly, migrants, or women; or, it can arise through taxation policy, where the economic value generated by businesses is channeled into priority development areas.

Value is also more easily extracted from data when the data ecosystem is mapped out, and the roles of the various actors within it – data providers, data consumers, data broker, etc. – are more clearly defined and legalised. This delineation makes it easier to know, and to understand, the different players that make up each data transaction; their particular characteristics, their specific interests, their relationship to other actors, and the value they ascribe to different types of data. Determining the ownership of data, and creating awareness about the latent monetary value of proprietary data, can also be considered important determinants of data market success. In order to correctly value traded data, it is important to ascertain the degree to which data owners have control over their data, as well as identify the economic incentives open to producers of data to share data products over a marketplace platform. Creating a sense of data ownership also contributes towards better data protection, and safeguards privacy, by encouraging more responsible data handling and data management practices.

Setting out the system- and national-level business case for data trading is central to creating a critical mass of data that can be used to drive innovation over the platform. In particular, it is important to clearly identify, amplify and promote those incentives that will encourage data producers to part with their resource holdings. Encouraging unfettered supply-driven innovation is also important in this context. To realise the benefits from increased data trading, and to mitigate the potential for conflict between free-market principles and notions of data as a public good, it is also vital for a country to establish a sound open data strategy and a balanced regulatory framework for data trading. These must take into account both national public priorities and free-market economic imperatives in order to help steer the development of a national data trading infrastructure in a direction that is at once socially desirable and profitable.

The final observation arising from this research is that, without the appropriate incentives and safeguards in place, the unfettered trading of data can result in the amplification of prevailing inequalities and biases. A data market project like the DMA needs to be carefully planned out, and its potential consequences – intended and unintended – thoroughly analysed from multiple perspectives, before it can be put into practice. It would be useful in this context, therefore, to compare social and cultural implications of a data market based on existing examples from around the world.

5 Conclusion

From a systematic review of relevant scholarly and practitioner literature, and a critical analysis of empirical research results obtained from workshop deliberations with data science experts and questionnaire responses from DMA project partners, a number of key themes, perspectives, lessons, and questions emerge and a number of conclusions arrived at. This research has identified benefits of a data-driven ecosystem especially related to long-standing socio-cultural challenges in the areas of economic growth, employment and job creation, ageing populations, migration, climate change, and small- and medium-sized enterprises (SMEs); and potential societal and cultural impediments to the success of a data market within the areas of privacy and trust, public decision making structures, social exclusion and gender inequality. Our findings reveal that data is a dual-purpose commodity that has both economic value and social application. Tension arises when its monetary value as a public good is not always the same as, indeed less than, its business or free-market value. In a commercial setting, data producers are less likely to share vital resources over a data market platform if they do not perceive significant economic returns. Further, without the appropriate incentives and safeguards in place, the unfettered trading of data can result in the amplification of prevailing societal inequalities and biases. Government, therefore, has a central role to play in reducing this friction. To realise the benefits from increased data trading, and to reduce the conflict between free-market principles and notions of data as a public good, it is vital for a country to establish a sound open data strategy and a balanced regulatory framework for data trading. Although presenting a comprehensive literature review and empirical analysis, the review is not exhaustive. Additional benefits and challenges of data-driven economy from areas beyond business, Economics, Political Science and Information Science could be identified with a different selection of database and keywords. Data collection in complementary data market initiatives could also bring light to contextual differences, adding value to the understanding of social, political, economic and cultural implications of data trading.

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