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TOWARDS DATA SOVEREIGNTY IN AGRICULTURE: LEGAL CHALLENGES AND COMPARATIVE REMARKS FOR A FAIR FARM DATA GOVERNANCE*

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HACIA LA SOBERANÍA DE DATOS EN LA AGRICULTURA: RETOS JURÍDICOS Y OBSERVACIONES COMPARATIVAS PARA UNA GOBERNANZA JUSTA DE LOS DATOS AGRÍCOLAS

Abstract
The application of big data in agriculture offers a promising opportunity for the sustainable transformation of the global agricultural sector. However, it also raises legal challenges that risk exacerbating the so-called "big data divide" between farmers and agribusinesses, as well as amplifying the "lock-in" problem for the former. In the context of rethinking traditional governance tools for data protection, which are currently crystallized around the dichotomy between personal and non-personal data, they

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fail to address the unique characteristics of agricultural data. In this context, a comparative legal analysis of the EU and US frameworks proves valuable for identifying converging trends in addressing this paradigm shift.

Keywords
big data; accessibility; data sovereignty; farm data; lock-in.

Resumen
La aplicación de los macrodatos a la agricultura ofrece una oportunidad prometedora para la transformación sostenible del sector agrícola mundial. Sin embargo, también plantea retos jurídicos que corren el riesgo de exacerbar la llamada "brecha de los macrodatos" entre agricultores y empresas agrícolas, así como de amplificar el problema de "dependencia" de los primeros. Estas cuestiones exigen un replanteamiento de las herramientas tradicionales de gobernanza de datos, que, al estar cristalizadas en torno a la dicotomía entre datos personales y no personales, no logran abordar las características propias de los datos agrícolas. En este contexto, un análisis comparativo de los marcos jurídicos de la UE y de EE. UU. resulta valioso para identificar tendencias convergentes al abordar este cambio de paradigma.

Palabras clave
macrodatos; accesibilidad; soberanía de datos; datos agrícolas; dependencia.

Big Data in Agriculture: Opportunities, Challenges, and Paradoxes

The imperative need for big data analytics systems to be safely deployed in farming presents a significant opportunity for policymakers and scholars to enrich discussions on revisiting traditional data governance models that have recently shaped European and North American legal frameworks.

Potentially, the use of big data in agriculture may offer unprecedented opportunities for farmers, both individually and collectively. Under the single farmer perspective, the "datification" (Zeno-Zencovich, 2018, p. 460) of the multiple qualitative and quantitative aspects featuring the rural context can empower cultivators with data-driven agronomic predictions, solutions, and prescriptions, with a considerable positive impact in terms of lower input costs and higher profit margins (Sykuta, 2016, p. 58). On a broader scale, the widespread dissemination of data among actors in the agri-food chain could play a pivotal role in addressing gaps in reliable indicators and monitoring criteria for evaluating the environmental performance of agricultural policies (European Court of Auditors, 2022). Such advancements are particularly relevant in tackling the major challenges of the 21st century, including biodiversity and ecosystem degradation, climate change, and food security (European Commission, 2019).

The wide range of outlined benefits is made possible by the distinctive characteristics that set big data apart from traditional methods of collecting and transforming data into information (Bergé et al., 2018, pp. 144–178). These characteristics, commonly referred to in the scholarly literature as the "three Vs"—volume, velocity, and variety (Hansen Krause & Porter, 2017, pp. 31–42)—highlight the unique potential of big data systems.

While the advantages of applying big data in farming have been demonstrated, the repercussions of its unique characteristics on the vulnerabilities of the agricultural sector remain to be analyzed. The very benefits associated with smart farming devices may, at the same time, foster farmers' dependence on the providers of such technologies (Ryan, 2020, p. 63).

As agronomic, meteorological, or production facts of agricultural activities are increasingly represented as "data," access to this latter transforms it into actionable "information" (Béguin-Faynel, 2020). The aggregation and integration of information from diverse origins and natures generate "knowledge": a new type of knowledge that goes beyond mere collection and plays a proactive role in shaping future farming decisions. Yet, the transformative potential of the journey from "representation" to "knowledge" is hindered by the fact that these processes are controlled by entities with technological and economic dominance over farmers (Atik, 2022, p. 711).

As a result, at a certain stage in the processing of farm data, the data originators—farmers—lose track of its use and their ability to derive any benefit from it. In contrast,

agricultural technology providers (ATPs) expand their informational resources, engaging them in market profiling to tailor subsequent contractual offers to farmers. This dynamic exacerbates existing informational and technological asymmetries between farmers and ATPs, resulting in a market failure that displays, on the one hand, as a "lock-in" effect for agricultural producers (Atik, 2023a, pp. 380–409) and, on the other hand, as a distortion of competition among agribusinesses providing digital technologies (Atik & Martens, 2020).

Focusing on the first type of phenomenology of such "informational capitalism" (Las Casas, 2024; Sadowski, 2019), agri-food corporations implement various "fit-for-farmer" measures. The most glaring examples are practices like timing recommendations for purchasing new equipment based on the predicted lifespan of previously sold machines or restricting the portability of farm data to devices purchased from competitors (Carbonell, 2016).

These dynamics highlight the darker side of the "big ag-data" phenomenon, revealing a new facet of the digitization's "transparency paradox" (King & Richards, 2013, pp. 41–47): while data was initially heralded as a cornerstone of the digital revolution (European Commission, 2021), aimed at making the world more intelligible and predictable, its interaction with global market trends often leads to it becoming inaccessible to collective scrutiny, monopolized by a small number of dominant "data landlords" (Mantelero, 2012, p. 135).

Consequently, a general reluctance to share data has emerged within the farming community, stifling rather than fostering social and economic innovation. This reluctance has been notably identified as one of the key barriers to employing big data and advanced analytical techniques in the evaluation of the Common Agricultural Policy (CAP), as highlighted in by the European Court of Auditors in 2022, emphasizing that this hesitation, coupled with low levels of data literacy in the primary production sector, hampers progress in leveraging the potential of big data (European Court of Auditors, 2022).

Comparative Legal Approaches to Agricultural Data Governance: EU and US Traditional Frameworks

The central matter arising from the aforementioned questions concerns providing users of digital agricultural systems with adequate guarantees of access (Mezzanotte, 2017, pp. 159–187), transparency, and control over data generated by such devices.

The search for an effective legal framework requires, first and foremost, the demarcation of the object of legal protection, given the absence of any legal source explicitly providing a clear definition of the term "agricultural data" (Tomasso, 2022). Since the

defining stage itself, a sharp dissonance emerges between the reliance on the discerning criterion of the "personal" character, typical of traditional data taxonomies, and the unique characteristics of big farm data generation.

The European classification of data based on its personal nature has significantly influenced heterogeneous US sources on the subject (Barrio Andrés, 2022, pp. 186–193; Di Lella, 2023, pp. 511–551) and has historically shaped the continental legal tradition, until the recent approval of the new European data governance framework (European Parliament & EU Counsel, 2022, 2023). The rationale behind this dichotomy lies in balancing the need to provide individuals with adequate guarantees for the protection of identifiable information with the interest in ensuring the free flow of data to foster knowledge proliferation.

In this context, one can easily appreciate, on the one hand, the link between the personal nature of data and the mere "identifiability" of the concerned individual, as well as the strict regulatory framework established by the General Data Protection Regulation (GDPR; European Parliament & EU Counsel, 2016), and, on the other hand, the residual criterion and the comprehensive liberalization logic underpinning the definition and regulation of non-personal data, as introduced by the Free Flow of Non-Personal Data Regulation (European Parliament & EU Counsel, 2018).

As previously mentioned, this framework has been mirrored in the US legal context, notwithstanding the adoption of a fundamentally different approach to data protection. Specifically, the comprehensive and uniform nature of the GDPR contrasts with the fragmented, "patchwork" regulatory system in the United States (Jolly, 2016), driven by the absence of a federal standard that harmonizes data processing across the nation.

It is important to highlight, however, that federal legislation in the US has addressed data protection only within specific sectors of the economy, such as commerce (63rd United States Congress, 1914), healthcare (104th United States Congress, 1996), and finance (106th United States Congress, 1999). In these areas, federal laws aim to harmonize regulations not only to ensure data protection but also to preserve free competition across US territory.

A more holistic approach to data protection is evident in certain state-level legal frameworks, with California being a notable pioneer. The California Consumer Privacy Act (CCPA; California State Assembly, 2018), followed by the California Privacy Rights Act (CPRA; California State Assembly, 2020), has prioritized empowering consumers with the "right to know" and the "right to opt out." These provisions aim to inform consumers about the scope of personal data collected by businesses they interact with, as well as the purposes for which such data is collected, thereby enabling them to opt out of its processing if desired (Goldman, 2021).

Within this framework, ag-data represent a somewhat fuzzy concept that is challenging to classify. On the one hand, many pieces of information generated through smart farming can be linked to a farmer's identity as a natural person—for instance, GPS data from agricultural machinery or the registration details of a farm vehicle (Tomasso, 2024). The classification of this kind of data as "personal" grants its holder the specific legal guarantee that its use will rely on a legal basis, which can be explicit consent or compliance with GDPR requirements. On the other side, agricultural operators also rely heavily on substantial amounts of non-personal data in their regular business activities. For example, one of the classifications of farm data most commonly endorsed in academic scholarship (Janzen, 2019) has identified several categories of farm non-personal data: agronomic data, which pertain to plants, such as soil nutrient levels or the concentration of herbicides and pesticides; soil data, which relate to the geographical location of farmland and the type of cultivation performed; machinery data, encompassing metrics like agricultural equipment performance, hours of operation, and machinery durability; and production data, which include strategic business information such as a company's financial status, contractual relationships, and operational metrics (Kosior, 2021, p. 68). As a consequence of the consideration of this data as mainly non-personal, its processing and exploitation are justified by the conclusion of a contract between agricultural producers (who "use" farm data) and agricultural service providers (who "hold" farm data). Yet, due to informational, technological, and economic asymmetries between ag-data users and ag-service providers, applying the "deregulated" framework based on the non-personal nature of such data appears quite forced and inequitable.

The highlighted regulatory gap raises fundamental questions about the nature of the rights and prerogatives that farmers hold over the non-personal data generated by the systems they use. Specifically, it is crucial to determine whether these rights should be categorized under property rights or governed by contractual frameworks (Atik, 2023b).

Prior to the extensive doctrinal debate that ultimately dismissed the notion of "data ownership" (Zeno-Zencovich & Giannone Codiglione, 2016, pp. 29–58), a potential form of protection had been identified in Europe through the sui generis right, introduced by the 1996 Database Directive (European Parliament & EU Counsel, 1996) to safeguard the contents of a database that lacks originality from extraction or reuse—either in whole or in part. However, the protection offered by the *sui generis* right has proved unsuitable for addressing the issues at hand, both because of the inherent inconsistencies in the concept of "data ownership" and the specific contractual asymmetries between farmers and agricultural service providers (Drexl, 2018, pp. 37–39).

From the first perspective, it is sufficient to note that the protection provided by the Directive does not match with the question of farm data accessibility and portability (Sganga, 2022, pp. 651–704): the rationale behind the *sui generis* right lies in recognizing and rewarding the human effort involved in arranging and organizing data within an electronic archive by granting exclusivity rights. In contrast, the "creation" of non-personal data by farmers is inherently tied to the use of machinery and does not involve any creative contribution. Furthermore, the primary concern of ag-data users is not the enhancement of data related to their own enterprise but the preservation of the value that such data already has, once accessed and converted into actionable information.

From a second perspective, granting users ownership rights over ag-data does not eliminate the risk of losing access to it, as contracts often lack sufficient transparency guarantees (Atik, 2022, pp. 701–742).

Similar considerations apply to the US legal system, where a form of protection designed to meet the needs of companies, rather than individual consumers, was identified in trade secret protection regulations. In this context, the Uniform Trade Secrets Act (UTSA; Uniform Law Commission, 1985) and the Defend Trade Secrets Act (DTSA; 114th United States Congress, 2016) provide robust protection for trade secrets, defining them as information that derives its economic value from not being "generally known and not easily ascertainable by appropriate means by others who could derive economic value from its disclosure or use."

However, the inadequacy of the US framework becomes evident when considering the needs of ATP users, which, as already stated, prioritize the accessibility of information, thereby diverging from the paradigms of exclusivity and secrecy central to trade secret protection.

Therefore, both in European and North American legal systems, the heart of the discussion has shifted from property rights to contractual frameworks identifying contract law and the paradigm of "access" (Resta, 2023, II, p. 654; Van Erp, 2017) as the foundations to build up mechanisms that provide legal protections for agricultural producers.

From Ownership to Contract: The Role of Soft Law and Bottom-Up Approaches in the Farm Data Governance Evolution

What becomes crucial, therefore, is selecting the most appropriate legal strategy to rebalance the contractual relationships between farmers and ATP providers. At this stage, how the involved legal systems are attempting to address this phenomenon is a question that calls for the attention of the comparatist, opening up two key areas of discussion: the choice between a bottom-up and top-down methodology and the trade-off between

voluntary and mandatory standards. Initial efforts predominantly adopted a bottom-up and voluntary approach to decision-making.

The most striking examples include the launch of the US Privacy and Security Principles for Farm Data in 2014 (American Farm Bureau, 2014) and of the EU Code of Conduct on Agricultural Data Sharing by Contractual Agreement (EUCC) in 2018 (European Commission, 2018). Following a similar model, the *Charte* Data-Agri was introduced in French law in 2018 (Fédération Nationale des Syndicats d'Exploitants Agricoles, 2018).

These initiatives established a set of strategic principles aimed at restoring farmers' trust in sharing their data, developed through a participatory process involving multiple stakeholders within the sector (Van Der Burg et al., 2021, pp. 185–198). In general, it is about soft law sources encouraging agribusinesses to provide farmers with clear information on how their ag-data is used, thereby enabling them to make informed decisions about whether to share it with technology service providers.

On the one hand, the voluntary principles provide companies that collect and analyze farm data with guidelines for structuring their contracts and technologies, focusing on 13 key areas; on the other hand, the architecture of the EUCC is organized around five macro-pillars.

Both models, thus, aim to address several concerns, such as protecting the so-called "data originators" by granting them the right "to benefit from and/or be compensated for the use of data created as part of their activity."

Nevertheless, the self-regulatory approach has proven insufficient to achieve an effective contractual balance (Sanderson et al., 2018). While these codes of conduct have the merit of highlighting the importance of farm data issues at an institutional level, they fail to address the information asymmetries that characterize relationships between vulnerable contractual parties that, according to EU law, fall under the matters of "public order," justifying public intervention to counterbalance the limitations of party autonomy. Specifically, both codes exhibit significant flaws in their regulatory approach and substantive content.

From a methodological standpoint, the self-regulatory model does not compel large agribusinesses to grant farmers access to data; instead, it relies on incentives that often conflict with the very goals being pursued (Di Porto & Zuppetta, 2023, II, p. 548). For instance, the codes adopt a hyper-protective logic regarding ag-data, when more emphasis should be placed on fostering trust among farmers to encourage the free sharing of their data with relevant stakeholders. Paradoxically, it has been observed that "the Code of Conduct provides for more restrictions to the free flow of data than would seemingly apply under the GDPR for personal data" (Graef et al., 2018, p. 12).

From a substantive perspective, the codes still remain anchored to the concept of "data ownership" as the central legal framework for designing ag-data rules, rights, and principles. As a result, they fail to effectively address the structural inequalities present within the big data industry.

From Bottom-Up to Top-Down Approaches: EU Initiatives for Multiple "Common Data Spaces"

Given the evident inadequacy of the traditional legal framework in addressing the challenges arising from digital farming, it becomes essential to examine the measures undertaken—and still adoptable—by the considered legal systems to align their respective farm data governance structures with the described "top-down" model. While in Europe, the focus lies on regulations, which embody the most comprehensive tools for standardization, in the United States, the evolution of federal legislation will be explored.

Notably, the Data Act, which entered into force on January 11th, 2024 (European Parliament & EU Counsel, 2023), seeks to address the multiple challenges of the "data economy" (Ryan et al., 2024). Its provisions are horizontally organized into several chapters, including a dedicated focus on "business-to-consumer and business-to-business data sharing" in Chapter II. Indeed, the Data Act marks a significant step toward overcoming the traditional distinctions between personal and non-personal data, as it attaches protections to data irrespective of its "personal" nature, solely relying on the assumption that data is "used." Specifically, Article 4 grants "data users" the right to access data generated through their use of a product held by a "data holder," prescribing that access is provided "without undue delay, free of charge, and, where applicable, continuously and in real-time." The significance of such prescriptions lies in the provision of binding data access and sharing rights for users of IoT devices, including farmers. It thus reflects a notable shift in EU legislative intervention, from the self-responsibility of weaker contractual parties toward the imposition of strict compliance standards on stronger subjects. The Data Act obliges supplier companies to respect accessibility requirements for final users since the design and manufacturing stages of digital devices production. Symmetrically, users are guaranteed not only the right to access the data generated by their use of such systems, but also full control over data sharing with third parties. The described approach underscores a clear commitment to protect farmers not as consumers but as vulnerable entrepreneurs, by ensuring that they are fully aware of how their farm data is used and are accordingly empowered to make informed and autonomous decisions within the agro-industrial market.

To finally complement the set of guarantees provided to farmers under the European initiative to "reshape the digital future," it is also essential to quote the measures

introduced by the Data Governance Act (DGA) (European Parliament & EU Counsel, 2022), which significantly contribute to promoting the secure and efficient circulation of ag-data. Among the three macro-areas addressed by the DGA—reuse of certain categories of data held by public sector bodies, data intermediary services, and data altruism (Baloup et al., 2021)—a detailed analysis of the provisions concerning intermediary services for data exchange proves particularly relevant. These provisions aim at establishing a framework for facilitating relationships between data users and digital device providers for the storage and sharing of non-personal data. The DGA codifies a comprehensive framework for brokering services, structured around *ex ante* notification requirements, substantive conditions for service provision, and *ex post* mechanisms for public supervision (Ducuing, 2024, pp. 63–90). This framework is specifically designed to ensure the neutrality of intermediary platforms, a fundamental prerequisite for fostering trust among data holders in the reliability of digital services within a European sectoral data space (Ruohonen & Mickelsson, 2023). In this regard, it is particularly noteworthy that the definition of "brokering services" explicitly excludes those based on industrial data exploitation models.

Arranging the Mosaic: Applications of US Federal Data Rules to Agriculture

With regards to the US, the development of a "farm data law" reflects the characteristic "mosaic" structure of data regulation in the United States. The prerogatives that best address farmers' needs have primarily emerged from doctrinal analyses (Ferris, 2017, pp. 309–342), often resulting in the analogical application of existing federal rules designed to protect consumers' personal data in other economic sectors. The most widely accepted argument supporting this analogy lies in the similarity of the market dynamics that threaten both consumers and the contractual autonomy of data-generating agricultural operators.

In other words, if it is true that "John Deere is the Apple of farmers" (Hackfort, 2023), it is equally true that users of ATPs deserve transparency regarding the destiny of the non-personal data they generate. Such transparency is crucial to preserving their economic freedom to choose suppliers and determine the terms of their contracts, much as consumers are able to limit their profiling for marketing purposes. In this context, there are some doctrinal remarks aimed at extending the various federal sources on consumer data protection to ag-data users.

Let us consider, first, the "*de facto* common law" value attributed to the consent decrees issued by the Federal Trade Commission (FTC) (63rd United States Congress, 1914), expected to ensure compliance in business-to-consumer negotiations and counteract mis-

leading and abusive practices by commercial enterprises concerning consumer data. While these measures primarily consist of orders to comply with subsequent decisions, the clauses incorporated within them, which have gained a status comparable to the binding precedent rule, are largely designed to grant consumers control over the handling of their data for commercial purposes through the mechanism of prior consent.

One more federal intervention that has been frequently proposed as a model for uniform regulation of farm data in the US is the Health Insurance Portability and Accountability Act (HIPAA) (104th United States Congress, 1996). HIPAA is built on two foundational pillars: the "privacy rule" and the "security rule." The former prescribes, in a strict and precise manner, when and how an individual's personal data may be disclosed, and for what purposes. Conversely, the security rule establishes a "minimum floor" of data security measures that all entities subject to the act must guarantee. Additionally, HIPAA imposes disclosure and transparency obligations on healthcare institutions, ensuring that patients are informed about how their data may be disclosed and how they can access it.

Finally, the Gramm-Leach-Bliley Act (GLBA) (106th United States Congress, 1999) deserves consideration. Enacted to address the dual goals of bridging competitive gaps in the American financial market and enhancing the security of consumer information, the GLBA delegates to federal authorities the task of establishing minimum requirements for financial institutions. Notably, it mandates notification to consumers about the types of data being collected, the extent to which third parties may access the data, and the mechanisms for exercising the right to opt out.

New Data Legal Frameworks and New Flaws: Is There Room for Agricultural Data Protection?

Despite the contributions of the above-described measures to the previously voluntary, bottom-up legal framework, significant limitations persist in the application of both the EU and US data legal frameworks within the agricultural sector (Atik, 2023a).

Regarding the Data Act, the primary concerns center on the terminology used to adapt the horizontal definition of "user" to the rural context. The term "user" is defined in the Data Act as "a natural or legal person who owns a connected product, to whom temporary rights to use that connected product have been contractually transferred, or who receives related services" (Data Act, 2023, Article 2(12)). While the given definition covers both owners and lessees of IoT devices, it does not adequately address the diversity of agricultural practices. For example, farmers may hire external companies to conduct harvesting operations using farm machinery, which they neither own nor

lease, leaving them without direct control over the equipment. Furthermore, a closer examination of Article 4 of the Data Act suggests that the user's exclusive right to access data reintroduces the exclusivity logic characteristic of proprietary frameworks (Calzolaio, 2024, p. 48). This appears to contradict the EU legislator's decision to abandon the proprietary regime in favor of the "accessibility" paradigm. It therefore remains to be explored how this access will be legally structured across EU member states and to what extent it will functionally mirror the principles of ownership (Calzolaio, 2023, pp. 287–326). To address the noted gaps, scholars have proposed a revised framework for the notion of "user," tailored to farm data and centered on a "non-waivable data portability right for farm units" (Atik, 2022, p. 730). This approach would ensure that data related to a farm unit—rather than an individual farmer or a legal entity—remains accessible to the person responsible for that farm unit. This proposal consists of three core elements: the "non-waivability" of the farm data portability right; its focus on "farm units" rather than individual farmers; and its scope of application, particularly its extension to aggregated and real-time data.

Similarly, the various US legal references discussed above can only serve as valuable examples of federal contributions to the data legal framework. However, the analogy with consumer protection merely underscores the urgency of establishing a comprehensive framework for farm data protection. Yet, legislative action in this area must be tailored to the specificities of the generation and use of ag-data.

Such interventions require not only adjustments to tackle the multiple forms of agricultural businesses but also the implementation of measures that comprehensively address the specific digital concerns of farm data users, thus supplying them with robust guarantees that preserve their economic freedom in order to safeguard the autonomy of agricultural enterprises in a data-driven economy.

Final Remarks: Forthcoming Steps to Balance Innovation and Trust in Farm Data Governance

From the advantages and limitations of the proposed solution, it appears that both legal systems, despite diverging in their initial approaches to data regulation, are converging towards an intermediate framework for farm data protection. Through the Data Act and Data Governance Act, the European Union has reaffirmed its comprehensive approach to data regulation, shifting the focus of protection from the referability of data to an individual to its function of representing real-world events or facts. These methodological premises guide European efforts to establish a single, cross-sectoral data market while also addressing specific and strategic sectors, including agriculture.

From this perspective, the framework established by the Data Act and Data Governance Act departs from the traditional dichotomy of hyper-protecting personal data and liberalizing non-personal data. Instead, it adopts a logic aimed at maximizing data sharing and proliferation, emphasizing the need for building trust among data holders. Still, it is important to note that these regulations are general and cross-sectoral in nature and were not explicitly designed to address the unique challenges posed by farm data. For instance, questions arise regarding the application of the Data Act's definition of "user" in the agricultural context, considering the organizational complexities of farming practices across Member States.

At the same time, the voluntary sector-specific guidelines within the existing EUCC are insufficient to address data lock-in due to their non-binding nature. At this stage, if a possible solution involves introducing binding sectoral regulations to address farm data access concerns (Atik, 2023b), given the lengthy process of enacting vertical regulations, a more feasible approach may be a comprehensive update to the EUCC.

Such a modernization could align the EUCC with the Data Act by giving up outdated concepts such as "data ownership" and "non-personal data," while also tailoring the definition of "user" to the agricultural reality; instead of mandatory measures, economic incentives could be introduced to foster trust in farm data sharing.

In line with this approach, the European Commission has approved the preparatory "AgriDataSpace" project, paving the way for the launch of the Common European Agricultural Data Space (CEADS) in January 2025. CEADS is envisioned as a "federation of Data Space Initiatives," meaning that it operates more as a decentralized network rather than a centralized solution (García & Gil, 2024).

To reach such an ambitious goal, several recommendations have been developed to align the EUCC with the Data Act (European Commission, 2024). For example, one recommendation calls for the appointment of a "data coordinator" at the Member State level to manage the application of the Data Act in ag-data exchange; moreover, the sixth recommendation paradigmatically advocates for updating the EUCC to facilitate the application of the Data Act in the primary sector.

Conversely, the "compartmentalized" approach adopted by US federal legislation offers certain methodological advantages, particularly in addressing the specific needs of individual economic sectors. This is highlighted by scholarly efforts to design a vertical, sector-specific federal framework for farm data, as well as the proposed Agricultural Data Act in 2018, although it never came into force. The proposed legislation, however, sought to balance trust in data sharing with transparency in data control by requiring prior consent for data processing, replacing the traditional model of subsequent opt-outs.

In other words, the motion pointed to strengthen the US Department of Agriculture's management of agricultural producers' data without undermining their rights—a goal closely aligned with the objectives of European governance.

Hence, the comparative analysis of the evolution of ag-data governance in Europe and the United States emphasizes how both legal systems are gradually converging towards intermediate solutions to address the challenges posed by ag-data management. On the one hand, the establishment of the CEADS offers an unprecedented opportunity to operationalize the concept of "data sovereignty" within agriculture by integrating existing regulations and fostering trust in data sharing; on the other hand, the US system, despite its fragmented nature, demonstrates the advantages of a sectoral approach tailored to the specific needs of individual economic areas. In this view, the attempt to introduce an Agricultural Data Act, although unsuccessful, underscores the need to balance transparency and trust while safeguarding farmers' rights and ensuring effective data management.

Ultimately, the future of ag-data governance in both Europe and the United States will depend on striking a balance among innovation, regulation, and trust. Only by combining mandatory measures with economic incentives can the sustainability and autonomy of farmers be integrated into an increasingly data-driven economy.

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