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RESEARCH DATA MANAGEMENT WITHIN THE EU DATA POLICY FRAMEWORK

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ABSTRACT

The rapid digitalization has significantly influenced EU research policy, particularly in open science and research data management. While free access to research data is integral to open science, the broader concept of research data management extends beyond mere accessibility. The EU has introduced various regulations to address the evolving challenges of digital technologies, balancing innovation with fundamental legal principles such as privacy and intellectual property

protection. Although no single legal framework is dedicated to research data, multiple EU policies directly impact its management. The Open Data Directive emphasizes the reuse of publicly funded research data, promoting open access while safeguarding intellectual property and privacy rights. The Data Governance Act complements this by creating a framework for reusing protected public sector data, balancing openness with the need to protect commercial, intellectual, and personal data. The Data Act primarily focuses on private sector data and facilitates data sharing across businesses and sectors, particularly in the domain of the Internet of Things, while promoting interoperability and fair contractual terms. Despite these robust EU-level frameworks, Lithuania's national policies lag behind, particularly in addressing the growing needs of artificial intelligence innovation.

KEYWORDS

Open Science, Research Data Management, EU Data Policy, Data FAIR Principles.

INTRODUCTION

Rapid digitalization has inevitably influenced the priorities and objectives of EU research policy. In the context of EU research policy, open science and research data management policies are rapidly developing with the ongoing global digitization processes. These two areas overlap in some respects, but they are also distinct. Free access to research data is part of open science, but on the other hand, the management of research data is a much broader construct than merely access to data.

In response to the rapid development of digital technologies, large-scale efforts are being made not only to create infrastructure for the full functioning of the digital economy, for example, the creation of data spaces, but we also inevitably face the need for new regulations, especially to ensure that the use of digital technologies does not violate fundamental legal principles, including the right to privacy, protection of intellectual property, non-monopolization of business, and the like.

Over the last decade, the EU has approved strategies and adopted a comprehensive package of legal acts to regulate emerging social relations in the digital space. Although there is no separate legal act dedicated to research data, some of them have a direct impact on its management. It should also be emphasized that although EU policy has outlined the main priorities and guidelines for the management of research data, a lot of freedom is also left to the Member States to establish requirements for national research data policies.

The study "Evaluating the Practices and Progress of Open Access to Scientific Publications and Data Collection," published by the Lithuanian Science Council in 2022, also examines research data management in Lithuania. It states that "the most common reason cited by universities for restricting access to research results is various barriers related to a "potential breach of legislation, where research data is confidential due to the protection of personal data, or sensitive due to commercial confidentiality."[1]

This article aims to identify the EU legal norms governing research data and data accessible for research purposes by examining the main provisions of selected EU legislation. The first section will reveal the research data's place in the general EU open science policy. The second section will be devoted to identifying and analyzing EU legal

[1] Lithuanian Research Council, *Evaluating the Practices and Progress of Open Access to Scientific Publications and Data Collection* (2022) // https://lmt.lrv.lt/media/viesa/saugykla/2023/10/gT5VZIFKkVE.pdf

norms regulating research data management. The third section will address the legal regulation of research data in Lithuania in the context of artificial intelligence technologies.

The article adopts a documentary research approach, focusing on the examination of EU legislation applicable to research data. It began with a systematic pre-selection of EU legislative acts whose regulatory scope encompasses research data. Given that no single legislative instrument exclusively governs the regulation of research data, the research prioritized acts that significantly influence research data management practices within the EU. Following the preliminary selection, the study undertook a detailed analysis to extract and interpret the legal norms specifically applicable to the regulation of research data. This involved identifying provisions addressing open access, intellectual property, and the FAIR (Findable, Accessible, Interoperable, and Reusable) data principles. Lithuania was selected as a case study to contextualize the application of EU legislation. Lithuania's example provides a practical lens to explore the interplay between EU-level directives and national implementation, particularly highlighting challenges in adapting legal norms to local conditions and institutional capacities.

Finding academic articles that critically analyze the issues about the legal regulation of research data presents considerable challenges. Nevertheless, two significant EU Commission studies contribute substantially to this field[2]. Additionally, there is a more robust body of literature concerning scientific data management policies and opening research data[3].

In the articles mentioned above, the authors stressed the importance of open science in the future. "The Open Science phenomenon should be explored to understand both the opportunities and the big challenges of the 21st century that humanity has to face. In this scenario, it will be interesting to promote further research to explore the links among Open Learning, Open Science, and Open Innovation and how they contribute to the creation of a new Open Society".[4] A systematic literature review on data management policy concluded that "policymaking is one of the main observed areas that is done poorly, especially in developing countries at institutional and country levels. The reason behind this is poor collaboration among higher education institutions and/or research boards, funding agencies, and higher education commissions or ministries".[5]

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[2] European Commission: Directorate-General for Research and Innovation, Improving access to and reuse of research results, publications and data for scientific purposes – Study to evaluate the effects of the EU copyright framework on research and the effects of potential interventions and to identify and present relevant provisions for research in EU data and digital legislation, with a focus on rights and obligations, *Publications Office of the European Union* (2024) // https://data.europa.eu/doi/10.2777/633395; European Commission: Directorate-General for Research and Innovation and M. Eechoud, "Study on the Open Data Directive, Data Governance and Data Act and their possible impact on research," *Publications Office of the European Union* (2022) // https://data.europa.eu/doi/10.2777/71619

[3] Yimei Zhu, "Open-access policy and data-sharing practice in UK academia," *Journal of Information Science* 46, No. 1 (2020): 41–52 // DOI: 10.1177/0165551518823174; Iain Hrynaszkiewicz et al., "Developing a Research Data Policy Framework for All Journals and Publishers," *Data Science Journal* 19, No. 1 (2020): 5 // DOI: 10.5334/dsj-2020-005; Antti M. Rousi and Mikael Laakso, "Journal research data sharing policies: a study of highly-cited journals in neuroscience, physics, and operations research," *Scientometrics* 124 (2020): 131–152 // DOI: 10.1007/s11192-020-03467-9; Murtaza Ashiq, Muhammad Haroon Usmani, and Muhammad Naeem, "A systematic literature review on research data management practices and services," *Global Knowledge, Memory and Communication* 71, No. 8/9 (2022): 649-671 // DOI: 10.1108/GKMC-07-2020-0103; Ruben Vicente-Saez and Clara Martinez-Fuentes, "Open Science now: A systematic literature review for an integrated definition," *Journal of Business Research* 88 (2018): 428–436 // DOI: 10.1016/j.jbusres.2017.12.043

[4] Ruben Vicente-Saez and Clara Martinez-Fuentes, "Open Science now: A systematic literature review for an integrated definition," *Journal of Business Research* 88 (2018): 435 // DOI: 10.1016/j.jbusres.2017.12.043

[5] Murtaza Ashiq, Muhammad Haroon Usmani, and Muhammad Naeem, "A systematic literature review on research data management practices and services," *Global Knowledge, Memory and Communication* 71, No. 8/9 (2022): 668 // DOI: 10.1108/GKMC-07-2020-0103

An appropriate data policy is essential for scientific journals. "An increasing number of publishers and journals are implementing policies that require or recommend that published articles be accompanied by the underlying research data These policies are an essential part of the shift toward reproducible research and contribute to the availability of research data for reuse".[6] Also, researchers identified the main problematic areas to proper research data management: "(i) alignment of research management and data management, (ii) resourcing, (iii) researcher openness, and (iv) research data governance, which demonstrate the complexity of both managing and sharing research data at a time when data and collaboration are central to modern research".[7]

1. RESEARCH DATA WITHIN THE CONTEXT OF OPEN SCIENCE AND DATA POLICY

Research data is an integral part of two EU policy areas: open science and data policy. This section will outline the primary goals and efforts in open science and data policy, aiming to situate the role of research data before delving into the relevant legal framework. Thus, we will examine the EU's open science and data policies.

1.1. Open Science and Research Data

Open Science constitutes a pivotal component of European research policy. Its primary aim is to cultivate a research ecosystem that effectively connects researchers with society and expedites scientific discoveries through the dissemination of data and the integration of scientists from diverse backgrounds.

It is worth mentioning the key elements of open science. (1) Early and open sharing of research results includes pre-registration, registered reports, data storage in shared repositories, and pre-prints. (2) Open collaboration includes cooperation within the scientific community and with other knowledge producers and users. (3) Immediate and unrestricted open access refers to scientific publications, research data, models, algorithms, software, protocols, notebooks, workflows, and all other research outputs. (4) Ensuring verifiability and reproducibility includes practices guaranteeing that research results can be verified and reproduced. (5) Responsible research output management complies with the FAIR (Findable, Accessible, Interoperable, and Reusable) principles for research data. (6) Public engagement in research and innovation promotes citizen science and increases public trust in science.[8]

The European Commission strongly promotes open science activities. The European Research Area Policy Agenda[9] is the foundational document for promoting open science incentives and rewards through initiatives such as the Research Assessment Reform Agreement[10] and the Coalition for the Advancement of Research Assessment[11]. In addition, the EU legal framework for data, copyright, and digital policies underpins

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6 Iain Hrynaszkiewicz et al., "Developing a Research Data Policy Framework for All Journals and Publishers," *Data Science Journal* 19, No. 1 (2020): 5 // DOI: 10.5334/dsj-2020-005

7 Geoffrey Birkbeck, Thomas Nagle, and David Sammon, "Challenges in Research Data Management Practices: A Literature Analysis," *Journal of Decision Systems* 31, sup. 1 (2022): 164 // DOI: 10.1080/12460125.2022.207465

8 "Open Science," *European Commission* (2024) // https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

9 European Commission, *European Research Area Policy Agenda: Overview of Actions for the Period 2022–2024* (2021) // https://commission.europa.eu/system/files/2021-11/ec_rtd_era-policy-agenda-2021.pdf

10 Coalition for Advancing Research Assessment (CoARA), *Agreement on Reforming Research Assessment* (2022) // https://coara.eu/app/uploads/2022/09/2022_07_19_rra_agreement_final.pdf

11 *Coalition for Advancing Research Assessment (CoARA),* 2022 // https://coara.eu/

the practice of open science within the policy agenda of the European Research Area. The European Open Science Cloud[12] is considered as one of the European data spaces, while Open Research Europe[13] provides an innovative open-access publishing platform for research funded by all EU programs.

As we can see, research data is emphasized in three key elements of open science: (1) data deposition in shared repositories before publication, (2) unrestricted access to data, and (3) data management following FAIR data principles. However, it must be recognized that open science policy greatly emphasizes the openness and accessibility of research data nevertheless, as we will discuss later, not all research data need to be open. Its availability to third parties may be restricted for various reasons, including protecting personal data and intellectual property. Of particular importance to the European Union's initiatives on research data is, therefore, the creation of the European Open Science Cloud, which aims to create a common platform for storing and sharing research data. In addition, establishing a system to encourage researchers to open research data and adopting a balanced legal framework are essential components of open science. The legal regulation of research data is mainly based on the EU data policy, which is analyzed in the following discussion.

1.2. EU Data Policy and Research Data

The European Union has implemented a comprehensive set of strategic and legislative measures to navigate the evolving landscape of digital technologies. At the center of this initiative is the EU's data strategy, which aims to create a single data market that drives the digital economy while prioritizing data protection and security. The key document that sets out the EU's data policy framework is "A European Strategy for Data."[14] This strategy initiates the creation of common European data spaces in various strategic sectors, including health, agriculture, manufacturing, energy, mobility, finance, public administration, and skills. The creation of the European Open Science Cloud as a separate data space emphasizes the importance of investing in data infrastructure to support scientific research and innovation.

The "A European strategy for data" aims to make the EU a global leader in the data-driven economy by ensuring that data is widely available and can be shared across different sectors and borders. The European Data Strategy endeavors to achieve several key objectives: (1) Enact legislation to ensure effective data management, access, and re-use. (2) Enhance the availability of high-value data across the EU by enabling its re-use without charge. (3) Invest €2 billion in a major European project to develop a robust data management infrastructure, including sharing tools, architecture, and governance mechanisms. (4) Facilitate access to secure, equitable, and competitive cloud services This policy also champions the ethical and sustainable use of data and seeks to ensure that data-driven technologies and artificial intelligence contribute positively to societal well-being and sustainable development.

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[12] EOSC Association, *Advancing Open Science in Europe* (2024) // https://eosc.eu/

[13] Open Research Europe, *Open Research Europe* (2024) // https://open-research-europe.ec.europa.eu/

[14] European Commission, *Proposal for a Regulation on Artificial Intelligence (Artificial Intelligence Act)*, COM (2021) 206 final (2021) // https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX-%3A52020DC0066

In response to the complexities of digitalization and following data policy goals, the EU has implemented a variety of regulatory actions, such as the Open Data Directive[15], the Data Governance Act[16] , the Digital Services Act[17], the Digital Markets Act[18], the Data Act[19], the Artificial Intelligence Act[20], and the Interoperable Europe Act[21].

The Open Data Directive is part of a set of measures to strengthen the European Union's data economy, including the development of artificial intelligence. It establishes a regulatory framework for the re-use of information held by public sector bodies or public undertakings and data from publicly funded research. This Directive is based on the general principle that public and publicly funded data should be re-used for commercial or non-commercial purposes[22].

The Data Governance Act is an important component of the European data strategy as it regulates processes and structures that enable voluntary data sharing. Together with the Data Act, the Data Governance Act seeks to clarify who can benefit from data and how to promote trustworthy and secure data access. These acts play a crucial role in creating a unified EU data market, aiming to boost the European economy and society.[23]

The Data Act aims to enhance the EU's data economy by making industrial data more accessible and usable, encouraging data-driven innovation, and increasing data availability. It ensures fairness in allocating data value among actors in the data economy and clarifies who can use what data under which conditions. The act addresses the growing availability of connected products in the EU, significantly increasing data for reuse. It aims to give users greater control over the data they generate while maintaining incentives for data technology investments.[24]

The Digital Services Act and Digital Markets Act aim to improve safety and fairness in the digital space and ensure fair competition for businesses. The Digital Services Act targets online intermediaries and platforms, imposing specific regulations for large online platforms and search engines with over 45 million monthly users in the EU. The Digital Markets Act regulates gatekeeper platforms that exert significant influence on the internal market and act as intermediaries between businesses and consumers.

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15 *Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on Open Data and the Re-use of Public Sector Information (recast),* Official Journal of the European Union (2019, no. L 172/56) // http://data.europa.eu/eli/dir/2019/1024/oj

16 *Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European Data Governance (Data Governance Act),* Official Journal of the European Union (2022, no. L 152/1) *// http://data.europa.eu/eli/reg/2022/868/oj*

17 *Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market For Digital Services (Digital Services Act)*, Official Journal of the European Union (2022, no. L 277/1) // http://data.europa.eu/eli/reg/2022/2065/oj

18 *Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on Contestable and Fair Markets in the Digital Sector (Digital Markets Act)*, Official Journal of the European Union (2022, no. L 265/1) // http://data.europa.eu/eli/reg/2022/1925/oj

19 *Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on Harmonised Rules on Fair Access to and Use of Data*, Official Journal of the European Union (2023, no. L 351/1) // http://data.europa.eu/eli/reg/2023/2854/oj

20 *Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act)*, Official Journal of the European Union (2024, no. L 198/1) // http://data.europa.eu/eli/reg/2024/1689/oj

21 *Regulation (EU) 2024/903 of the European Parliament and of the Council of 13 March 2024 on Measures for a High Level of Public Sector Interoperability*, Official Journal of the European Union (2024, no. L 105/1) // http://data.europa.eu/eli/reg/2024/903/oj

22 European Commission, *Summary of: Directive (EU) 2019/1024 on Open Data and the Reuse of Public-Sector Information* (2024) // https://eur-lex.europa.eu/EN/legal-content/summary/open-data-and-the-reuse-of-public-sector-information.html

23 European Commission, *Summary of: Regulation (EU) 2022/868 on European Data Governance (Data Governance Act)* (2024) // https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:32022R0868

24 European Commission, *Data Act Explained* (2024) // https://digital-strategy.ec.europa.eu/en/factpages/data-act-explained

This legislation addresses issues such as unfair business practices, limited consumer choices, and the online sale of illegal goods and content.[25]

The Artificial Intelligence Act promotes the responsible development and utilization of AI technologies. Its primary objective is establishing a secure AI environment that benefits various sectors. The Act classifies AI systems into four categories: minimal risk, specific transparency risk, high risk, and unacceptable risk, each accompanied by specific obligations and requirements.[26]

The Interoperable Europe Act aims to facilitate cross-border data sharing within the EU and support the digital transformation of the public sector. The Act seeks to improve interoperability within the Digital Single Market by introducing a cooperation framework across multiple levels, mandatory interoperability assessments, establishing an Interoperable Europe Portal, and enhanced support for innovation and policy implementation.[27]

Thus, while each legal text is related to regulating research data to different extents, no single legal text is explicitly dedicated to research data. Consequently, it is necessary to analyze each law to identify the norms that govern research data. In the following section, we will outline the laws that have the most significant impact on managing research data and discuss their main legal provisions.

2. EU LEGISLATION'S IMPACT ON RESEARCH DATA MANAGEMENT

The section seeks to investigate the effects of EU legislation on data management in research, providing insights into the current challenges and potential pathways for more effective data governance in the scientific community. Also, it should be noted that this paper aims to identify the main aspects of the regulation without delving into its details, which include numerous exceptions and specific cases. Responding to the rapid pace of digitization, the EU has enacted directives and regulations that profoundly impact research, particularly in two distinct areas: the management of research data and the availability of data for research purposes.

Whereas the purpose of the paper is to provide an overview of the selected EU legislative developments, it will analyse the provisions of the Open Data Directive[28] (ODD), the Data Governance Act[29] (DGA) and the Data Act[30] (DA), not covering the issues related to intellectual property rights and personal data protection. However, it is crucial to recognize that both intellectual property rights and personal data protection are inseparable components of the overall ecosystem of data regulation in research.

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25 European Commission, *The Digital Services Act Package* (2024) // https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package

26 Modulos AI, *AI Regulation* (2024) // https://www.modulos.ai/eu-ai-act/?utm_term=what%20is%20the%20eu%20ai%20act&utm_campaign=EU+AI+Act+(December+2023)&utm_source=adwords&utm_medium=ppc&hsa_acc=9558976660&hsa_cam=20858946124&hsa_grp=159677877987&hsa_ad=705319461314&hsa_src=g&hsa_tgt=kwd-2223681832775&hsa_kw=what%20is%20the%20eu%20ai%20act&hsa_mt=p&hsa_net=adwords&hsa_ver=3&gad_source=1&gclid=CjwKCAjw2dG1BhB4EiwA998cqHZwR-Te0tlhN26NWDIpIWZnm3ioGEPEH2OKNsbxLqG4UMPonct30hoCzfMQAvD_BwE

27 European Commission, *Interoperable Europe Act Enters into Force Today* (2024) // https://commission.europa.eu/news/interoperable-europe-act-enters-force-today-2024-04-11_en

28 *Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on Open Data and the Re-use of Public Sector Information (recast)*, Official Journal of the European Union (2019, no. L 172/56) // http://data.europa.eu/eli/dir/2019/1024/oj

29 *Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European Data Governance (Data Governance Act)*, Official Journal of the European Union (2022, no. L 152/1) // http://data.europa.eu/eli/reg/2022/868/oj

30 *Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on Harmonised Rules on Fair Access to and Use of Data*, Official Journal of the European Union (2023, no. L 351/1) // http://data.europa.eu/eli/reg/2023/2854/oj

The guiding principle is that opening and sharing data must not infringe on the protection of intellectual property and the protection of personal data.

Before examining the individual pieces of legislation, it is important to note their differences. The ODD is a directive, which means that the legal rules it provides have to be transposed by national legislation. It gives Member States more flexibility in the choice of specific regulations. The DGA is a regulation and, therefore, directly applicable in the Member States. The DA is also a regulation. Although it has already been approved by the EU institutions, it will only be applicable in the Member States from 12 September 2025.

2.1. Data Management in Research Under the Open Data Directive

The first and most significant legal act on research data management is the Open Data Directive (ODD). The primary objective of this directive is to establish guidelines for the reuse of public-sector information, which includes geographic, land registry, statistical, and legal data held by public-sector bodies or public undertakings and data from publicly funded research. The directive provides a precise definition of research data, which is crucial as it ensures a unified understanding across all EU Member States.

According to the directive, "'research data' means documents in a digital form, other than scientific publications, which are collected or produced in the course of scientific research activities and are used as evidence in the research process, or are commonly accepted in the research community as necessary to validate research findings and results" (ODD Art. 2(9)). "Research data includes statistics, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings and images. It also includes meta-data, specifications and other digital objects". (ODD Recital 27). However, administrative data and educational materials are excluded from the scope of the ODD.

Another significant aspect of the ODD is identifying which research institutions fall under its regulations. The ODD is not specifically tailored for universities or research-performing organizations; consequently, this can sometimes create challenges in determining the applicable norms for these entities. This complexity arises because the ODD establishes different regulatory regimes for public sector bodies, public undertakings, and research data, making it difficult to discern which norms apply to universities and similar institutions. Universities often qualify as public sector bodies under the ODD, which defines a university as "any public sector body providing post-secondary higher education leading to academic degrees" (ODD Art. 2(4)). It is important to note that the ODD applies to universities only regarding research data, excluding documents held by educational establishments and administrative parts (ODD Art. 1(2)(l)). Additionally, the ODD sets different regulatory regimes for libraries, including university libraries (ODD Art. 1(2)(j)).

The directive also uses the terms "research performing organizations" and "research funding organizations" without explicitly defining them. These organizations fall under the directive's scope only if they align with the definition of a "public sector body."

Article 10(1) of the ODD mandates that Member States establish an open-access policy for research data. The ODD significantly relies on national open access policies, granting substantial discretion to Member States to define the conditions when data should be made open. This follows the principle of "as open as possible, as closed as necessary." Additionally, the ODD explicitly states that it does not mandate data

opening if there are valid reasons to keep them closed. Open access under ODD "is understood as the practice of providing online access to research outputs free of charge for the end user and without restrictions on use and re-use beyond the possibility to require acknowledgment of authorship." It can be provided by publishing under Creative Commons Public Domain Dedication (CC0,), Creative Commons Attribution (CC-BY) or other "open content licences" (ODD Recital 27).

The ODD does not override the protection granted to data by intellectual property rights, trade secrets, or the General Data Protection Regulation. The directive requires research data to be open only if this requirement does not conflict with other EU or national laws, adhering to the principle "as open as possible, as closed as necessary". The main requirement for research data policy is that data should be open by default and follow the FAIR data principles.

Article 10(2) of the ODD obligates the Member States to make research data reusable for commercial and non-commercial purposes if they are "publicly available through an institutional or subject-based repository". Here, we observe the interplay between Member States' competence to set open access policies and the ODD. While the ODD obliges data to be reusable only when publicly available, the power to set conditions for public availability lies with the Member States by setting open access policies.

The ODD sets several key requirements for the reusability of research data: transparency (ODD Art. 7), non-discrimination (ODD Art. 11), and the principle that reuse should be free of charge (ODD Art. 6). These provisions ensure that research data is accessible and usable, promoting transparency and innovation across the European Union.

Finally, it should be stressed that the ODD is oriented toward opening public data that can be freely used for research purposes. Therefore, it can be argued that the ODD not only imposes obligations on researchers regarding the opening of research data but also gives access to a huge amount of public data that can be used for research purposes.

In conclusion, the ODD represents a landmark regulation in managing and reusing research data across the EU. The ODD ensures consistency and fosters a collaborative research environment among Member States by providing a clear and unified definition of research data. The directive's flexibility allows each Member State to establish its open access policies, adhering to the principle of "as open as possible, as closed as necessary." This approach respects the protection of intellectual property, trade secrets, and privacy while promoting transparency and innovation. Moreover, by mandating the reusability of publicly funded research data and setting key requirements such as transparency, non-discrimination, and free reuse, the ODD significantly enhances the accessibility and usability of research data. Consequently, the ODD not only imposes obligations on researchers to open up their data but also facilitates access to a vast public data repository, thereby supporting research across the EU.

2.2. Data Management in Research Under the Data Governance Act

While the ODD provides a framework for reusing public-sector information, it acknowledges that certain types of data cannot be made open due to various legal and ethical constraints. To complement the ODD and address these limitations, the Data Governance Act (DGA) was enacted and has been in effect since September 24, 2023. The

DGA aims to regulate the reuse of specific public sector data, including research data that cannot be released as open data. This dual approach ensures that a wide range of data can be used for public benefit while respecting necessary restrictions.

Article 3 of the DGA identifies four specific types of data that fall under its regulation:

a) Commercial confidentiality, including business, professional, and company secrets.

b) Statistical confidentiality.

c) Protection of intellectual property rights of third parties.

d) Protection of personal data.

By establishing a common voluntary framework, the DGA facilitates the reuse of these protected categories of data in a manner that balances openness with confidentiality. This framework is essential for maintaining trust and ensuring that protected data is only reused under strict conditions.

Public research-performing organizations (RPOs) are also subject to the DGA regulations, with the notable exception of university libraries. This inclusion is crucial because RPOs frequently handle data that falls within the protected categories outlined by the DGA. Article 4 of the DGA explicitly prohibits exclusive arrangements related to data covered by the act, which prevents monopolies and ensures broader access to valuable data.

RPOs must publish the conditions under which data can be reused, and the procedures for requesting such reuse should be facilitated via a single information point. This transparency is designed to streamline access and foster a more efficient data reuse process. Additionally, these RPOs are responsible for preserving the protected nature of data when making it available for reuse. Article 5(3) of the DGA provides various measures to achieve this, such as anonymizing personal data and treating other protected data to remove confidential information or intellectual property rights. These measures ensure that while data is made available for reuse, it does not compromise the confidentiality or proprietary rights of the original data holders.

The DGA promotes the reuse of research data and emphasizes the significance of RPOs accessing protected data from public bodies. This access is vital for advancing scientific research, allowing researchers to utilize a broader range of data while adhering to legal and ethical standards. The DGA explains that "scientific research purposes should be understood to include any type of research-related purpose regardless of the organisational or financial structure of the research institution in question, with the exception of research that is being conducted by an undertaking with the aim of developing, enhancing or optimising products or services" (DGA, Recital 25). This inclusive definition ensures that various research activities can benefit from the DGA's provisions.

Another critical aspect of the DGA is its regulation of data intermediaries. It is important to note that repositories that enable the reuse of scientific research data according to open-access principles are not considered data intermediaries if they do not seek to establish commercial relationships (DGA, Recital 29). This distinction ensures that academic and non-commercial repositories can operate without the regulatory burdens placed on commercial data intermediaries, facilitating easier access to research data.

In addition to these measures, the DGA addresses the concept of data altruism. Article 2(16) defines "'data altruism' means the voluntary sharing of data on the basis

of the consent of data subjects to process personal data pertaining to them, or permissions of data holders to allow the use of their non-personal data without seeking or receiving a reward that goes beyond compensation related to the costs that they incur where they make their data available for objectives of general interest as provided for in national law, where applicable, such as healthcare, combating climate change, improving mobility, facilitating the development, production and dissemination of official statistics, improving the provision of public services, public policy making or scientific research purposes in the general interest." This concept encourages individuals and organizations to share data for purposes of general interest, such as healthcare, combating climate change, improving mobility, developing official statistics, enhancing public services, public policy making, or scientific research. By regulating data altruism, the DGA provides a framework for harnessing the goodwill of data holders for the greater good, promoting a culture of sharing and collaboration.

In conclusion, the DGA complements the ODD by providing a comprehensive regulatory framework for reusing protected data. RPOs, under the DGA, play dual roles as data recipients and data-sharing entities. This dual functionality allows RPOs to benefit from and contribute to the broader data ecosystem, promoting innovation and the public good through the responsible management and reuse of protected data. The DGA's provisions ensure that data is made available in a manner that respects confidentiality and proprietary rights while still enabling significant advancements in research and public policy.

2.3. Data Management in Research Under the Data Act

The Data Act (DA) differs from the ODD and DGA in several critical ways, particularly concerning the institutions it addresses and the nature of the data it covers. While the ODD and DGA primarily target public institutions and the data they hold, the DA focuses on data held mainly by private companies. Importantly, the DA does not override any national or EU laws that limit data sharing, such as those related to intellectual property rights and personal data.

The DA lays down rules to govern several key areas, as outlined in Article 1 of DA:

a) the making available of product data and related service data to the user of the connected product or related service;

b) the making available of data by data holders to data recipients;

c) the making available of data by data holders to public sector bodies, where there is an exceptional need for those data for the performance of a specific task carried out in the public interest;

d) facilitating switching between data processing services;

e) introducing safeguards against unlawful third-party access to non-personal data; and

f) developing interoperability standards for accessing, transferring, and using data.

Chapter II of the DA regulates business-to-business (B2B) and business-to-consumer (B2C) data sharing, especially within the Internet of Things (IoT) market. This regulation applies to all raw and pre-processed data generated from the use of connected products or related services that are readily available to the data holder. This includes personal, non-personal, and metadata. Notably, the sui generis database right does not apply under these conditions.

Research-performing organizations (RPOs) can benefit significantly from these provisions. As users, RPOs can access data from data holders under the conditions set by the DA, enabling them to use this data for their research purposes or share it with third parties. Additionally, RPOs can be third-party when users request data holders to share data with them. However, it is crucial to note that data holders are not obligated to share readily available data with third parties for testing new connected products, substances, or processes not yet on the market unless contractually permitted.

RPOs can also act as data holders, particularly when they retrieve or generate product or related service data while providing a related service. If an RPO qualifies as a data holder, it must comply with all obligations set by the DA, ensuring transparency and fairness in data sharing.

Chapter III of the DA addresses situations where a business (the data holder) has a legal obligation under EU or national law to make data available to another business (the data recipient). This Chapter applies to all data businesses hold, extending beyond the data regulated by Chapter II. It ensures that businesses cannot unfairly withhold data when there is a legal requirement to share it, promoting a fair and competitive market.

RPOs, as potential data recipients, can request data holders to share data with them. However, data holders are not obligated to share readily available data with third parties for testing new connected products, substances, or processes not yet on the market unless contractually permitted. This provision ensures that businesses can protect their innovative processes while still complying with legal data-sharing requirements.

The DA permits data holders to charge data recipients for data sharing. Article 9(4) limits the price charged to non-profit RPOs, ensuring it only covers the costs incurred for making the data available, such as formatting, electronic dissemination, and storage costs. This provision ensures that data sharing is fair and does not impose undue financial burdens on non-profit research organizations.

Chapter IV of the DA ensures fair contractual terms for acquiring data, particularly when one business has a stronger bargaining position and imposes non-negotiable data access and use terms. However, it is unclear if RPOs will always be considered the weaker party. Any unfair contractual terms unilaterally imposed on a weaker party should not be binding. This ensures that RPOs can negotiate fair terms and access the needed data without being subject to exploitative conditions.

Additionally, Chapter IV allows public sector bodies to access data usually held by private entities under specific terms and conditions when there is an exceptional need. This provision includes all data, although access to personal data is subject to restrictive conditions. The DA empowers public institutions to share accessed data with RPOs. Article 21(1)(a) entitles public sector bodies to share data with individuals or organizations for scientific research or analytics compatible with the original purpose of the data request. RPOs must comply with specific requirements, including a notable requirement to retain data for no longer than six months. However, exemptions may apply, such as when archiving is required under Union or national law for public access and transparency obligations (DA Art. 19(1)(c)).

Chapter VIII of the DA addresses data interoperability, establishing essential requirements to ensure data from different sources can be used within and between Common European Data Spaces. These requirements are crucial for researchers and research organizations active in the European Open Science Cloud. While compliance

with these requirements is necessary, they provide significant benefits by facilitating data reuse within these data spaces.

Interoperability standards are essential for ensuring that data from various sources can be integrated and used effectively. This is particularly important for research organizations that rely on diverse data sets to conduct comprehensive studies. By adhering to these standards, RPOs can enhance their research capabilities and contribute to a more interconnected and collaborative research environment. Additionally to DA, the Interoperable Europe Act[31] was adopted to facilitate cross-border data exchange and accelerate the digital transformation of the public sector.

In summary, the Data Act introduces a comprehensive framework for data sharing and access, significantly impacting research-performing organizations. By focusing on data held by private companies and promoting fair and transparent data-sharing practices, the DA complements the ODD and DGA. It ensures that data is accessible while also protecting sensitive information and respecting existing legal protections. The DA's emphasis on interoperability and fair contractual terms further enhances the potential for innovative research and collaboration across the European Union.

3. THE CHALLENGES OF RESEARCH DATA GOVERNANCE IN LITHUANIA: BARRIERS TO AI ADVANCEMENT

The data ecosystem consists of two primary components: data sharing and data usage, both of which require proper regulation. The previous sections have predominantly focused on the regulation of data sharing. In this section, we have chosen to focus on artificial intelligence innovation and the case study of Lithuania. We will explore the relationship between the regulation of data usage and data sharing and the significance of the national research data policy.

3.1 The Critical Role of Research Data in Artificial Intelligence Development

The accessibility of research data is a crucial 'fuel' for artificial intelligence, as it supplies the diverse, high-quality datasets necessary for training AI models. Also, innovations in AI can enhance the potential utility of research data by facilitating more sophisticated analyses, pattern recognition, and trend prediction. In the proposal for the AI Act the Commission states: "the promotion of AI-driven innovation is closely linked to the Data Governance Act, the Open Data Directive and other initiatives under the EU strategy for data, which will establish trusted mechanisms and services for the re-use, sharing and pooling of data that are essential for the development of data-driven AI models of high quality."[32]

Open science principles are inseparable from advances in artificial intelligence because they provide access to a wide range of high-quality datasets. This openness encourages the development of more accurate, reliable, and fair AI models and fosters collaboration, transparency, and trust in AI technologies. It should be noted that the public sector produces data primarily for public sector functions. Therefore, the quality

[31] *Regulation (EU) 2024/903 of the European Parliament and of the Council of 13 March 2024 on Measures for a High Level of Public Sector Interoperability*, Official Journal of the European Union (2024, no. L 105/1) // http://data.europa.eu/eli/reg/2024/903/oj

[32] *European Commission. Proposal for a Regulation on Artificial Intelligence (Artificial Intelligence Act),* COM (2021) 206 final (2021) // https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0206&from=ES

and suitability of this data for the development of AI innovation is the subject of a separate study. In the case of research data, open science obliges detailed documentation of datasets, including methodologies for data collection, processing, and potential biases. Such transparency ensures that AI developers can assess the data quality, which helps build more accurate and reliable AI models. Datasets shared under the principles of open science are often subject to peer review, where the scientific community evaluates and validates the data. This process helps maintain the data's high quality and ensures that AI models trained on these datasets are based on reliable data. The studies show that flawed, incomplete, or biased datasets can have negative societal impacts when used in AI applications. It underscores the importance of high-quality data in achieving ethical and effective AI systems[33].

The EU has established a solid framework for sharing research data, however, to be effective, this regulation needs to be complemented by national policies that adapt open science principles to local conditions and ensure their consistent application. National governments must adapt EU directives to the specific needs and characteristics of their research ecosystems.

In Lithuania, research data sharing is regulated by a few pieces of legislation. *The Right to Information and Data Reuse Law*[34] is the primary legislation that transposes the provisions of the *Open Data Directive* into national law. It adopts the definition of research data as outlined in the ODD (Article 3(12)). Article 10(8) of this Law mandates that 'Data from publicly funded research and high-value datasets shall be made available for reuse free of charge." Article 2(2)(8) stipulates that the law does not apply to data held by public higher education institutions and public research institutes, except for research data when such research is financed by public funds and made available to the public". This provision is also specified by the Lithuanian Law on Research and Studies[35], Article 51, which stipulates that "To ensure the quality of research and experimental development carried out with state budget funds, transparency of the use of state budget funds, and to promote scientific progress, all results of research and experimental development carried out in research and study institutions with state budget funds must be made publicly available (on a website and in other ways), insofar as this does not contradict the legislation on the protection of intellectual property and commercial or state secrets." The law mandates the Lithuanian Research Council to regulate open access to research data.

The Lithuanian Research Council adopted the *Guidelines for Open Access to Scientific Publications and Data*[36] in 2016, with their legal effect designated to last until the end of 2018[37]. These guidelines have remained unchanged for many years, so they do not adequately reflect current realities. In parallel to the existing guidelines, the Lithuanian Research Council has recently approved the Description of the Procedure for *Open Access to the Data of Research and Experimental Development*[38]. This document aligns

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[33] Stephen Slota, Kenneth Fleischmann, Sherri Greenberg, Nitin Verma, Brenna Cummings, Lan Li and Chris Shenefiel, "Good systems, bad data?: Interpretations of AI hype and failures," *Proceedings of the Association for Information Science and Technology* Vol. 57, No. 1 (2020): e275 // https://doi.org/10.1002/pra2.275

[34] *Law on the Right to Information and Re-use of Data* (TAR, 2023, no. 2023-22984).

[35] *Law on Research and Studies of the Republic of Lithuania*, Official Gazette (2009, no. 54-2140).

[36] *Order of* the President of the Research Council, *On the Approval of the Guidelines for Open Access to Scientific Publications and Data* (TAR, 2016, no. 2016-04101).

[37] Order of the President of the Research Council, *Establishing a transitional period for the guidelines for open access to scientific publications and data* (TAR, 2024, No 2024-15267).

[38] Order of the President of the Research Council, *Description of the Procedure for Open Access to the Data of Research and Experimental Development (TAR, 2024, No 2024-15337).*

more closely with contemporary needs, yet the implementation of its most critical points has been deferred until 2026 or even 2030. Consequently, it can be concluded that Lithuania lacks a comprehensive national policy on research data management. Such a policy is essential to underpin a strategically balanced approach to data management as envisioned by EU legislation. Additionally, this situation raises questions regarding the proper transposition of EU legal acts into the national legal framework.

It is important to note that a new version of the *Law of the Republic of Lithuania on the Governance of State Information Resources*[39] was adopted in December 2023. However, due to the ambiguity of its language and the lack of practice, it remains challenging to assess its implications for research data regulation.

3.2. Legal Framework for Open Access to Research Data in Lithuania

The published study by the Lithuania Research Council revealed that only approximately 27% of research project proposals include plans to collect research data during project implementation. This trend is consistent across universities and research institutes, with averages of 26% and 27%, respectively. Data collection is notably prevalent in the social sciences, with 54% of projects including this activity. Similarly, medical and health sciences report data collection in 50% of projects. However, data collection is less common in other fields, ranging from 0% in technology and agricultural sciences (based on limited data) to 17% in natural sciences. These findings suggest that research data collection is not systematically integrated into project workflows in most scientific domains, except for social sciences and medical sciences. In response to such passive management of research data, new legislation has been adopted to introduce stricter requirements for research data management.[40]

The Description of the Procedure for Open Access to the Data of Research and Experimental Development[41] (the Description) outline the legal framework governing open access to scientific publications and research data. This section will delve into the regulation concerning access to research data, highlighting the challenges and differences in defining and applying the concept of research data in various legislative frameworks, both at the national and EU levels. It will also discuss the future vision for managing research data, particularly the obligations and timelines for making data openly accessible

One of the primary concerns surrounding the regulation of research data is the inconsistency between definitions used in different legal documents. Paragraph 5 of the Description provides 18 definitions, including one for "research data", which is essential for determining the scope of regulation. However, the definition in this document diverges from that provided in the Law on Access to Information and Reuse of Data of the Republic of Lithuania.

The Description defines research data as "data used and/or generated in the course of the research, which may be made available and accessible together with the publications or stored in a repository with a persistent identifier and metadata." By contrast, the *Law on Access to Information and Re-use of Data* defines research data as

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[39] *Law on Management of State Information Resources* (TAR, 2023, no. 2023-26025).

[40] Lithuanian Research Council, *Evaluating the Practices and Progress of Open Access to Scientific Publications and Data Collection* (2022) // https://lmt.lrv.lt/media/viesa/saugykla/2023/10/gT5VZIFKkVE.pdf

[41] Order of the President of the Research Council, *Description of the Procedure for Open Access to the Data of Research and Experimental Development (TAR, 2024, no. 2024-15337).*

"data, other than scientific publications, which are collected or produced in the course of research activities and are used as evidence or are necessary for validating findings".

The analysis of the two definitions highlights several key differences:

- The definition in the Description emphasizes the importance of making research data accessible in conjunction with publications or in institutional repositories. In contrast, the Law on Access to Information and Re-use of Data centers more on using research data for validation and evidence in research, with less focus on how data is stored or accessed.
- The Law on Access to Information and Re-use of Data explicitly excludes scientific publications from its definition of research data, while the Description does not make this distinction as evident, though they imply that data and publications are separate entities.
- The Description defines the role of institutional repositories and requires persistent identifiers and metadata for research data. These technical requirements are not mentioned in the Law on Access to Information and Re-use of Data, which focuses more on the data's evidentiary function.

These differences are fundamental and may create confusion regarding the mandatory characteristics of research data, potentially undermining legal certainty. In cases of conflicting definitions, the higher-ranking legal act generally prevails, suggesting that the definition in the Description may not be valid.

The timeline for implementing open data policies also introduces complexity. Sections 14 and 16 of the Description relate to the obligation to open research data, and implementation is set for January 1, 2030. This future date suggests that there is no current obligation under these provisions to open research data.

Section 14 of the Description stipulates that research datasets and their metadata must be made accessible at specified times, in a designated manner, and under defined conditions, as determined by the research and study institution or the R&D funding body. If a scientific publication is based on research data, the metadata must be concurrently opened and linked to the publication. This suggests that the obligation to open data, according to the procedures of research institutions or funding bodies, commences in 2030. Nonetheless, the Law on Access to Information and Reuse of Data, effective from July 17, 2021, applies to research data if the research is publicly funded and the data has already been publicly available. Furthermore, from January 1, 2026, Section 31 of the Description mandates research and higher education institutions to establish procedures for managing open access to publications and the results of scientific research and economic development. Section 32, effective January 1, 2025, requires research funding bodies to include open access to research datasets in project funding agreements. Allowing internal documents to regulate open data policy aligns with EU standards, yet it remains unclear from which date these procedures are mandatory for researchers.

Section 16 of the Description introduces the principle of "as open as possible, as closed as necessary" for research data access. This principle is derived from the EU Open Data Directive, which mandates its implementation by July 2021. However, the delay of this provision until 2030 in the national legislation raises questions about the legality of the postponement and whether it aligns with EU requirements.

The analysis suggests that the compliance of the Description with superior legal acts from the Republic of Lithuania and EU legislation is dubious, indicating flaws in legal technique and unclear applicability. The reason for these issues warrants further

investigation. However, it may not stem from oversight but from the drafters' challenging task of reconciling established research data policy requirements with the actual readiness of institutions to implement these standards.

Thus, despite Lithuania's ambition to be at the forefront of AI technology development and the critical role of data in this process, the country lacks an advanced strategy for opening and sharing research data. Consequently, many valuable datasets remain inaccessible to AI developers, and the public cannot fully benefit from AI models that could be appropriately trained with this data.

CONCLUSIONS

The management of research data is an integral part of the EU open science and EU data policy. Therefore, their management strategy and priorities are determined by the provisions of the EU legal acts implementing the aforementioned policies.

The newly enacted European Union legislations, specifically the Open Data Directive, the Data Governance Act, and the Data Act, collectively delineate the data management framework within the research domain.

The Open Data Directive concentrates on the reuse of public-sector information, instituting explicit guidelines and definitions that guarantee a uniform approach among all EU Member States. It emphasizes transparency, non-discrimination, and the unrestricted use of publicly financed research data, thereby fostering innovation and enhancing accessibility. The directive's relationship to national open data policies provides adaptability while conforming to the principle of "as open as possible, as closed as necessary. This framework ensures adherence to intellectual property rights and privacy considerations thereby establishing a balanced approach to data openness.

The Data Governance Act complements the Open Data Directive by furnishing a regulatory schema for the reuse of protected public sector data, encompassing data associated with commercial interests, statistical analysis, intellectual property, and personal data protection. It seeks to promote the reuse of such data through a voluntary framework, ensuring the preservation of confidentiality and proprietary rights, thereby enabling research-performing entities to access critical data while complying with ethical and legal standards.

The Data Act is focused on data retained by private sector organizations, establishing guidelines to facilitate the accessibility of product and service-related data for users, data recipients, and public sector organizations. It regulates data sharing both among businesses and among businesses and consumers, with a particular focus on the Internet of Things sector. The emphasis of the Data Act on interoperability standards and contractual frameworks enhances the functionality of various data sources, thereby fostering innovative research initiatives and collaborative endeavors.

The current legal framework in Lithuania does not adequately address the dynamic requirements of AI innovation. As a result, the scarcity of accessible, high-quality data hampers the development of robust AI models, thereby limiting the broader societal benefits that AI could provide. To effectively leverage AI's potential, Lithuania needs to establish a more integrated national policy on research data management, aligning with EU guidelines to ensure that valuable datasets are available for AI-driven progress.

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