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Strategic Assessment and Responses for Regulatory Compliance, Market Fit, and Ecosystem Building by European Agricultural Data Intermediaries

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Abbreviations

AI	Artificial Intelligence
B2B	Business-to-Business
CEADS	Common European Agricultural Data Space
CEDS	Common European Data Space
DGA	Data Governance Act
DI	Data Intermediary
DIS	Data Intermediation Services
DISP	Data Intermediation Services Providers
EU	European Union
IDSA	International Data Spaces Association
NGO	Non-Governmental Organization
R&D	Research and Development

1   Introduction

1.1   Data Sharing Landscape in the European Union

The widespread adoption of digital technologies has led to an unprecedented generation of data, fostering an ecosystem of actors engaged in collecting, processing, analyzing, and sharing information across various sectors (Fassnacht et al. 2024; Oliveira and Lóscio 2018; Richter 2023). Data has become a strategic resource for organizations, driving innovation and economic development. Its inherent characteristics, non-rivalry and complementarity, allow it to be reused without losing value and enriched by combining it with other datasets.

In this context, data sharing offers organizations opportunities to improve data access and generate new opportunities from data, such as informed decision-making (European Commission 2024; Farrell et al. 2023; Fassnacht et al. 2024; Martens et al. 2020; Oliveira et al. 2019). However, several challenges deter organizations from sharing data, including uncertainties about third-party use, unclear data ownership and rights, lack of adequate technical infrastructure, complex legal requirements, and the costs of negotiating, implementing, and monitoring agreements (European Commission 2018; European Commission 2024; Martens et al. 2020; Richter and Slowinski 2019).

In a growing digital world, in 2020, the EU introduced its Data Strategy to tackle challenges hindering the boost of the data economy in the region. The EU's goal was to create a European Single Data Market in which there would be a free flow of data within and across business sectors and member states. In this context, business-to-business (B2B) data sharing was recognized as a cornerstone of the Strategy (European Commission 2018; European Commission 2020). And it has been addressed by different initiatives to clarify data access rights, define rules for sharing, promote trust, and support data ecosystems, such as the Data Governance Act (DGA), the Data Act, and the Common European Data Spaces (CEDS). Beyond those initiatives, the EU highlights the role of the Data Intermediaries (DI), regulated and promoted on the DGA, as instrumental actors in increasing trust in B2B data sharing by facilitating transactions in several ways (European Commission 2020; Farrell et al. 2023; Martens et al. 2020).

A Data Intermediary (DI) functions as a neutral third-party facilitating data sharing transactions by mediating between data suppliers and data users. They facilitate and mediate data sharing between various actors within established or developing data ecosystems (Brousseau et al. 2024; Janssen and Singh 2022). These ecosystems consist of a complex network of organizations and individuals involved in producing, exchanging, consuming, or reusing data and related resources (Oliveira and Lóscio 2018).

In the B2B context, DIs can address trust concerns through their service offerings, mitigate market power imbalances, and provide technical, legal, and operational support. DIs are also expected to contribute to the development of sector-specific data spaces.

Unlike traditional platforms that primarily serve their own commercial interests, DIs, under the framework of the DGA, are explicitly characterized by their neutrality and the absence of conflicts of interest regarding the data they manage. Their core objective is to establish a secure and equitable data sharing environment that benefits all stakeholders (Richter and Slowinski 2019). By offering alternative channels for data exchange, DIs can help rebalance existing asymmetries in data access and use, particularly those created by dominant online platforms with extensive data holdings. In doing so, they not only reduce reliance on these powerful actors but also promote a more inclusive and competitive data economy (Data Governance Act 2022; European Commission 2020).

Despite their potential to produce societal benefits beyond economic value and enhance B2B data sharing, DIs remain underdeveloped due to ongoing market and regulatory constraints that limit their ability to establish and scale data-sharing ecosystems (European Commission 2020; Janssen and Singh 2022; Martens et al. 2020; Micheli et al. 2023; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022).

1.2 The Landscape for European Data Intermediaries

DIs also operate within a complex EU regulatory landscape. The DGA, approved in 2022 and entered into force in September 2023, was the first EU regulation addressing them directly, introduced ambiguities, restrictions, and compliance costs, which might hinder their potential to create value for B2B data sharing (Carovano and Finck 2023; Pathak 2024; Richter 2023; Verstraete et al. 2023; Von Ditfurth and Lienemann 2022). The definition of Data Intermediary in the DGA is unclear, leaving many organizations uncertain about whether they qualify as such and need to comply with the regulation.

Besides, the compliance measures lack clarity on the concrete steps DIs should take and might require DIs to develop technical, legal, and organizational measures to implement obligations (Carovano and Finck 2023; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022). It also imposes restrictions on DIs' business models and activities by enforcing a neutrality principle that prohibits them from using the data they handle for their own commercial purposes. And requires them to separate their intermediation services from any other business activities. Finally, DGA restricts the contractual freedom of DIs and their partners, creating limits to tailoring their services to meet specific market demands. While restraining the DIs' approach, the DGA lacked incentives for supporting organizations to engage with DIs (Richter 2023; Von Ditfurth and Lienemann 2022).

In 2024, the Data Act, which becomes applicable in September 2025, might add new complexities for Data Intermediaries. Whilst it offers opportunities for DIs to support other businesses with data sharing obligations, it might also impose burdens. Though not explicitly referencing DIs, the Act regulates those entities if they classify as data holders that manage data generated through their products or services. This may require DIs to share data with minimal or no compensation, increasing operational costs. Additionally, Data Act restrictions on third-party data sharing create ambiguities around data commercialization, limiting DIs' ability to monetize exchanges and potentially undermining their role in the data economy (Carovano and Finck 2023; Richter 2023).

Moreover, due to the early development stage of the EU data-sharing market, DIs often face market challenges. A key issue is generating demand for their services, as potential users frequently lack an understanding of DI functionalities and the benefits of participating in the data ecosystem, whether as suppliers or users. Few widely recognized and successful real-world use cases demonstrate the tangible benefits of data sharing (Micheli et al. 2023; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022). Demand constraints are also fueled by companies' fears of misuse of shared data, unauthorized access, data breaches, and the risk of losing competitive advantages. In this scenario, Data Intermediaries deal with limited business willingness to pay for data intermediation, considering competition from traditional data sharing options (Brousseau et al. 2024; Micheli et al. 2023; Richter and Slowinski 2019; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022).

While managing demand shortage, DIs struggle to establish sustainable revenue and cost structures. They often require significant resources, particularly in their early phases, for investments in areas such as technology infrastructure and legal compliance. Besides, they find it difficult to assess the tangible value of data and establish fair pricing mechanisms. Despite trying various revenue models, including subscription fees or transaction fees, they often require external funding from investors (Micheli et al. 2023; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022).

To build their data-sharing ecosystems, Data Intermediaries have to continuously assess and respond to the needs of strategic stakeholders. As mediators, they operate as two- or more-sided markets (Von Ditfurth and Lienemann 2022), and depend on network effects, where their value proposition and market success rely on attracting both data suppliers and users simultaneously. This dual-sided engagement requires DIs to carefully balance stakeholder interests and maintain ongoing alignment with their expectations (Martens et al. 2020; Micheli et al. 2023; Schweihoff et al. 2024).

As the European Data Strategy foresees the establishment of common European data spaces, DIs are expected to play a key role in facilitating access to data within these decentralized infrastructures, which are designed for secure data access, sharing, and use, all governed by common rules and frameworks. In this context, DIs could play a key role by providing essential external services, such as identity management, observability, cataloguing, and connectivity. These services enable businesses to engage in data-sharing environments while ensuring trust, legal compliance, and interoperability (Bobev et al. 2023; DSSC 2023, 2024; Farrell et al. 2023; Martens et al. 2020). DIs should therefore address stakeholder concerns around issues such as trust, data rights, and regulatory alignment. By doing so, they reinforce their role as credible mediators who facilitate cooperation across diverse actors. As these data spaces expand, DIs can scale their services through economies of scale, broaden monetization opportunities, and access a larger pool of shared data.

1.3   Data Intermediaries' Presence in the Agriculture Sector

In the evolving EU data-sharing landscape, many sectors are gradually integrating Data Intermediaries, with some use cases emerging (Micheli et al. 2023). The agriculture sector stands out as a particularly relevant context for picturing the DIs' development dynamics, as it exemplifies both the challenges and opportunities that define their evolution. This sector's prominence is reflected in its view as strategic by the EU Data Strategy (European Commission 2020) and pushed by policy initiatives, such as AgriDataSpace. The project is a preparatory project to support the roll-out of the Common European Agriculture Data Space (CEADS) through analyses, inventories, and recommendations. It coordinates with multiple organizations, including universities, research institutions, and agribusinesses, to create interoperable data sharing infrastructures. It further identifies DIs as crucial technological infrastructures that facilitate secure and efficient data exchange among agricultural stakeholders (AgriDataSpace 2024; Deroo and Maes 2023).

Data sharing has long been a key concern in the agricultural sector, given the recognition of the value of data use. Even before the introduction of the DGA, the sector had taken proactive steps to build trust in data sharing practices. The EU Code of Conduct on Agricultural Data Sharing by Contractual Agreement, introduced in 2018, sought to establish transparent and balanced agreements between farmers and other actors on a voluntary basis (Van der Burg et al. 2021). These early initiatives highlight the sector's commitment to responsible data sharing frameworks and its efforts to ensure fair and transparent exchanges.

The digital transformation of agriculture has further enhanced the sector's potential to benefit from data sharing practices. The adoption of technologies such as the Internet of

Things has led to the generation of vast datasets that, when effectively shared, can optimize resource efficiency, sustainability, and competitiveness (Kosior 2021; Van der Burg et al. 2021). For instance, precision farming relies on data exchange to enable tailored agricultural practices that improve yields and reduce environmental impacts (Fassnacht et al. 2024).

Also, a growing number of data sharing initiatives within that sector indicate a positive trend towards leveraging B2B Data Intermediaries. Many of these initiatives are operational at the regional level, and while not all are formally recognized as DIs, they provide intermediary services that facilitate data exchange (Eisenträger et al. 2024). Examples of operational DIs identified in the literature include DKE-Data, DjustConnect, JoinData, and DataSpace Europe, which actively enhance data sharing practices in the sector (European Commission 2024; Micheli 2023). The presence of these initiatives suggests that agriculture is progressively establishing a robust data intermediation ecosystem.

The sector's unique characteristics make it well-suited to benefit from the facilitation services of DIs. Agriculture involves a diverse range of stakeholders, including farmers, cooperatives, technology providers, and policymakers, who might need and benefit from data exchange mechanisms. This complexity underscores the necessity for digital assets and governance frameworks that ensure fair and equitable data sharing practices (Kalmar et al. 2022; Wysel et al. 2021). However, the lack of standardized, legally robust mechanisms often impedes collaboration (Farrell et al. 2023). Farmers, framed in this literature as businesses in the context of data sharing, frequently express concerns regarding data misuse, unauthorized access, and unclear benefits, which serve as barriers to participation (Brown et al. 2023, Sullivan et al. 2024, Van der Burg et al. 2021). Additional sector-specific challenges include disparities in technological adoption among farmers (Kosior 2021) and the sensitive nature of specific agricultural data, including proprietary farm operation information (Brown et al. 2023).

DIs, through their service offerings, have the potential to address these barriers by fostering trust and promoting the participation of various stakeholders in data sharing ecosystems. They can provide secure technical infrastructure for data exchanges, consent and permission management systems that grant farmers greater control over data access, and tools to monetize data assets. Additionally, they can act as educators, facilitating agreements and increasing awareness of the benefits of data-sharing practices. Furthermore, DIs are key players in overcoming the sector's fragmented data landscape by encouraging interoperable collaboration between data holders and users in a broader

data sharing ecosystem (Brown et al. 2023; Deroo and Maes 2023; DSSC 2024; Ryan et al. 2024; Sullivan et al. 2024).

Nonetheless, the increasing number of operational DIs and the expansion of use cases highlight the sector's potential to lead to data intermediation and innovation. Despite these opportunities, DIs in the agricultural sector, like their counterparts in other domains, should navigate the complexities of EU regulatory frameworks (Bustamante 2023; Ryan et al. 2024; Sullivan et al. 2024), in an emergent stage of the data sharing market in agriculture. Therefore, the agricultural sector, with its combination of established data-sharing practices, diverse stakeholder involvement, and sector-specific policy initiatives, creates fertile ground to observe the development and consolidation of DI-led ecosystems.

1.4   Data Intermediaries Literature Research Gap

Despite the growing importance of DIs in facilitating B2B data sharing, academic research on the topic remains nascent, gaining momentum primarily after the 2022 DGA underscored their role. Most existing studies have concentrated on broadly defining DIs and analyzing their value propositions (Janssen & Singh 2022, Micheli et al. 2023, Richter & Slowinski 2019, Schweihoff et al. 2023) as well as their functions within the broader data sharing ecosystem (Bobev et al. 2023; Fassnacht et al. 2024; Hansen et al. 2024; Micheli et al. 2020; Oliveira et al. 2019; Schweihoff et al. 2024). In parallel, scholars have addressed the challenges DIs face in developing sustainable business models (Micheli et al. 2023; Richter and Slowinski 2019; Verstraete et al. 2023; Von Ditfurth and Lienemann 2022) and complying with complex regulatory requirements (Carovano and Finck 2023; Hansen et al. 2024; Pathak 2024).

Although DIs are shaped by factors such as data types, regulatory frameworks, market maturity, and sector-specific risks and incentives (Janssen and Singh 2022), there is limited research on their operation in specific industries. Agriculture, in particular, stands out as a sector prioritized in the EU Data Strategy (Micheli et al. 2023). While data sharing initiatives in this field have been expanding, they remain fragmented along the value chain. Only a small number focus explicitly on data intermediation services (Brown et al. 2023; Brunori et al. 2025). When it comes to Data Intermediaries, key barriers such as limited incentives and business model sustainability have been identified, but how these issues are currently being addressed remains unclear (Deroo and Maes 2023).

In recent years, data sharing in Europe has become a central research focus, with most literature published since 2019 (Sullivan et al. 2024). Within the agricultural domain, this trend has also intensified (Brown et al. 2023). Research has primarily explored farmers' perceptions of data sharing (Brown et al. 2023; Ryan et al. 2024), analyses of the EU Code of Conduct's strengths and limitations (Ryan et al. 2024; Van der Burg et al. 2021),

and broader drivers and barriers to data exchange (Sullivan et al. 2024; Wolfert et al. 2024). Recently, attention has shifted to the development of agricultural data spaces, spurred by the EU Data Strategy. Scholars have examined their benefits, core components, challenges, and architectural design (Brunori et al. 2025; Kalmar et al. 2022; Kosior 2021).

Although DIs are often portrayed as neutral, trusted agents that facilitate governance and alleviate power imbalances (Brown et al. 2023) or as enablers of data sharing (Ryan et al. 2024; Sullivan et al. 2024), their development in agricultural data ecosystems remains underexplored. A significant contribution in this area comes from the AgriDataSpace inventory of agricultural data sharing initiatives, which shows that most DIs are still in pilot or conceptual phases, and few operate as self-identified DIs (Eisenträger et al. 2024).

Besides, the term "data intermediary" is not always used explicitly in the agricultural context; related terms appear frequently. Scholars refer to entities such as data sharing platforms (Wysel et al. 2021), contractual agents (Van der Burg et al. 2021), institutional mechanisms (Wolfert et al. 2024), or governance and trust frameworks (Kalmar et al. 2022; Wolfert et al. 2024). Despite varying terminology and abstraction levels, these works consistently describe third-party entities supporting data exchange through neutral governance models, closely aligning with the DI concept (Micheli et al. 2023).

Indeed, literature has mapped DIs' contributions in broader terms to the data sharing ecosystem (Bustamante 2023; Kosior 2021), explored their struggles to establish trust (Brown et al. 2023), highlighted coordination complexities among stakeholders (Eisenträger et al. 2024; Ryan et al. 2024), and noted their limited adoption in the sector (Brunori et al. 2025; Kalmar et al. 2022; Sullivan et al. 2024). Further challenges include navigating evolving regulatory landscapes (Ryan et al. 2024; Van der Burg et al. 2021) and developing viable business models (Eisenträger et al. 2024; Wysel et al. 2021). Despite their growing relevance for trustworthy and fair data sharing (Micheli et al. 2023) and the valuable contributions of mapping efforts such as the AgriDataSpace Inventory (Deroo and Maes 2023), there remains a lack of understanding DIs development within the agricultural data sharing market, how they perceive and respond to these ongoing challenges.

1.5   Research Question

This research proposes to explore Data Intermediaries' (as neutral third parties facilitating data sharing in agriculture) assessment, and responses to the context in which they operate, considering regulations, the market, and ecosystem dimensions, through the following primary research question, further explored in sub-questions 1 to 3.

How are European Data Intermediaries in the agriculture sector assessing and responding to the nascent and regulated EU data sharing market and building their data sharing ecosystems?

1. **Regulatory Compliance:** How do DIs assess and respond to EU data sharing regulations?
2. **Market fit:** How do DIs assess and adapt their business models in light of the nascent and regulated nature of the data sharing market?
3. **Ecosystem Building:** How do DIs assess and respond to strategic stakeholder relationships to build their data sharing ecosystem?

1.6   Research Lenses

This study employs two complementary theoretical frameworks to examine how Data Intermediaries respond to regulatory, market, and ecosystem pressures in the agricultural sector. The first is the Dynamic Capabilities Theory (Teece 2007; Teece et al. 1997), which explains how organizations sense opportunities, interpret change, and adapt strategically. This perspective is particularly relevant for DIs operating in an emerging and complex data-sharing landscape, where survival depends on their ability to innovate and build trust. The second framework is the Platform Business Model (Srinivasan 2021; Tiwana, 2014a, 2014b, 2014c), which focuses on the economic and organizational dynamics of platform enterprises. It highlights the importance of stakeholder relationships, network effects, and value co-creation in shaping the structure and behavior of such platforms.

While Dynamic Capabilities Theory explains how DIs build adaptive capacity in response to uncertainty and market complexity, it does not fully capture the platform-based, networked nature of these actors. In contrast, the Platform Business Model framework sheds light on how DIs structure their value propositions and build their user communities as an intermediary. By combining these perspectives, the study develops a nuanced understanding of how DIs are navigating the data-sharing ecosystem in the EU agricultural sector. Together, these frameworks allow for an integrated analysis of the organizational, economic, and social factors that influence the evolution of DIs as trusted B2B data-sharing alternatives in agriculture.

1.7   Relevance and Motivation

As the agricultural sector increasingly embraces technological advancements and the benefits of a data-driven economy, the role of Data Intermediaries becomes more relevant. In this context, the European Union's initiative to promote seamless agricultural data exchange and to establish sector-specific Data Spaces (Brunori et al. 2025; Farrell et al. 2023), along with the recognized importance of DIs in enabling data-sharing

mechanisms (Deroo and Maes 2023; Ryan et al. 2024; Sullivan et al. 2024), underscores the need to assess how they are positioning themselves to support this transition. At the same time, as data becomes an increasingly valuable asset for business development, access to and use of data present significant challenges. This is particularly evident in the agricultural sector, where power imbalances persist and stakeholders have diverse and sometimes conflicting needs (Turpeinen et al. 2024; Wysel et al. 2021). Within this landscape, DIs act as neutral third parties and offer an alternative model for data processing, being key enablers of effective and trustworthy data-sharing practices in the EU agricultural sector. Their function can reduce the concentration of data control among dominant actors and provide smaller economic players with the means to access and share the data they produce.

By adhering to fair, transparent, and non-discriminatory procedures in areas such as access, pricing, and service terms, and by providing robust contractual frameworks for data sharing, Data Intermediaries play a key role in enforcing regulatory obligations and supporting compliance with data governance rules (European Commission 2020; Micheli et al. 2023; Richter and Slowinski 2019). As DIs become increasingly central to fostering a trustworthy, fair, and efficient data-sharing environment in the EU, their strategic responses to sector-specific challenges demand closer examination. This study focuses on the agricultural sector and investigates how DIs address persistent challenges related to regulatory complexity, market uncertainty, and the demands of ecosystem building (Ryan et al. 2024; Sullivan et al. 2024; Wolfert et al. 2024). In doing so, it offers new insight into the evolution of DIs as foundational yet underexplored actors within the EU's agricultural data-sharing landscape.

1.8   Structure of the Work

This thesis is organized into seven chapters. To begin, Chapter 1 introduced the research problem while also presenting the relevance of Data Intermediaries in the EU data-sharing landscape. In addition, it contextualized their role in the agricultural sector, outlined the research question, identified the literature gap, and introduced the theoretical lenses guiding the study. Following this, Chapter 2 provides a structured literature review that covers the evolution of data sharing in the EU, regulatory developments, definitions and typologies of DIs, and sector-specific considerations in agriculture. Next, Chapter 3 presents the theoretical framework, integrating Dynamic Capabilities Theory and Platform Business Model literature to analyze how DIs respond to regulatory, market, and ecosystem challenges. Moreover, the framework also outlines the analytical dimensions of the empirical study.

Then, Chapter 4 details the methodological approach, including research design, data collection methods, and analytical procedures. This chapter justifies the qualitative strategy and explains how the data support the research objectives. Furthermore, Chapter 5 reports the empirical findings, structured around three main themes: regulatory compliance, market fit, and ecosystem building. It synthesizes insights from interviews with DIs leaders and EU policymakers. In Chapter 6, the findings are discussed considering the theoretical framework, highlighting how DIs mobilize capabilities and platform strategies in response to contextual pressures, while situating their strategies within the broader EU policy context shaping their operational scope. Finally, Chapter 7 concludes the thesis, synthesizing key insights, discussing contributions to theory and practice, and highlighting limitations and avenues for future research.

2   Literature Review

2.1   Data Sharing in Europe

Data sharing can be broadly understood as the process of making data available to other individuals, organizations, or systems (European Commission 2020; Farrell et al. 2023; Kosior 2021; Richter and Slowinski 2019). The European Commission defines "data sharing" as encompassing all forms and models through which data is accessed or transferred, whether in business-to-business contexts or beyond. This includes a wide range of exchange mechanisms involving various actors and sectors.

Over the past decade, data sharing has gained significant attention as a central policy issue in the European Union, as it is seen as essential for enabling data-driven innovation and a thriving data economy. It can enhance decision-making across domains and support the scaling of innovations that contribute to more intelligent and sustainable development (Farrell et al. 2023; Kosior 2021). For instance, it plays a critical role in promoting sustainability and competitiveness in agriculture by helping farmers make smarter decisions using data. This allows them to grow more food with fewer resources, reduce waste, protect the environment, and stay competitive in the market through efficient and eco-friendly practices (European Commission 2020).

In 2020, the EU launched the European Strategy for Data, recognizing that the rapid expansion of digital technologies has led to a substantial increase in data generation. This growing volume of data is now viewed as a strategic asset for driving innovation and improving various aspects of life. The trend is expected to continue across sectors, offering considerable potential for both economic growth and societal benefit. Within this framework, the strategy highlights the importance of enhanced data sharing, both for the public good and for business-to-business collaboration (European Commission 2020).

To realize this potential, EU policymakers envision a data market in which data flows are secure, open, and governed by regulations that safeguard fundamental rights. As a result, the strategy prioritizes the development of governance frameworks to regulate the access, sharing, and use of data. It also proposes the creation of sector-specific data spaces in strategic areas, such as agriculture, to support the development of tools and infrastructure that enable cross-border data exchange while ensuring that individuals and businesses retain control over their data.

However, achieving this vision depends on overcoming several persistent challenges. These include the underutilization of data, concentrated market power, poor data quality, and limited interoperability between platforms. In the B2B context, additional barriers, such as lack of trust, fear of losing competitive advantage, and unclear contractual terms,

continue to hinder data sharing practices. Beyond supporting innovation, the strategy also frames data sharing as a way to address fragmentation and structural imbalances in the data economy, given that a small number of large companies control a disproportionate share of data, creating competitive disadvantages for small and medium-sized enterprises. To promote a more equitable digital landscape, the Strategy supports measures that broaden data access and encourage sharing among a wider and more diverse range of actors (European Commission 2020, European Commission 2024), such as Data Intermediaries.

2.2 Defining Data Intermediaries

The literature on Data Intermediaries, as organizations that facilitate data sharing transactions, within the EU context, is still limited. The term encompasses multiple interpretations and lacks a standardized definition (Janssen and Singh 2022; Schweihoff et al. 2024; Micheli et al. 2023). Efforts to clarify and establish a common understanding are found in some academic and policy works, especially after the implementation of the DGA, which established a regulatory framework for Data Intermediation Services. However, no consensus has been reached.

A recent and relevant contribution to objectively defining Data Intermediaries is provided by Janssen and Singh (2022). By exploring the concept of intermediaries within data processing ecosystems and related policy frameworks, they offered a definition of Data Intermediary as "a mediator between those who wish to make their data available and those who seek to leverage that data" (p. 6). The authors note that this definition encompasses various nuances and terminologies in the literature, which often depend on the governance structures and business models of existing DIs.

Although Janssen and Singh (2022) provide a helpful glossary for understanding DIs in the current context, they note that the evolving and overlapping nature of DI implementations continues to obscure conceptual clarity in literature. To aid in mapping out and understanding DIs, the Data Governance Act introduced new terminology for organizations mediating data sharing between data holders or subjects and data users. The act refers to these organizations by their service offer, introducing the concept of "Data Intermediation Services" (DIS):

> A service which aims to establish commercial relationships for the purposes of data sharing between an undetermined number of data subjects and data holders on the one hand, and data users on the other, through technical, legal or other means, including for the purpose of exercising the rights of data subjects in relation to personal data (European Parliament and Council of the European Union 2022, Chapter I)

It also complements, in its Art. 10, which type of Data Intermediation Services Providers (DISP) must adhere to the regulation through a notification process. Although DGA does not directly mention the term "Data Intermediaries" in the law, the registration label adopts it: "EU Recognized Data Intermediary" (DG Connect 2023), thereby reinforcing the understanding of DIS providers as such. Moreover, the Act reinforced the notion of DIs as neutral third-party mediators, excluding from the definition, hence from the regulatory framework, any data exchange entities that do not engage in this intermediation role, such as cloud storage providers and analytics services (European Parliament and Council 2022)

To clarify which services, qualify under this framework, Bobev et al. (2023) provide a detailed legal interpretation of the DGA's scope. They propose six defining criteria for DISPs: (1) the provision of services in exchange for economic value, (2) commercial intent to connect data holders and users, (3) a focus on enabling data sharing rather than secondary use, (4) the use of legal, technical, or organizational mechanisms, (5) engagement with an undetermined number of actors, and (6) a primarily commercial rather than altruistic orientation. On this basis, they characterize Data Intermediaries, under the DGA, as market-based actors central to the EU digital data economy. While this interpretation brings clarity to the legal boundaries of intermediation under the DGA, it also highlights ongoing confusion among service providers regarding whether their activities fall under the regulation (Bobev et al. 2023). This ambiguity points to the broader challenge of conceptualizing DIs beyond strict legal terms.

To address this ambiguity and reflect the growing role of DIs in the data-sharing landscape, the EU Joint Research Centre released a report in 2023 (Micheli et al. 2023), using the term "Data Intermediaries" in line with the definition proposed by Janssen and Singh (2022). The report adopts Data Intermediaries as an overarching term that encompasses the various functions and business models of entities facilitating data sharing. It also clarifies that the DGA applies only to a subset of existing DI models that meet specific requirements, such as establishing commercial relationships. By combining the DGA's regulatory approach with literature and policy perspectives, which position DIs as tools to empower individuals, support collective decision-making, and foster fairer data governance, the authors propose the following definition: "Data Intermediaries allow the establishment of a relationship (commercial or non-commercial) between data subjects and/or data holders, on the one hand, and data users on the other hand" (Micheli et al. 2023, p. 31).

This definition aims to reflect the diversity of intermediation services, transitioning from commercial models to inclusive governance structures. The authors note that DIs differ

in their operational approaches and societal roles. For instance, one key distinction lies in data control, whether it resides with individuals or collectives. Their operational mechanisms also vary, some rely on technical frameworks, others on legal structures. Moreover, their motivations differ, with some DIs being profit-driven and others community-based.

The report acknowledges that while certain DIs may align with those outlined in the DGA (Art. 10), the correlation is not perfect. Some models adhere fully to the Act, others only partially, and some fall outside its scope, even though they promote inclusive data governance. This divergence arises from the DGA's specific focus on intermediaries involved in commercial interactions, governed by strict neutrality conditions. To address this complexity, the authors suggest viewing DIs within a broader ecosystem that includes both regulatory and market-based models facilitating data sharing regardless of whether they meet all DGA criteria.

Whereas Micheli et al. and Bobev et al. focus on regulatory and structural dimensions, Schweihoff et al. (2023) emphasize the functional roles DIs play across data ecosystems. Adopting the view of DIs as mediators, they shift attention from institutional definitions to the actual services these entities perform. Rather than tying their analysis to particular business models or platforms, the authors identify five interrelated domains in which DIs operate: transaction, governance, sovereignty, technology, and data. These are not isolated functions, but rather the layered and multifaceted nature of intermediation. For instance, DIs may facilitate data exchanges between providers and users by enabling matchmaking mechanisms, often through platforms such as data marketplaces. And also play a governance role by setting and enforcing legal agreements, managing access rights, and ensuring compliance.

These overlapping functions reflect the complex role of DIs as both enablers of data exchange and stewards of the legal, technical, and ethical dimensions of data governance. By mapping these services, Schweihoff et al. (2023) offer a nuanced understanding of how DIs operate across data sharing ecosystems. Their analysis reveals that DIs often combine multiple functions rather than adhering to a fixed model, providing a more technical and operational perspective that had been underexplored. This functional perspective is further elaborated in Schweihoff et al. (2024).

The authors addressed the existing conceptual blurriness in the data intermediation market, which arises due to the varied implementations and multiple interpretations that DIs take. The authors developed a taxonomy of Data Intermediation Services based on a cluster analysis of 86 companies identified as DIs. Eight service patterns were encountered: privacy and anonymization, data control, providing infrastructure, data

catalogs, governance and sovereignty, identity management, transaction, and enabling data. They also showed that not all services are present in every DI, with some of them considered as foundational, and others are more specialized. For example, technical infrastructure and basic support are essential components across most cases, whereas services like identity management or data quality assurance tend to be implemented only in specific contexts. With this taxonomy, Schweihoff et al. (2024) reinforced the understanding of DIs as hybrid actors that not only offer technical solutions but also manage legal, organizational, and trust-related aspects of data sharing. The authors continue the technical orientation introduced in Schweihoff et al. (2023), showing that DIs rarely offer the full spectrum of services. Instead, they assemble service bundles tailored to their operational needs. In doing so, the authors underscore the importance of a general yet flexible definition of DIs, one grounded in their core mediating function across institutional, technical, and governance dimensions.

In sum, the literature illustrates that Data Intermediaries are multifaceted entities whose definitions vary depending on regulatory scope, institutional focus, and functional roles and context. Given this diversity, and in line with the broader conceptualizations advanced in the literature, this study adopts an inclusive definition of Data Intermediaries as entities that mediate between data subjects or holders and data users, regardless of whether they fall within the regulatory scope of the DGA. This approach allows for the analysis of both formally recognized and emerging models of intermediation, capturing the full range of actors shaping data sharing practices in contemporary digital ecosystems. The following sections will explore those actors in more detail.

2.3   Regulatory Landscape for Data Intermediaries

The EU has introduced initiatives to promote data sharing across different contexts. However, since the launch of the European Data Strategy, there has been a marked increase in efforts specifically targeting B2B data sharing. While the 2018 Guidance on Sharing Private Sector Data (European Commission 2018) laid important groundwork by outlining principles for B2B data exchange, the European Strategy for Data has provided a more strategic and comprehensive framework. This includes initiatives such as the DGA, the Data Act, and the conceptual and practical foundations for CEDS, with supporting sector initiatives such as the AgriDataSpace.

The DGA was the first building block of the European Data Strategy. It established rules and tools to enable trustworthy data sharing. It was introduced as a mechanism to increase trust between parties and encourage participation from individuals and companies, thereby improving data availability for data-driven development in the EU. A key element of the regulation was the creation of a governance framework for Data Intermediaries, who are seen as important actors in enabling business engagement in data sharing. These intermediaries are expected to contribute to reshaping the data economy by building trust and reducing power and information asymmetries, acting as neutral facilitators between data holders and data users (Carovano and Finck 2023; Von Ditfurth and Lienemann 2022). One of the DGA's main goals is to strengthen trust in these intermediaries (Richter 2023). In this context, the DGA introduced rules to ensure that DIs operate under fair, transparent, and non-discriminatory conditions and to prevent vertical abuses often seen in digital platforms. Entities offering DIS, as defined by the DGA, must complete a notification process. Once registered, they receive a recognized label showing compliance with the regulation, which can also help promote trust in DIs.

As the first regulation specifically addressing Data Intermediaries, the DGA leaves room for interpretation and does not offer full legal certainty to organizations that might fall under this category. This has caused uncertainty about qualification and compliance, allowing DIs to avoid regulation or remain unaware of how it applies to them. Bobev et al. (2023) point out that the definition of DIs in Chapter I of the DGA creates several interpretation problems. It is unclear what qualifies as a commercial relationship, how to define the technical or legal means used to provide services, or what is meant by an "undetermined number" of data subjects. There is also uncertainty about whether all third-party data services fall under the regulation. While the DGA provides three examples of DI types, it does not explain whether services must meet all or just one of these criteria.

Beyond these definitions, the DGA introduces compliance obligations that affect how DIs are organized and operated. These may require additional technical, legal, and

organizational efforts. The regulation acknowledged this and granted extra time for compliance. As a first step, DIs must complete a notification and compliance process with National Competent Authorities, demonstrating that they meet the required conditions. Once registered, they are also subject to ex-post monitoring, which may require additional organizational resources to meet supervisory requirements (Carovano and Finck 2023).

A key challenge remains the lack of practical guidance on how to apply for the DGA. DIs are left without clear instructions on how to implement the regulation, which increases the burden on their internal legal, technical, and organizational capacity. Although the DGA required each Member State to set up a national authority to support implementation, the role of these authorities in providing clarity has not been clearly defined (Bobev et al. 2023). The decentralized enforcement structure, combined with the obligation for each country to appoint its own authority, suggests that implementation may progress at different speeds across Member States. A notable point is the limited number of DIs currently registered under the DGA as its review date approaches.

The compliance rules require DIs to use a separate legal entity to provide their services. They are also not allowed to combine data intermediation with other services such as data analytics. This limits their ability to expand offerings and may restrict innovation (Bobev et al. 2023; Richter 2023; Von Ditfurth and Lienemann 2022). To preserve neutrality, the DGA prohibits DIs from using data collected during operations for purposes other than improving the intermediation service. While this helps prevent conflicts of interest, it also limits the possibility for DIs to generate insights or develop new services from that data (Bobev et al. 2023; Von Ditfurth and Lienemann 2022). DIs are also prohibited from making their services conditional on the use of other services from the same or related providers. This restriction on bundling is intended to prevent unfair advantages (Bobev et al. 2023; Carovano and Finck 2023; Richter 2023), but it may also limit business opportunities and innovation.

Although the DGA was intended to build trust, support fair competition, and promote data sharing, it has also introduced regulatory burdens that may slow the development of DIs. This is especially relevant given that many DIs are still emerging, often without commercial success, and operate in new markets. The regulation might discourage new entrants or lead existing actors to adapt their business models to avoid falling under its scope (Bobev et al. 2023). It remains unclear whether the expected benefits of the regulation will outweigh its burdens, particularly as the same rules apply regardless of the intermediary's size or market position (Von Ditfurth and Lienemann 2022).

The upcoming Data Act complements the DGA by setting rules on data access and use across all sectors. It is a horizontal legislative proposal adopted by the European

Commission to establish harmonized rules for fair access to and use of data. It further opens access to data by imposing obligations related to data portability and availability, especially for data generated by connected devices and services and for data handled by processing services such as cloud providers. The goal is to maximize the value of data in the EU economy by supporting broader reuse of business data, fostering competition, and encouraging innovation. The Data Act introduces mandatory data-sharing obligations in specific contexts, particularly for data from connected devices, which may also support B2B data exchange (Pathak 2024).

Although the Data Act does not explicitly refer to DISP, its broader provisions on access, sharing, and portability may still affect the operations of DIs. DIs could act as recipients of shared data, supporting both B2B and B2C exchanges (Carovano and Finck 2023; European Commission 2020; Farrell et al. 2023). At the same time, they may also qualify as data holders and become subject to obligations on access, portability, interoperability, and security. Unlike the DGA, which mostly sees data holders as those who control access, the Data Act treats them as regulated actors, requiring them to make data available to users or third parties, often without delay and sometimes without compensation (Carovano and Finck 2023; Pathak 2024).

DIs providing technical infrastructure for data sharing may also be classified as Data Processing Service Providers and have to meet requirements for interoperability and provider switching. However, the Data Act does not clearly include DISP, which creates uncertainty about the responsibilities of entities that might act as DIs, data recipients, data holders, or processing service providers at the same time (Carovano and Finck 2023).

Despite these ambiguities, DIs could play an important role in the implementation of the Data Act by lowering transaction costs and supporting large-scale data-driven innovation (Richter 2023). As both the DGA and the Data Act continue to evolve, further clarification will likely be needed. The DGA is scheduled for review by September 2025, only two years after its compliance obligations took effect, reflecting the ongoing changes in this regulatory space (Data Governance Act 2022; Von Ditfurth and Lienemann 2022). To better understand their development and relevance, the following section turns to the current state of the data intermediation market, examining how these services are taking shape and what dynamics are influencing their emergence.

2.4   Data Intermediaries Fit in the Market

Scholars characterize the B2B data intermediation market as being in its nascent stages of development (Richter 2023; Richter and Slowinski 2019; Schweihoff et al. 2024; Verstraete et al. 2023), a perspective corroborated by the European Commission (2020). This market is emerging within the specialized domain of data monetization, which

encompasses the methods by which organizations generate revenue from their data assets. Organizations may achieve this either through direct data sales or by leveraging data to enhance their offerings. However, this segment remains in a developmental phase, with many organizations just beginning to recognize the data they possess, evaluate its potential value, and consider avenues for revenue generation (European Commission 2024).

Operating in a nascent data intermediation market presents several significant challenges for Data Intermediaries, primarily due to inherent uncertainty and difficulties in achieving long-term establishment. A key obstacle for DIs in an undeveloped market is the unpredictable demand for their services and the necessity of reaching out to potential users who may be unfamiliar with the advantages of data sharing through intermediation. Considering the specialized nature of their offerings, these potential users require a substantial level of awareness, knowledge, and expertise in data and digital matters to fully comprehend the implications of data processing and transfer, alongside the benefits offered by DIs (Micheli et al. 2023). All of this is in a scenario in which the digital skills gap in many sectors is recognized as a big hurdle for the advancement of a data-driven economy in the EU (European Commission 2024).

Given the dynamic and still immature state of the data-sharing market, there is no universally accepted or straightforward method for determining a fair price that reflects the varied nature and potential uses of data. Although different pricing models exist, such as per transaction fees and membership-based approaches (Micheli et al. 2023; Richter and Slowinski 2019), selecting an appropriate strategy is still a challenge based on the context's needs. DIs need to address the complex challenge of assigning value to data while convincing users of its relevance and utility, and unlike physical goods, data is difficult to evaluate before it is used.

In addition to pricing challenges, demand is constrained by businesses' reluctance to share data due to concerns about competition, privacy, and reputational harm. Despite the potential benefits, this hesitancy reflects a lack of confidence, often stemming from the absence of well-established success stories that clearly outweigh these perceived risks (Bernal 2024; Richter and Slowinski 2019). Consequently, building trust with parties is a critical task for DIs to increase their uptake. Without it, they may struggle to attract sufficient participants, undermining their ability to reach the economies of scale necessary for sustainable revenue generation (Carovano and Finck 2023).

Moreover, the limited number of successful B2B DI cases in the EU market highlights the slow evolution of the data-sharing landscape. Scholars have examined early market dynamics and questioned the assumptions underlying the EU's regulatory approach,

particularly the DGA. Although the DGA aims to promote data sharing by regulating commercial relationships in data exchange, it rests on the premise that the market is already prepared to pay for such services. However, current evidence suggests that this assumption may be premature, as the market may not yet be fully ready, willing, or able to engage in large-scale paid data sharing (Carovano and Finck 2023; Richter 2023; Richter and Slowinski 2019; Von Ditfurth and Lienemann 2022).

Despite regulatory expectations for DIs to facilitate the take-off of a B2B data-sharing market through trust mechanisms, the high costs associated with implementing such data-sharing initiatives remain a critical factor for their operational viability (Von Ditfurth and Lienemann 2022). DIs often have value-driven cost structures initially, focusing on developing attractive services for their different users while also implementing technical standards to maximize usage control and minimize perceived risks. To meet these goals, DIs should invest heavily in secure and interoperable infrastructure. This includes substantial costs related to data storage, processing, filtering, and protection, each essential to ensuring compliance with privacy and security standards and maintaining user trust (Carovano and Finck 2023; Bernal 2024; Micheli et al. 2023).

Two-sided platforms, DIs, like other platform-based models, needed to attract a sufficient number of both data providers, the supply side, and data users, the demand side, to become viable. As previously discussed, this proved particularly challenging in nascent markets. Scholars argued that DIs, therefore, needed to articulate a clear value proposition beyond simply connecting buyers and sellers, such as reducing search and transaction costs or aggregating and improving data quality (Micheli et al. 2023; Richter and Slowinski 2019; Schweihoff et al. 2023). In a two-sided market, consumers are often hesitant to invest without a clear understanding of potential benefits, while providers may be reluctant to share data without certainty about its value or associated risks. This imbalance often results in data being perceived as overpriced by consumers and undervalued by providers (Bernal 2024), adding a further layer of complexity to this sector.

However, their market strategies as platforms have some limitations. Although DIs share features with traditional platforms, such as acting as matchmakers, coordinating ecosystems, and benefiting from network effects and economies of scale, they also have distinct characteristics. They are often described as a new type of entity within the data economy, differing in both structure and regulatory purpose from traditional platforms (Carovano and Finck 2023; Richter and Slowinski 2019; Schweihoff et al. 2024; Verstraete et al. 2023; Von Ditfurth and Lienemann 2022). The DGA introduced DIs as an alternative to existing data-handling practices of large digital platforms, aiming to

enhance individual and organizational control over data through several mechanisms. Namely, structural separation of their data intermediation services from other business activities, safeguards against anti-competitive behavior, and prohibition of use of the data they intermediate for their own purposes (Micheli et al. 2023; Verstraete et al. 2023; Von Ditfurth and Lienemann 2022).

Within this regulatory framework, identifying viable and attractive business models proved complex. While traditional platforms frequently monetize data through advertising, personalization, or analytics, the neutrality requirement limits the scope of the same monetization strategies for DIs. While these constraints aligned with the DGA's broader goals, they also raised questions about the feasibility and scalability of DI business models, which remained largely untested in this context. As a complicator, DIs operate in a competitive landscape that includes traditional data brokers and large, vertically integrated firms offering data-related services outside the scope of DI regulations. These established actors often possessed pre-existing network effects and substantial data assets, which positioned them with an advantage (Bobev et al. 2023; Carovano and Finck 2023; Von Ditfurth and Lienemann 2022).

Overall, the development of the data intermediation market revealed a tension between the EU's ambition, articulated in the DGA, to position DIs as enablers of a trustworthy B2B data sharing, and the market realities surrounding the viability of their business models. This tension posed a significant challenge to the EU's goal of fostering a data-driven economy, particularly in light of efforts to strengthen Europe's position in global digital competition against more advanced actors in the United States and Asia (European Commission 2020; European Commission 2024). However, realizing these ambitions necessitated more than just overcoming regulatory and market hurdles. It also relies on the DIs' capacity to establish their data-sharing ecosystems. The following section delves into this matter.

2.5   Data Intermediary Building an Ecosystem

When discussing the broader landscape of data sharing, terms such as data ecosystems, data sharing ecosystems, and data spaces often emerge. While these terms reflect different contexts and applications, they share a defining feature: a complex network of actors, resources, and activities centered around data. A data ecosystem can be considered in broader terms, encompassing not only data exchange but also the supporting infrastructure, governance mechanisms, and the varied roles and motivations of participants (Oliveira and Lóscio 2018).

Data sharing is not distinct from a data ecosystem. Rather, it represents a fundamental activity within it. It refers to configurations in which the sharing of data among

participants is the central focus, supported by mechanisms, incentives, and governance structures that facilitate such exchanges (European Commission 2018; Fassnacht et al. 2024; Oliveira and Lóscio 2018). The use of data sharing platforms as intermediaries is key to these ecosystems (Richter and Slowinski 2019), alongside the emergence of specialized environments designed for data sharing, known as data spaces.

Data spaces are a more concrete, infrastructure-oriented implementation of the broader concept of a data ecosystem. They are structured, federated environments designed to facilitate data sharing among multiple stakeholders, based on shared technical, legal, and ethical standards. It can also be tailored to specific sectoral or domain-specific needs (Bacco et al. 2024). In the EU Data Strategy, a central aspect is the implementation of these constructs as a specific policy instrument of the European Union's data strategy. They are in alignment with EU rules and values, supported by legislation such as the Data Governance Act, and are intended to contribute to the creation of a single market for data (European Commission 2024; Farrell et al. 2023). Rather than acting as monolithic platforms, data spaces serve as flexible frameworks that Data Intermediaries and other stakeholders can leverage to advance their broader data ecosystem strategies.

Overall, in data ecosystems where sharing is central, Data Intermediaries can play a pivotal role in enabling data exchange, access, and use among diverse participants (Micheli et al. 2020; Schweihoff et al. 2024). DIs contribute to ecosystem development by orchestrating actors, providing technical infrastructure such as platforms and catalogs (Brousseau et al. 2024; Schweihoff et al. 2024), and mitigating skepticism while raising awareness of the benefits of data exchange, particularly in B2B contexts (Farrell et al. 2023; Fassnacht et al. 2024). They may also promote best practices and inclusive governance structures by enabling stakeholders to participate in decisions regarding data access, control, and use (Micheli et al. 2023).

The strategic development of DIs depends on their ability to build and maintain sustainable ecosystems of data providers and consumers. As two-sided platforms, DIs need to align incentives across these groups to generate positive network effects. This includes encouraging data provision and enabling collaboration that leads to new data-driven services and innovations (Micheli et al. 2023; Schweihoff et al. 2023, Schweihoff et al. 2024). As data ecosystems grow in complexity and scale, the demand for trustworthy intermediaries becomes increasingly apparent, particularly in environments involving a wide variety of participants (European Commission 2024). This position allows them to design business models that redistribute value and capture positive externalities, particularly in environments where asymmetries in power or data access are common, such as markets dominated by large platforms (Martens et al. 2020).

Besides, as data ecosystems typically comprise a broad range of actors, including public authorities, researchers, developers, and entrepreneurs (Janssen and Singh 2022; Micheli et al. 2023), DIs need to harmonize the interests, creating the conditions for the ecosystem to develop. Indeed, while users expect transparent and accessible services (Janssen and Singh 2022; Micheli et al. 2020, Micheli et al. 2023), regulators emphasize compliance with legal and competition frameworks (Bobev et al. 2023; Carovano and Finck 2023). Balancing these expectations requires DIs to address their own internal challenges, particularly the development of economically sustainable business models that ensure long-term operational viability (Bobev et al. 2023; Verstraete et al. 2023).

Ultimately, DIs are not passive facilitators embedded in pre-defined systems. Instead, they act as ecosystem builders, structuring stakeholder relationships, coordinating governance, and fostering trust. The following section examines their performance in the agricultural sector, a domain where these dynamics are particularly evident.

2.6 The Agriculture Sector as a Landscape for Data Intermediaries

The agricultural sector has emerged as a pivotal area for the execution of the EU Data Strategy. This strategy acknowledges that data sharing holds significant potential benefits for a diverse array of stakeholders, including farmers, service providers, and policymakers, ultimately serving the common good. The vision was to establish a comprehensive data space for agriculture, based on the integration of various initiatives, interoperability of data sources, and fair contractual agreements (European Commission 2024).

In its Data Market Study (2021–2023), the European Commission (2024) provided examples of how the agricultural sector was already using data-driven innovation to improve operations. Modern technologies and digital platforms have supported better data sharing among stakeholders, increased transparency in the supply chain, and helped reduce food waste. The study also highlighted data's potential to improve the sector's sustainability and competitiveness. The digital transformation sector has aimed to improve efficiency, productivity, and decision-making in line with environmental, economic, and social goals. EU policies have supported this direction. The European Green Deal and the Common Agricultural Policy encourage the adoption of digital technologies as tools for achieving sustainability targets (Brown et al. 2023; Sullivan et al. 2024; Van der Burg et al. 2021).

The growing integration of digital technologies across the agricultural value chain, including sensors, drones, satellites, and advanced agricultural machinery, has facilitated the systematic collection of diverse data pertinent to agricultural production. This includes vital information regarding crop yields, soil health, water availability, and

meteorological conditions (Sullivan et al. 2024). Data is increasingly recognized as a key asset for driving innovation and value creation in agriculture. Given its significance, data sharing has emerged as a critical strategy for leveraging this information across a wide range of stakeholders (Brown et al. 2023; Bustamante 2023; Sullivan et al. 2024; Wolfert et al. 2024).

The sector took early actions to address problems and encourage data sharing. In 2018, an initiative led by farmers, cooperatives, and industry representatives resulted in the EU Code of Conduct on Agricultural Data Sharing by Contractual Agreement. This voluntary tool was developed to guide stakeholders in establishing responsible and fair agreements. It addressed regulatory gaps concerning data control, trust, and transparency, while clarifying the roles and responsibilities of each party. A key principle was that the person generating or owning the data retains control over its use (Ryan et al. 2024; Van der Burg et al. 2021).

Alongside its strategic role in the EU Data Strategy and the Code of Conduct, the sector has also explored data-driven opportunities through various data-sharing initiatives. These initiatives differ in stakeholder involvement, duration, business models, and technical setups. Preparatory actions have also been launched to support the future Agriculture Data Space through the AgriDataSpace project (Bustamante 2023; Deroo and Maes 2023; Micheli et al. 2023; Wysel et al. 2021). While data sharing has progressed, the sector still faces important challenges, as in other EU sectors. The agricultural domain experiences disparities in digital skills and technology adoption across countries, regions, and farm types, which limit participation in data-sharing initiatives (Bustamante 2023; Kosior 2021). While foundational barriers are being addressed, additional unresolved challenges persist, despite initiatives like the EU Code of Conduct on Agricultural Data Sharing (Van der Burg et al. 2021).

Farmers also express fears of losing competitive advantage and control over their data, including the potential misuse of data by governments for regulatory enforcement or administrative sanctions (Ryan et al. 2024). There is also skepticism about the benefits of data sharing, uncertainty over who ultimately benefits from the data (Sullivan et al. 2024), and concerns about how it will be used (Kosior 2021). From a technical and regulatory perspective, barriers include the lack of interoperability between on-farm machinery and digital systems, insufficient IT infrastructure for data storage and management, and limited enforceability of protections such as trade secrets (Brown et al. 2023; Ryan et al. 2024; Sullivan et al. 2024).

In this context and considering the EU's horizontal policies like the DGA and CEDS, Data Intermediaries have emerged as a key mechanism to create a structured environment for

data exchange while addressing trust and technical issues. This is crucial given the sector's diverse stakeholders, from farmers to retailers, with varying needs and expectations for data sharing, alongside challenges such as data fragmentation, lack of interoperability, and complex sharing regulations (Brown et al. 2023; Farrell et al. 2023; Ryan et al. 2024; Sullivan et al. 2024; Wolfert et al. 2024).

DIs help build trust by ensuring transparency in data exchanges, supporting data monetization, and offering legal and technical expertise. They can also act as "translators" for smaller or less experienced actors, such as farmers, helping them navigate complex data environments. Within the EU Data Spaces framework, DIs are expected to support agricultural stakeholders by offering connection services and technical support. They may also play a role in developing the infrastructure needed to address data fragmentation (Brown et al. 2023; Brunori et al. 2025; Sullivan et al. 2024; Turpeinen et al. 2024).

The AgriDataSpace inventory on data-sharing initiatives highlights the diverse contributions of various initiatives toward facilitating data sharing in agriculture. While offerings may differ among DIs, they generally provide platforms for farmers to manage permissions for their business data. These initiatives also enable secure data transfers between stakeholders using connectors, along with identity/access management systems, comprehensive data catalogues, and metadata services. Additionally, many DIs engage in semantic mapping of data standards and offer platforms for monetizing data through commission or licensing models (Deroo and Maes 2023). However, it indicated that, while some data-sharing initiatives exhibit functionalities akin to those of Data Intermediaries, only a limited number have officially adopted the formal designation of Data Intermediary or attained recognition under the DGA.

Similarly, in the literature on data sharing within the agricultural sector, there are a few notable sources that explicitly identify such entities as Data Intermediaries (Brown et al. 2023; Brunori et al. 2025; Sullivan et al. 2024). Some scholars refer to the entities that facilitate data exchange by connecting stakeholders and supporting community-based data sharing as "platforms," "initiatives," or "mechanisms" (Bustamante 2023; Wysel et al. 2021). These platforms are often identified as key actors in the development of data space ecosystems (Kosior 2021), a role typically associated with Data Intermediaries (Farrell et al. 2023). While specific governance models and service portfolios may distinguish different types of DIs, the literature often discusses them through the narrower lens of platforms. They are seen as foundational elements of the evolving agricultural data ecosystem, offering the architecture and tools required to unlock the value of shared data (Brown et al. 2023; Bustamante 2023; Sullivan et al. 2024; Wysel et al. 2021).

However, DIs operating as platforms in the agricultural sector face a broad range of challenges, regulatory, business-related, and ecosystem-level, that closely mirror those encountered in other domains. This is largely due to the horizontal nature of EU data legislation, including the DGA, Common European Data Spaces, and the forthcoming Data Act (Carovano and Finck 2023; Schweihoff et al. 2024; Von Ditfurth and Lienemann 2022). These difficulties are further compounded by the novelty and evolving nature of economic drivers in the data intermediation market (Brousseau et al. 2024; Micheli et al. 2023; Richter and Slowinski 2019).

From a regulatory perspective, DIs need to navigate an increasingly complex and evolving legal landscape shaped by EU instruments such as the DGA and the upcoming Data Act. These frameworks often lack clarity in their application to the agricultural sector, particularly in defining core concepts and addressing sector-specific arrangements (Ryan et al. 2024). Once applied, they impose compliance obligations that can constrain the flexibility of DIs in crafting their value propositions. Simultaneously, DIs need to invest in awareness-raising and trust-building to enhance their appeal to potential users (Sullivan et al. 2024; Turpeinen et al. 2024). To lower the entry barrier for users, DIs should integrate this regulatory complexity into seamless user experiences, which necessitates a robust technical infrastructure and expertise in data management, security, and anonymization (Brunori et al. 2025).

In terms of business models, balancing data monetization with fairness and trust is particularly challenging, as farmers tend to be hesitant to pay for intermediation services without clear, immediate benefits. Persistent concerns, such as fears of data misuse, low trust levels between providers, mainly farmers, and consumers, like agribusinesses, and the market dominance of large platform providers, further hinder the ability of DIs to deliver compelling and competitive services. Given that farmers may not be the most willing or capable to finance such services, DIs should diversify revenue streams, finding incentives for user uptake while managing infrastructure and operational costs (Brown et al. 2023; Bustamante 2023; Deroo and Maes 2023; Eisenträger et al. 2024).

At the ecosystem level, DIs are tasked with managing diverse and often misaligned stakeholder expectations. Farmers (*framed as businesses*) and industry actors frequently report limited perceived benefits from engaging with neutral data sharing services offered by DIs, highlighting a general lack of incentives in the current agriculture data sharing environment. Moreover, uncertainties persist around value distribution across the data chain, raising questions about who should be compensated, whether farmers, platforms, or service providers (Deroo and Maes 2023; Eisenträger et al. 2024). Despite the EU's push for Common Agricultural Data Spaces, fragmentation remains a persistent

challenge. Even so, these policy initiatives may present opportunities for DIs to define more specialized roles and explore innovative business models by leveraging synergies with existing regional, national, and international efforts (Turpeinen et al. 2024).

The agricultural sector highlights the opportunities and challenges of developing DIs, especially regarding their role in policy. While DIs are vital for addressing fragmentation, building trust, and reducing regulatory complexity, their effectiveness is hindered by sectoral barriers and broader structural issues. The growing role of DIs in agricultural data-sharing and the challenges they face emphasize the need for a thorough understanding of their adaptation to this context. Analyzing DIs' responses requires a multifaceted approach, which the next section will introduce through relevant theoretical frameworks.

3 Theoretical Framework

3.1 Dynamic Capabilities

In complex and ever-evolving environments, particularly those shaped by rapid technological advancements, organizations should continuously develop the capacity to respond to shifting market demands. Without such adaptability, they risk losing relevance and ultimately facing business failure. Drawing from this perspective, Teece et al. (1997) and Teece (2007) introduced the Dynamic Capabilities framework to assess how firms in a changing business and technology environment (dynamic) coordinate and redeploy resources internal and external resources (capabilities), fastly and flexibly, to survive in the market keeping their competitive advantage.

The theory emphasizes that a firm's capacity to adapt to rapidly changing environments continuously is more crucial than its existing assets that ensured past successes. The ability to integrate, build, and reconfigure resources to respond to change empowers the firm to excel in unpredictable and competitive environments, giving it a unique advantage in the market in which it operates (Teece et al. 1997). Dynamic Capabilities encompass the processes, activities, structures, and decisions that help organizations navigate uncertain environments. Teece (2007) identified three critical capabilities that firms should develop to maintain their fitness in rapidly changing contexts:

- **Sensing:** identifying and assessing emerging opportunities and threats in the business environment, including monitoring technological advancements, changing customer needs, and competitor actions.
- **Seizing:** when an opportunity or threat is identified, making timely and effective investment decisions to capitalize on it, such as developing new products, processes, or business models.
- **Reconfiguring:** continuously adapting and reconfiguring the organization's asset base and structure to remain competitive, whether through redeploying resources, altering processes, or exiting outdated markets.

These three interdependent and overlapping capabilities form a comprehensive framework for analyzing both macro- and micro-level organizational actions. They encompass critical internal processes such as coordination, decision-making, and resource allocation while also accounting for external institutional factors like regulations, market positioning, and competitive landscapes. Moreover, the Dynamic Capabilities framework extends beyond decision-making by emphasizing an organization's ability to optimize knowledge transfer, integrate expertise across functions, and foster adaptability, key elements in sustaining long-term strategic advantage (Teece 2007; Teece et al. 1997).

Despite their significance, these capabilities do not always develop equally within an organization. A firm may excel in sensing opportunities but struggle with seizing or reconfiguring them effectively. When all three capabilities are strong, they enable radical innovation and market leadership. Conversely, weak capabilities can leave firms constrained by past investments and rigid business models. This underscores the need for organizations to actively cultivate and balance these strategic capabilities. Partnerships and outsourcing can also complement internal competencies, enhancing an organization's ability to adapt and compete in evolving markets (Teece 2018).

Beyond immediate strategic adaptation, Dynamic Capabilities are fundamental in shaping long-term business success. Firms that continually refine their capabilities can redefine market boundaries, develop innovative products, and adjust their business models to sustain profitability beyond short-term gains. In this context, Teece highlighted the importance of business model analysis, particularly regarding intangible elements such as reputation, which may not have an explicit market value. The ability to design and implement an effective business model, therefore, becomes a crucial capability, requiring the integration of sensing, seizing, and reconfiguring skills to shape both firm strategy and the broader business ecosystem (Teece 2010, Teece 2018).

Studies have used the Dynamic Capabilities framework in various ways to analyze organizations operating in challenging environments. These include the development of a questionnaire tool (Achtenhagen et al. 2013), a processual model for an adaptation roadmap (Liu and Yu 2021), and a best practices report (Lin et al. 2020), all aimed at helping organizations take practical steps to respond to their market contexts.

The Dynamic Capabilities framework stands apart from other organizational theories by offering a holistic approach that integrates both internal organizational factors and external market forces. It draws from the Resource-Based View to emphasize internal resources, incorporates Schumpeterian Economics to highlight the role of innovation in fast-changing environments, and builds on the Strategy and Behavioral Theory of the Firm to analyze decision-making, routines, and the impact of social and organizational contexts. Unlike these more segmented theoretical perspectives, Dynamic Capabilities synthesize their insights, demonstrating how firms can harness collective knowledge, adaptability, and strategic execution to sustain long-term success (Achtenhagen et al. 2013; Lin et al. 2020; Teece 2007; Teece 2018; Teece et al. 1997; Zollo et al. 2016).

3.2   Platform Business Models

The Platform Business Model serves as a framework for analyzing the unique dynamics that differentiate platform businesses from traditional ones. Platforms operate as networks through digital or physical mediums that connect multiple user groups. These businesses

act as intermediaries, facilitating interactions between at least two different sides of the market. Their value proposition focuses on enabling value-creating interactions for users that are difficult or costly to achieve independently. Benefits offered by the platforms include reducing search costs, streamlining transactions, and enhancing overall value for participants, which are key for such businesses to build a network of users (Srinivasan 2021; Tiwana 2014b).

Technology also represents a relevant feature of the platform business model, especially considering that such organizations have gained momentum due to digital technologies and internet growth. The modern platform business has, as a foundational element, a software-based infrastructure, or simply put as a digital platform, that enables, through its many features, the connection of different groups of users and facilitates their interactions on a large scale (Srinivasan 2021). Through the software, a set of core services that bring different utilities to their users is offered by this type of business; however, it is not limited to that, as complementary services might also be offered as a means to support their ecosystem building.

Platform businesses focus their investments on developing the technology they use for intermediation, which accounts for most of their cost structures, especially in their early stages when they are funding the necessary infrastructure. While a key investment and cost, the intermediation services also imply coordination costs. In terms of revenue, they typically extract monetary value through different pricing models, such as transactions, advertising, or subscription based. The pricing strategy depends on the bargaining power of their users and their overall perception of the platform value (Srinivasan 2021; Tiwana 2014c).

Building an ecosystem is a key feature of platform companies. Their success depends on network effects, where the platform becomes more valuable as more users join. Since platforms connect different groups of users, it's essential that all sides participate. This makes attracting multiple user groups a core strategy. In the early stages, however, platforms face challenges like the "Chicken-or-Egg" problem, users wait for others to join first, and the "Penguin Problem," where everyone hesitates to be the first mover (Tiwana 2014b). Overcoming these is crucial for scaling and long-term success. For instance, to create network effects and overcome typical users' hesitation, platforms may implement asymmetric pricing by selecting a specific user group to monetize while subsidizing another group. This strategy can attract the latter group to the platform, enhancing overall value for all users; however, it is not always straightforward, as the business should consider users' market options and sensitivity to pricing (Srinivasan 2021; Osterwalder and Pigneur 2013).

Moreover, because platforms operate within ecosystems composed of multiple interdependent stakeholders, their success is not based solely on internal efficiency but also on how well they manage relationships within their environment. Rather than traditional management approaches, platform firms emphasize orchestration over direct control, adaptability over stability, and autonomy to innovate over rigid structures. Their boundaries become fluid, as they should coordinate interactions among users, partners, rival platforms, and the broader competitive landscape. Successfully managing these dependencies relies on their ability to orchestrate the many actors to whom the platform business has no direct authority.

In such a scenario, their governance structures and business architecture should reflect this autonomy, coevolution, and mutual benefits relationship, allowing ecosystem development and sustainability. A rigid focus on efficiency and predictability alone is insufficient. Instead, platforms require adaptability to accommodate emerging user behaviors, technological advancements, and external disruptions. Ultimately, their success depends on the value created for all stakeholders, including end users, ecosystem participants, and the platform itself (Tiwana 2014c).

3.3 Contextualizing Dynamic Capabilities and Platform Business Model Lenses

As discussed earlier, DIs are emerging as central actors in a data-sharing market shaped by regulatory requirements and shifting market dynamics. The European Union's push for a trustworthy and transparent free flow of data has positioned DIs as key enablers, facilitating secure, neutral, and efficient data transactions. To meet these expectations, DIs should develop sustainable business models that support continuous service provision while engaging stakeholders in a growing data-sharing economy (Schweihoff et al. 2023; Farrell et al. 2023; Von Ditfurth and Lienemann 2022; Oliveira et al. 2019).

Dynamic Capabilities Theory offers a useful framework for understanding how organizations adapt and maintain strategic positions in evolving environments. Although the theory has traditionally been applied to large, established firms, scholars such as Achtenhagen et al. (2013) and Liu and Yu (2021) highlight its relevance for emerging organizations. These firms also require continuous adaptation and business model renewal to sustain value creation. Given the rapidly changing and uncertain environment in which DIs operate, the theory is highly applicable regardless of firm size. In the case of DIs, examining their Dynamic Capabilities helps reveal how they asses and respond to regulatory, market, and ecosystem pressures, and how such pressures may hinder their ability to operate sustainably, particularly in the agricultural sector. This framework supports the analysis by focusing on three core capabilities:

- **Sensing:** identifying and assessing new opportunities and risks, such as regulatory changes, market pressures, or ecosystem demands.
- **Seizing:** mobilizing resources and adapting business models to act on those opportunities through partnerships, service innovations, or structural changes.
- **Reconfiguring:** realigning organizational structures and resources to meet evolving external conditions and internal operational needs.

These capabilities are developed under regulatory pressures shaped by EU policies such as the DGA and the Data Act. DIs need to interpret these frameworks, anticipate their implications, and adjust compliance strategies accordingly (Schweihoff et al. 2024). Besides, integrating into policy discussions and regulatory frameworks can influence governance structures, advocate for favorable conditions, and align with broader EU data strategies (Deroo and Maes 2023). In this context, insights from DI leaders on how they interpret and implement regulations, alongside perspectives from EU policymakers involved in data sharing frameworks, are crucial.

Dynamic Capabilities also inform business model development and market adaptation. Scholars such as Lin et al. (2020) and Liu and Yu (2021) argue that viewing business model evolution through the lens of Dynamic Capabilities offers valuable insights into how platform-based and data-driven organizations respond to uncertainty and complexity. Business models determine how companies create, manage, and deliver value. They need to be flexible to keep up with changing market conditions by adjusting things like service offerings, customer relationships, revenue sources, and key partnerships (Teece 2010, Teece 2018).

For organizations like DIs, a well-adapted business model strengthens scalability, network effects, and value co-creation, allowing them to build sustainable competitive advantages (Osterwalder and Pigneur 2013; Teece 2010). Therefore, gathering insights from DI leaders on their business model strategies is crucial to understanding how they navigate market pressures. In turn, perspectives from EU policymakers contribute to assessing the policy expectations and actions for the Data Intermediary market readiness.

In parallel, as a defining characteristic of DIs is their role as platforms connecting data providers and data consumers, the nuances of the Platform Business Model must be acknowledged (Von Ditfurth and Lienemann 2022; Schweihoff et al. 2024). The value of platform-based services increases with participation, creating positive feedback loops that enhance data availability and user benefits (Verstraete et al. 2023; Von Ditfurth and Lienemann 2022). Platform operators need to balance the diverse needs of different user groups while attracting and retaining participants across all sides of the market

(Srinivasan 2021; Teece 2018). This balancing act requires ongoing integration of resources and adaptation to technological changes (Lin et al. 2020; Tiwana 2014c).

As platform-based firms (Srinivasan 2021; Tiwana 2014a), DIs also need to navigate complex mutual dependencies and value exchanges. Unlike large corporations with extensive internal resources, DIs rely heavily on ecosystem support and collaboration (Deroo and Maes 2023). Understanding how they develop their networks and position themselves within broader data ecosystems is critical to identifying both opportunities and constraints in the agricultural context. Previous studies have applied Dynamic Capabilities Theory to platform-based firms, showing how they evolve into complex ecosystems through capabilities that help them monitor user preferences, respond to policy shifts, and manage conflicting stakeholder interests (Achtenhagen et al. 2013; Lin et al. 2020; Liu and Yu 2021). These capabilities are central to maintaining innovation, resilience, and long-term viability in fast-changing digital environments.

In sum, DIs operate at the intersection of regulatory, market, and ecosystem forces. Within this environment, they act as neutral orchestrators of emerging data-sharing ecosystems. Positioned as two-sided platforms, they facilitate trusted data exchanges while responding to external pressures and aligning with internal business model logic. Their capacity to adapt to the pressures determines not only their organizational resilience but also their potential to advance EU-wide goals for neutral data sharing.

3.4   Lenses for Analyzing Data Intermediaries' Strategies

Figure 1 conveys the context in which DIs operate, also showcasing in which dimensions the contributions of the Theoretical Frameworks apply.
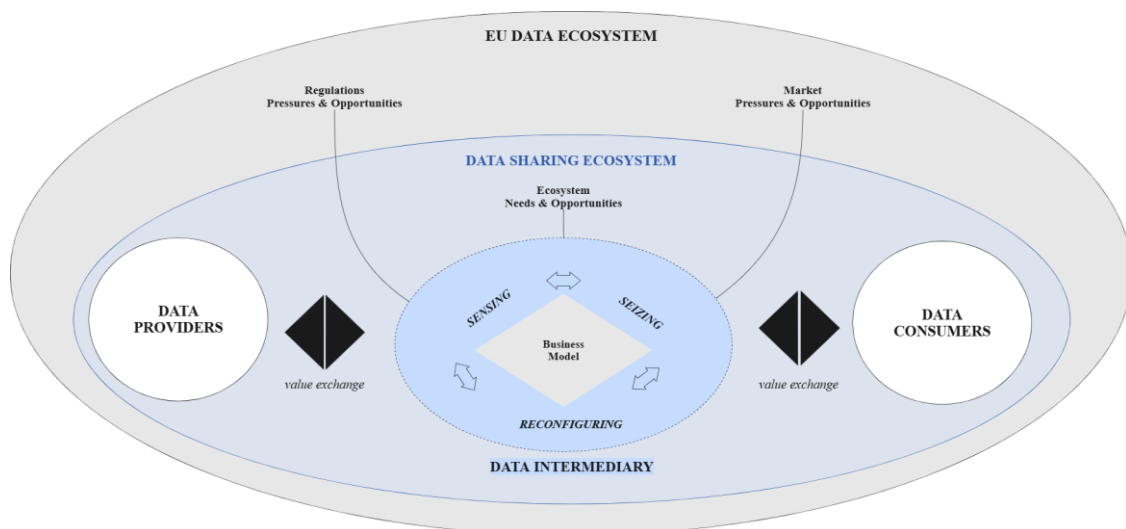
Source: Author's Elaboration

Figure 1.   Data Intermediaries Regulatory, Market, and Ecosystem Context

It presents DIs as embedded within a layered structure: the broader EU Data Ecosystem and, at the micro level, the data-sharing ecosystem developed by the DI itself. The EU Data Ecosystem introduces regulatory and market-level pressures and opportunities that define the operational context for DIs. Within this environment, each DI builds its own ecosystem by acting as a platform that facilitates value exchange between Data Providers and Data Consumers. This micro-ecosystem brings its own constraints and expectations, adding complexity to the DI's role.

At the center, the DI's business model is shown as continuously adapting, shaped by the organization's ability to sense, seize, and reconfigure in response to both macro- and micro-level pressures. This adaptive process reflects the role of Dynamic Capabilities in shaping strategic responses. At the same time, the Platform Business Model framework highlights the structural characteristics and stakeholder dynamics that influence how DIs organize value creation and exchange.

3.5   Theoretical Framework Novelty

This study introduces a novel analytical approach by applying Dynamic Capabilities Theory and the Platform Business Model framework to the underexamined case of Data Intermediaries in the EU agricultural data-sharing sector. First, while Dynamic Capabilities Theory is often used to study how established firms adapt to competitive markets, this research extends its application to emerging organizations like DIs. Despite their smaller size and regulatory constraints, DIs face similar pressures to sense opportunities, seize them through timely strategic action, and reconfigure their resources in response to market shifts. Like other firms in evolving environments, DIs need to continuously adapt to survive, remain relevant, and provide value, demonstrating the broader relevance of the Dynamic Capability's lens beyond its conventional corporate applications.

Second, the study advances the Platform Business Model literature by focusing on non-traditional platform businesses. Unlike commercial platforms operating in open markets, DIs must comply with legal obligations such as neutrality, transparency, and non-discrimination. These regulatory requirements shape how they structure interactions between Data Providers and Data Consumers, govern access, and build trust. By analyzing how DIs manage these constraints while still facilitating value exchange and stakeholder engagement, the study offers new insights into platform design in regulated environments.

# 4	Methods

## 4.1	Research Philosophy and Approach

This study contributes to the literature on Data Intermediaries in the European Union by qualitatively examining how agricultural DIs navigate regulatory, market, and ecosystem pressures. While previous research has outlined structural challenges in the EU data economy, limited attention has been given to the perspectives and lived experiences of DI leaders as they engage with these dynamics. To address this gap, the research investigates how DIs interpret, assess, and respond to external pressures. It primarily adopts an inductive approach (Saunders et al. 2019), allowing insights to emerge from empirical data gathered through interviews with DI actors and EU policymakers. These interviews provide a grounded view of how DIs make sense of their environment and develop strategies within it. At the same time, the analysis is informed by deductive elements, drawing on theoretical frameworks to structure and contextualize the interpretation of organizational responses.

This methodological approach is situated within an interpretivist research philosophy (Saunders et al. 2019), which emphasizes the importance of understanding how social actors construct meaning in relation to their environment. Rather than testing predetermined hypotheses, the study explores the diverse ways in which DIs perceive and respond to the regulatory and operational challenges they face. It considers both internal organizational perspectives and the viewpoints of policymakers, whose decisions shape the broader ecosystem in which DIs operate.

Furthermore, the study is guided by contextualist epistemology, which holds that knowledge is inherently situated within specific social, economic, and regulatory contexts. Recognizing this, the research acknowledges that the environments in which DIs function significantly influence their interpretations and strategies. By employing a qualitative and interpretive lens, the study captures patterns and themes that reflect both business and policy perspectives, offering a nuanced and context-sensitive understanding of how DIs are evolving within the EU data intermediation landscape.

As a final disclaimer, this research utilized AI-based writing assistance tools (OpenAI's ChatGPT and Grammarly) solely to enhance linguistic clarity and grammatical accuracy. Notably, their use did not influence the content, analysis, or findings in any manner.

## 4.2	Research Design and Techniques

This study employs an Exploratory Research Design (Yin 2014) to examine how Data Intermediaries in the European agriculture sector are responding to the emerging and

regulated EU data-sharing market. Exploratory research is particularly well-suited for studying evolving phenomena, such as the data intermediation market, where regulatory frameworks like the DGA and Data Act are still developing, mature business models for DI are lacking, and the participating stakeholders are still assessing the value of data sharing.

Given this early stage of DIs' development, an exploratory approach offers the flexibility to investigate open-ended questions and uncover patterns, strategies, and contextual nuances (Braun and Clarke 2022). It is especially valuable for identifying how DIs respond to challenges in the regulatory, market, and ecosystem realms. The goal is to generate insights that not only deepen conceptual understanding but also might provide routes for future research in the underexplored DI literature.

To address the research questions, the Exploratory approach is grounded on a qualitative approach based on semi-structured interviews with key stakeholders involved in the data intermediation market within data sharing, including DI leaders and EU policymakers. This method allows for rich, contextual exploration of how DIs perceive themselves and act in the data ecosystems, given the study's strength in capturing lived experiences and dynamic processes. This iterative engagement with the field also enables the refinement of research questions and the emergence of key themes. Given the limited number of officially recognized DIs, the study also incorporates perspectives from EU stakeholders involved in data and agricultural policy. These actors influence the regulatory and market conditions shaping the DI landscape, and their inclusion contributes to a more holistic understanding of the ecosystem.

Furthermore, to enhance validity and reliability, the study applies triangulation by integrating semi-structured interviews, document analysis, and theoretical frameworks (Bryman 2012; Yin 2014). This combination strengthens the robustness of findings by capturing both horizontal influences and contextual variations in how DIs adapt. The study employs a multi-method approach, incorporating the following sources:

- **Document Analysis:** Examination of EU regulations, official reports, and policy documents relevant to data sharing frameworks. And review publicly available reports, strategies, and communications from DIs to contextualize their operations.
- **Semi-structured interviews with DI leaders:** Conducted with representatives of European Data Intermediaries in the agricultural sector to gather insights into organizational strategies, regulatory adaptation, and market positioning.
- **Semi-structured interviews with EU policymakers:** Engaging officials and stakeholders involved in B2B data sharing frameworks and agricultural data policies to examine regulatory challenges, policy implementation, and their impact on DIs.

Integrating these diverse data sources strengthens the study by ensuring that findings are not solely dependent on stakeholder perceptions but also supported by regulatory documentation and institutional records. Besides, the multi-layered method, including interviews, document analysis, and theoretical guidance, provides additional advantages:

- **Capturing multi-variable influences:** The adaptation of DIs is shaped by a combination of regulatory, economic, and ecosystem-related factors, necessitating an approach that can address these interdependencies.
- **Enhancing data robustness:** Given the limited number of officially recognized DIs, this methodology ensures that findings remain empirically sound by incorporating perspectives from a broader set of stakeholders.
- **Mitigating participant bias:** Aggregating diverse case studies helps address potential participants' bias by contrasting their narratives with previous research knowledge.

Regarding the DI's interviewees' choices, given the emerging state of the European agricultural data intermediation market, selecting relevant interviewees required a targeted and strategic approach. The sector remains in its early stages, with relatively few DIs currently offering services. Many organizations are still in the pilot phase, testing business models for scalability, while others are evaluating their obligations under the DGA (Deroo and Maes 2023; Schweihoff et al. 2024; Verstraete et al. 2023). To ensure that the selected DIs provide meaningful insights into regulatory adaptation, market strategies, and network integration, the study applies the following criteria:

- **Function as a Data Intermediary**: Offers data intermediation services (according to Micheli et al. 2023 and Schweihoff et al. 2023), including data exchange platforms that are not recognized as DIs under the DGA framework. This study considers a broader spectrum of intermediation actors, acknowledging the ambiguity and early stage of the DGA framework, in which many organizations perform intermediation roles without formal registration. It seeks to illustrate the diversity of emerging intermediation models and highlight the practical tensions between regulatory classification and real-world functionality in the evolving data-sharing landscape.
- **Established Before the DGA (2022):** Founded prior to the introduction of the DGA to offer insights into the influence of the DGA Data Intermediation Framework on their operations.
- **Referenced in the Literature:** Cited in EU reports and/or academic studies as relevant cases in the data intermediation landscape.
- **Operate in the Agricultural Sector:** Engage with agriculture data-sharing, either as a primary or secondary focus, to capture sector-specific challenges and opportunities.

To examine organizational strategies and responses to market and network challenges, interviews will be conducted with key decision-makers, such as leaders or chief administrative officers, or business development managers. **Table 1** outlines the mapped DIs, according to the previously mentioned criteria, informing business type, year of establishment, country of origin, and service offerings.

Organization	Entity Type	Since	Location	Service offer (according to their official website)
DataSpace Europe	Limited Company	2016	Finland	*Tritom*: a platform that enables data holders to control access to their data and provides tools for cataloguing, metadata management, and secure cross-domain data exchanges.
DKE-Data	Non-profit Company	2016	Germany	*Agrirouter*: a platform for smart farming data exchange that allows farmers to manage and control data exchange between agricultural machines and software applications from multiple manufacturers.
DjustConnect	Public-Private cooperation	2020	Belgium	Digital infrastructure for secure data sharing in the agricultural food chain enables farmers to control who accesses their data via a personal dashboard. The platform offers a "Connect Shop" where users can explore available datasets and facilitate legally compliant data transactions.
JoinData	NGO / Cooperative Model	2021	The Netherlands	A platform for farmers to manage permissions for their agricultural data securely and share it with connected service providers.

Table 1.   Targeted Data Intermediaries

All individuals on the contact list were approached via email and invited to contribute to the research study. Out of the four entities listed, 2 accepted the invitation to participate: DKE-Data and DataSpace Europe. Despite multiple efforts to include them, DjustConnect and JoinData chose not to participate in the study.

The study also includes interviews with EU representatives from organizations involved with agricultural data sharing practices to capture the broader policy and regulatory context influencing Data Intermediaries in the European agricultural sector. The selection criteria focused on high-level policy stakeholders, responsible for strategizing EU data sharing frameworks and supporting the implementation of regulations that shape the agriculture data sharing ecosystem. By including these representatives, the study ensures a tailored understanding of policy expectations and compliance pressures shaping the context in which the European agriculture DIs, regardless of their country base, need to navigate to develop their business models. The list below presents the targeted EU policy

organizations and roles for the interview. **Table 2** lists the key organizations invited to the study according to the previously mentioned selection criteria.

Organization	Role	Targeted Participants
Directorate-General for Communications Network, Content and Technology (DG CONNECT)	Develops and carries out the Commission's policies on the Digital economy and society. Also, it supports policy and funding for data space development.	*Involved directly with data sharing policies and/or agricultural data governance.*
Directorate-General for Agriculture and Rural Development (DG AGRI)	Develops, implements, monitors, and evaluates the Common Agricultural Policy to meet specific economic, environmental, and social objectives.	

Table 2.   Targeted EU Policymakers

Participants were contacted via email and subsequently referred one another, voluntarily agreeing to take part in the study. All individuals gave their consent to take part in the interview process and requested confidentiality due to the sensitive nature of the policy discussions.

4.3   Data Collection and Analysis

This research is guided by Dynamic Capabilities Theory as the overarching framework to explore the adaptation strategies of Data Intermediaries. Concepts from Platform Business Model theory complement the analysis by providing contextual insights into the data intermediation landscape (see **Figure 1** for the integrated framework). Both theories are directly linked to the research questions and informed the structure of the interview guide. The questionnaires (see **Appendix A**) were developed based on these theoretical lenses and a review of existing literature, addressing topics such as data sharing regulations, market conditions, and ecosystem development. Rather than testing specific hypotheses, the focus is on understanding how theoretical concepts manifest in practice, allowing patterns and insights to emerge from participants' responses. **Table 3** outlines the relationship between research questions, focus areas, and data sources that guide data collection and analysis.

ID	Research Questions	Research Questions Focus	Data Source	Referential Concepts
1	How are European Data Intermediaries in the agriculture sector assessing and responding to the nascent and regulated European data sharing market and building their data sharing ecosystems?			
1.1 Regulatory Compliance	*How do DIs assess and respond to EU data sharing regulations?*	• Assessment of opportunities and challenges posed by regulations. • Responses for addressing current and future regulatory impacts on DIs	• Data Intermediaries leaders	• Sensing, Seizing, and Reconfiguring *(Dynamic Capabilities)* • Two-sided Market, Network Effects, Ecosystem Building

1.2 Market Fit	*How do DIs assess and adapt their business models in light of the nascent nature of the data sharing market?*	• Assessment of the current DI's business model and the diagnosis of the data sharing market • Responses adopted to review and improve the business model to cope with the data sharing market scenario.	• EU Policy Reports + EU policymakers • Data Intermediaries leaders + DIs public information	*(Platform Business Models)*
1.3 Ecosystem Building	*How do DIs assess and respond to strategic stakeholder relationships to build their data sharing ecosystem?*	• Assessment of the DI's strategic stakeholders and data sharing ecosystem • Responses adopted for managing stakeholder collaborations for building an operational data sharing ecosystem	• EU Policy Reports + EU policymakers • Data Intermediaries leaders + public information	

Table 3.   Research Questions, Research Focus, and Data Sources Link

For data analysis, this study employs a combined inductive and deductive approach to analyze the data collected from semi-structured interviews to get a multilayered understanding of the insights of the different interviewee groups. This happens in two stages of the data analysis, first with a Reflexive Thematic Analysis to capture the views of policymakers in the raw data, the topics that emerge within the central theme of the study, the Data Intermediaries in the EU data sharing market, followed by a Structural Coding. The latter captures the insights of DI's leaders structured within the research questions dimensions, followed by the analysis within the study's theoretical framework (Braun and Clarke 2022; Saldaña 2020). Besides being novel in the DI literature, this dual approach balances existing theoretical frameworks with an openness to discovering new strategic adaptation dynamics among Data Intermediaries in the EU agricultural sector.

In the first stage, using Reflexive Thematic Analysis to analyze the policymakers' dataset facilitates mapping how policymakers understand, frame, and interpret the data intermediation market, regulation, and ecosystem, thereby contributing contextual insight into the broader environment in which DIs operate. Thematic Analysis allows for the identification of patterns and themes that are not predetermined by the literature and theoretical framework, ensuring that sector-specific dynamics and new insights into DI adaptation emerge. The Analysis follows Braun and Clarke's (2022) recommended process: first, developing familiarity with the dataset, gathering emerging meanings from the data, then summarizing and attributing labels to blocks of similar topics, which are reviewed to find common patterns of meaning that may represent general themes. These initial themes undergo review and refinement to define them and explore their relationships with the research questions' focus, as in **Table 3**. Finally, the themes and the interpretative choices made are reported.

In the second stage, the Data Intermediaries' dataset is analyzed through Structural Coding, according to Saldaña (2020). In this phase, the data are interpreted using prior concepts (codes) from the academic literature on the three research question dimensions. This approach applies the meanings and concepts to the data segments in direct relation to the research questions. It enables us to examine the dataset and categorize the data into chunks of meaning that cross-reference the research questions and literature, which are then integrated into segments of meaning. These segments form the foundation for in-depth analysis to extract the general topics that support the answers to the research questions.

As a final methodological step, both coding phases are compared and contrasted with refining theoretical propositions by integrating empirical findings with existing frameworks. This process follows an abductive reasoning approach, iteratively adjusting theoretical insights based on the data (Saldaña 2020). This combined yet flexible analytical design ensures a comprehensive understanding of DIs' strategic adaptation. Structural Coding facilitates comparability across cases and alignment with prior knowledge, while Thematic Analysis allows for innovation and empirical discovery. By integrating these phases, the study captures both macro-level theoretical alignment and micro-level contextual nuances, contributing robust empirical insights to an emerging field.

The coding choices in this study are well-suited for some reasons. Reflexive Thematic Analysis is particularly valuable for exploring underrepresented and evolving topics, such as policymakers' perspectives on data sharing. It provides a broad perspective on the phenomena, helping to mitigate researchers' initial thoughts and biases while also opening avenues for further inquiry, particularly relevant to the emergent DIs literature. Structural Coding is also particularly appropriate for semi-structured data-gathering protocols, as it adds detail to pre-defined themes or concepts - in this study, regulatory, market, and ecosystem issues, potentially offering new insights. Furthermore, analyzing the DI contexts through three specific dimensions provides a fresh perspective on the DI market from the standpoint of the stakeholders directly impacted by these dimensions. Furthermore, combining Thematic Analysis with other coding methods, such as Structural Coding, allows the integration of emergent themes with pre-existing concepts (Saldaña 2020), enhancing the interpretation of the phenomena narratives.

Appendix B provides a summary of the methodology used in this study.

4.4   How the Data Answer the Research Question

As shown in Table 3, the study addresses the main research question across three dimensions: Regulatory Compliance, Market Fit, and Ecosystem Building. For each of

these dimensions, DIs provided responses to questions that offered insights into two key aspects: *Assessment and Response*. The data from the DIs' interviews were screened to capture, from an *Assessment* perspective, the perceptions, opinions, and evaluations of EU regulations, their standing in the market, and their interactions with key stakeholders. From the *Response* perspective, the data was combined to capture the actions, changes, and reactions that illustrate how they manage regulations, market, and ecosystem context to maintain a sustainable business model. These aspects are then used for coding the results.

Besides, policymakers' data is carefully analyzed to reveal the complexities of the macro-context surrounding policies, as well as the market pressures and expectations that are currently influencing or might influence the neutral data-sharing market in Europe. This free data analysis approach is essential, given their indirect role in the challenges faced by Data Intermediaries, as they shape the policy and market context within which DIs operate. Consequently, their insights are systematically organized to clearly represent their policies and views on Data Intermediaries in the agricultural data-sharing market.

Together, the data from DIs and policymakers provides a nuanced perspective on how agricultural Data Intermediaries in Europe are navigating and shaping a complex, regulated data-sharing environment. Furthermore, this thesis includes a range of stakeholder viewpoints, featuring critical reflections from both practitioners and policymakers, to offer a comprehensive overview of the current landscape. The analysis aims to foster constructive dialogue and improvement as the data-sharing ecosystem evolves.

4.5   Limitations of the Methods and Response Strategies

This study employs a multi-source methodology, integrating EU regulations and reports, academic literature documents to get a wide understanding of the problem, and uses in-depth interviews with practitioners to map out the DI's status in response to the needs of the European agricultural data sharing market. Despite its strengths, certain methodological limitations should be acknowledged.

The sector-specific focus on agriculture and EU DIs limits the generalizability of findings to other industries and geographic contexts. While this narrow scope enhances analytical depth, future research could apply similar methodologies to other sectors to assess the broader applicability of insights. Especially considering DIs are also spreading across other sectors. Also, the evolving regulatory landscape presents a challenge in capturing long-term trends. The DGA and other EU data policies continue to develop, potentially altering the operational environment for DIs. As a result, findings reflect a snapshot of the current adaptation strategies rather than definitive long-term outcomes.

Data accessibility and participant recruitment bring some constraints. DIs are limited in number, and some stakeholders may be reluctant to discuss regulatory and strategic challenges due to commercial sensitivities. To mitigate this, the study employs a triangulation method, integrating regulatory documents, reports, and multiple stakeholder perspectives, ensuring a balanced and well-supported analysis. Ultimately, as with all qualitative research, some subjectivity is unavoidable, especially when interpreting interview data. To address this, the study uses an iterative approach, enhancing its findings by cross-referencing various data sources and employing mixed methods for coding and analysis.

Additionally, there is a potential bias in participant selection. Although the perspectives of policymakers and DIs leaders provide valuable insights rooted in direct experience, they do not fully capture the diverse demands of the data-sharing ecosystem. Involving actors such as farmers and service providers could introduce additional viewpoints that are underrepresented in this study. To address this issue, the findings are cross-checked with previous studies that incorporate broader stakeholder perspectives, and the focus on policymakers and DI leaders is clearly articulated.

By interviewing DIs that are already operational and providing data intermediation services, the study may mainly represent organizations capable of navigating existing regulations and scaling their operations. In any case, such a fact appears as a premise to analyze the results, as the study aims to start a discussion that other scholars may further explore. Regarding the number of participants, the EU policymakers involved in the study were those directly engaged with the topic of Data Intermediaries and Data Sharing in the Agriculture Sector. These individuals also referred to one another, forming a network of experts with relevant knowledge and strategic roles. Their authoritative insights provided significant value, outweighing the benefits of increasing participant numbers merely for incremental knowledge.

Certain limitations related to the composition of the DI sample are also known. Geographically, the sample includes DIs from selected EU countries only. However, many of these organizations operate across borders within the EU, which may partially mitigate this limitation. The study is also framed specifically within the EU regulatory context; therefore, findings may not be directly transferable to non-EU settings. Additionally, not all interviewed DIs are formally recognized under the DGA. Given the early stage of the regulation's implementation and ongoing debates about its scope and definitions, excluding such organizations would have limited the inclusion of relevant market actors who might be currently active and navigating regulatory alignment.

To capture the broader landscape of DIs, the study invited organizations recognized in both academic and market contexts. Given that the data intermediation market is still developing, it was challenging to identify additional suitable participants. The study, therefore, prioritized the depth and comprehensiveness of data collected from the DIs. Both participants were senior experts in their organizations and the broader data field. They provided rich, detailed accounts that covered a wide range of issues, effectively compensating for the limited number of participants. Overall, the insights gathered from all participants strongly contributed to the study's core objectives: examining strategic responses to regulation, market adaptation, and ecosystem engagement. These objectives are best addressed through a smaller, targeted sample that enables in-depth, qualitative analysis.

Finally, this study's qualitative design aimed to gather detailed insights from experts with strategic roles in the EU data intermediation market, to deepen understanding of DIs in agriculture from the perspective of those involved in their development. By prioritizing evolving processes over static conditions, the research effectively captures the dynamic and shifting landscape of data intermediation across Europe. Furthermore, this study enhances the existing literature on DIs and actively contributes to policy discussions by engaging EU policymakers and DI industry stakeholders. It encourages a reflective evaluation of EU data-sharing policies pertaining to agricultural DIs and explores the strategic adaptations that DIs employ to navigate challenges and leverage opportunities within their respective data ecosystems.

5 Results

5.1 Presenting the interviewees

The study's insights combine the perspectives of five stakeholders directly involved in the EU data-sharing market: three EU policymakers and two leaders of Data Intermediaries in the agriculture sector. The policymakers group consisted of experienced European Commission policy officers working on data sharing policies with a cross-sectoral and sectoral focus. Their perspective emphasizes macro-level issues, including market structuring and governance models. However, it is important to note that these perspectives reflect the informed views of individual policy stakeholders and do not constitute the official position of the European Union on Data Intermediaries.

- **Policymaker 1** has played a role in the drafting of the Data Governance Act, including the conceptual foundations for Data Intermediaries. Their work focuses on cross-sectoral aspects of the EU data economy, particularly the role of governance and infrastructure in enabling data sharing across distributed ecosystems.
- **Policymaker 2** has experience across both digital and agricultural policy domains at the EU level. Their work addresses how horizontal data regulations interact with sector-specific frameworks, with particular attention to the operationalization of data-sharing mechanisms in agriculture.
- **Policymaker 3** is involved in activities related to agricultural data at the EU level. They contribute to initiatives aimed at advancing interoperability and supporting the development of technical and institutional frameworks under the Common European Agricultural Data Space.

The Data Intermediaries group included experienced leaders involved with their organizations from the start. They had strong familiarity with agricultural contexts, shaped by personal or organizational roots in the sector, influencing their platform design and engagement strategies. Their commitment is evident through long-term involvement, focus on farmer data sovereignty, and active engagement with technical, regulatory, and stakeholder challenges.

Mr. Johannes Sonnen is the Managing Director of DKE-Data. He is actively involved in its development, operation, and strategic direction and has extensive experience with technology in the agriculture field. About DKE-Data:

- Operates as a non-profit organization founded by a group of agricultural machinery manufacturers, and it maintains a small core team of four.
- It is an industry initiative that provides connectivity for agricultural machines through a data exchange platform called *Agrirouter*.

- It is a web-based data exchange platform that facilitates real-time machine-to-machine and machine-to-software communication without storing data.
- The company charges annual integration fees to connected companies, scaled by their size and return on investment. Farmers are not charged to join. It is governed on a non-discriminatory basis, where all members have equal voting rights.

DKE-Data does not self-identify as a Data Intermediary under the DGA and is not seeking certification under this framework. Nonetheless, it provides key intermediation functions such as cross-platform data exchange and access control, which align with broader definitions of Data Intermediaries (Micheli et al. 2023; Schweihoff et al. 2023). The AgriDataSpace Report (Eisenträger et al. 2024) similarly notes that DKE-Data, through its *Agrirouter* service, delivers core functionalities consistent with these broader interpretations. Including DKE-Data offers a market-based perspective that goes beyond the DGA's formal boundaries, improving understanding of its relevance across various Data Intermediary models. Meanwhile, DataSpace Europe serves as a unique example of a DGA-registered DI, illustrating the practical application of DGA principles.

Ms. Jaana Sinipuro is the CEO of DataSpace Europe. She leads the company's operations and strategic development and has an extensive background in data management and ecosystem development. About DataSpace Europe:

- DataSpace Europe functions as a Limited Company. It was initially developed under the name Value Unity in 2016 and relaunched in 2022. And it is operated by a team of five.
- It offers the *Tritom* platform for data intermediation service, which includes secure data exchange, consent-based access management, data format and transformation agreements, and a matchmaking ecosystem for data holders and service providers.
- *Tritom*'s pricing is based on a monthly subscription model, not data volume, but rather the diversity and complexity of data flows.
- The company has been registered as a DGA-recognized Data Intermediation Service since 2024.

5.2   Regulatory Compliance

This study explores how DIs understand and respond to EU data regulations, particularly the DGA and the upcoming Data Act. DI leaders were interviewed about their comprehension of these regulations, operational impacts, organizational responses, and essential internal resources and skills for management compliance. Since the aim was to understand how DIs navigate the EU data-sharing market, the interview's data was organized as follows:

Assessment: maps out the DI's interpretations, views, and judgment regarding EU data regulations that allow them to make sense of the EU regulatory environment
- *Understanding of Regulations*: interpretations of the EU data regulations' meanings
- *Perception of Regulation Impact*: opinions on how the EU data regulations affect their operations.

Response: outlines DI's actions and reactions regarding the EU data regulations, along with the related challenges.
- *Coping Actions:* actions taken to comply with or align with the EU data regulations.
- *Coping Issues:* difficulties or barriers to comply with EU data regulations.

Based on the cluster analysis, the leaders' insights identified the following points:

Category	Code	Subcodes (Interviewee)
Assessment	*Understanding of Regulations*	Data Governance Act • Differentiate neutral data sharing from large platforms (5) • Neutrality and non-discrimination in B2B data sharing (4) Data Act • Regulate machine-generated data sharing (4) • Guidelines for the flow and value of business data (5)
	Perception of Regulations Impact	In general • No direct push for farmers to share data (4,5) Data Governance Act • Compliance requirement eventually (4) • Branding/marketing for data intermediation (4, 5) • Support trust-building in data intermediation (5) Data Act • Push machine manufacturers to share data (4) • Increase the need for secure data sharing (5)
Responses	*Coping Actions*	In general • Maintain legal expertise (4) • Have fair governance mechanisms (4) • Following market standards (5) Data Governance Act • Embedding regulatory principles into technology and business model (5) • Institutional collaboration (5)
	Coping Issues	Data Governance Act • No meaningful driver for organizational development (4) • Precise neutral business model results are not clear (5) • Complexity of regulations concepts (4,5)

Table 4. Structural Coding of Regulatory Compliance

5.2.1 Assessing Data Regulations as a Data Intermediary

The results have shown that DI leaders view DGA and DA as shaping the principles of the data sharing market. Ms. Sinipuro highlights DGA as a regulation that encourages neutral data sharing, promoting the function of Data Intermediaries. At the same time, Mr. Sonnen interprets it more broadly as a pathway to foster fairness in B2B data exchange. Similarly, the upcoming Data Act is seen as a regulation that sets the foundation for B2B data sharing value and the opening of machine-generated data.

Although these organizations recognize the relevance of data regulations in the data sharing market from a principle's standpoint, they see, with varying levels of skepticism, limited effect on their operations and on their market uptake.

From Mr. Sonnen's perspective, these regulations are primarily a strategic compliance obligation. He views the DGA more as a formal requirement that might eventually need attention, a kind of label or branding tool, but not something that drives market adoption, that really helps farmers share data. Therefore, he does not have plans to pursue recognition as a DGA. In the Data Act case, he sees that while pushing to make machine manufacturers open up data, it is not a market driver "from the farmer's perspective."

Similarly, Ms. Sinipuro, leading an operational DGA DI, while sees DGA as a "branding and marketing" for building market trust among farmers, especially, she noticed the Act could benefit from direct incentives for businesses to share data, especially as the agriculture sector traditionally prioritizes data privacy, which limits farmers' willingness to share information. Regarding the Data Act, she also acknowledged room for encouraging farmers to share data, while also recognizing its value or DIs technical alignment to market data sharing needs, potentially enabling more B2B data sharing.

5.2.2   Responding to Data Regulations as a Data Intermediary

Those leaders demonstrated a clear commitment to fulfilling requirements, although their motivations and coping strategies differ significantly. Mr. Sonnen adopts a pragmatic, compliance-focused approach, aiming to meet legal obligations with minimal disruption to business operations. He emphasized the importance of fair and trustworthy organizational rules, such as shareholder agreements and antitrust memoranda, as well as the necessity of having access to lawyers to navigate compliance requirements.

Ms. Sinipuro integrates regulatory compliance into the core identity of her business, having it as a strategic foundation for building trust in the emerging data-sharing market. At DataSpace Europe, the adoption of recognized technical standards, such as IDSA, Gaia-X, and Citra's Fair Data Rulebook, forms the basis for a governance model that is both technically robust and aligned with European regulatory expectations. For her, compliance with the DGA was not an afterthought but a natural progression, as both the business model and technical architecture were already built around the principles of regulation. As she explained, "The design for our software or service was since the beginning very well aligned with the DGA," and added that "the technical solution [*Tritom*] is also quite well fit to this idea of the Data Act." Besides, she noted the policy engagement complements their technical and organizational compliance efforts, as the relationship with national authorities like Traficom in Finland, who encouraged and supported their DGA recognition, was also a key mechanism to navigate the regulation.

Overall, both see their current coping strategies for regulatory compliance supporting any future needs of the Data Act, while they haven't launched specific compliance actions. DKE-Data views that their technical infrastructure could accommodate the expected changes, but they do not treat it as urgent. DataSpace Europe indicates that their platform is already built on principles compatible with the Data Act, such as user consent, data control, and secure intermediation.

Those DIs have also mentioned some issues related to regulatory compliance in general, particularly concerning the DGA. Mr. Sonnen expressed that, from his perspective, the DGA currently offers limited direct incentives for market-driven adoption, emphasizing that market incentives, such as retail demands or subsidy conditions, play a more immediate role in encouraging data sharing. He conveys this view, differentiating the regulations' impact in their operations: one thing "is fulfilling the requirements from the EU level, whatever, and the other thing is, what are the drivers that farmers use to be differentiated."

Ms. Sinipuro while did see a strategic incentive to pursue DGA status, acknowledges the business model challenges under DGA neutrality rules: "if you act as a platform and try to reverse engineer your business models or your technology to be a neutral data intermediary, it's very complex because most of the platforms they play on transaction fees." She made clear that compliance alone is not a business driver, and economic sustainability remains a struggle.

Both interviewees observe the conceptual complexity of data regulation. Mr. Sonnen emphasizes that semantic confusion creates practical problems in implementation, especially around vague terms like "data space." Ms. Sinipuro shares this concern, describing the DGA as theoretically aligned but practically unclear. She points out that the concept of a "Data Intermediary" lacks tangible meaning for users, particularly farmers, which makes it difficult for Data Intermediaries to turn compliance into market trust or operational clarity. Overall, both DIs raise concerns about the clarity, market incentives, and operational feasibility of current data regulatory frameworks, particularly the DGA.

5.2.3 Data Intermediaries from the EU Policymaker's Regulatory View

Looking at regulatory dimensions, policymakers analyzed DIs' compliance demands, discussing policy expectations and challenges, DGA gains and hurdles, and future policy developments. Key topics appeared as shown in **Table 5.**

Theme	Subthemes (Interviewee)
Regulatory Expectations for Data Intermediaries	• Provide neutral data sharing (1, 2, 3) • Professionalize data sharing (1)

	• Preserve data ownership (2, 3) • Push forward the Data Strategy (2,3) • Make farmers benefit from their data (2,3) • Support for farmers navigating data sharing requirements (2)
Regulating DIs as a foresight activity	• Rules for avoiding future market lock-ins (1,3) • Market results may take years (3) • Limited understanding of how the DIs market might evolve (1, 2, 3)
DGA Benefits DIs	• Presents DIs as a relevant player for trustworthy data sharing (1,3) • Increase trust in DI's business model (1,2) • Increase perception of neutral data sharing value (1,2) • Clear definition of what DIs can/cannot do (2)
Challenges limiting DGA uptake by DIs	• May limit flexibility in business models choices (1, 2, 3) • Conceptual seen as a vague by some DIs (1, 2) • DGA DIs' benefits are not clear for many DIs (2) • May not fully address certain needs of emerging markets (1, 2, 3)
Barriers for DGA registration	• Regulation is unknown to many (1) • Lack of national push (1) • No clarity on implementation procedures (2) • Administrative burden for recognition (2)
Review of DGA as an opportunity	• Correct burdens on small players (1) • Address business models' burdens (2, 3) • Preserve the neutrality principle goals (1, 2, 3)

Table 5. Thematic Analysis of Regulatory Compliance

Policymakers have expressed positive regulatory expectations for Data Intermediaries as a neutral solution for data sharing. Policymaker 1 describes DIs as intermediary institutions in the economy, comparable to banks or financial entities, which can professionalize data sharing by, for example, standardizing contracts. They further emphasize that DIs are not only beneficial but necessary: "If a sector operates as a distributed market, where bargaining power is also dispersed, then you need a mechanism to bring these actors together."

Policymaker 2 highlights the social expectations placed on DIs as enablers of trustworthy data sharing, particularly in agriculture. In this context, DIs can support farmers in understanding data regulations and maintaining ownership of their data. They also suggest that DIs may serve as tools to advance the EU Data Strategy by making data rules accessible to various stakeholders, such as farmers and manufacturers. Policymaker 3 reinforces this view, stating that DIs were designed as a core element of the strategy, aiming to "put the citizen, put the customer back in the center, give him or her take control over his or her data", a critical goal in a sector marked by data concentration among large service providers. According to Policymaker 3, DIs can help farmers become more independent, gain data sovereignty, and even monetize their data.

Although policymakers acknowledged the economic and social potential of Data Intermediaries, particularly in agriculture, they emphasized that regulating DIs under the DGA remains largely a forward-looking effort. One policymaker noted that DIs are still

emerging and relatively unfamiliar to many stakeholders, which makes them challenging to conceptualize and regulate effectively at this stage. This reflects the broader difficulty of designing regulations around a model that is still in development. Policymakers 2 and 3 share a similar perspective, highlighting that the DI concept is not yet widely recognized, few actors are currently operating at scale, and sustainable business models are still evolving.

Building on this, Policymaker 1 also characterized the DGA as "enabling legislation," aimed at guiding the market before concrete risks arise: "We're anticipating risks that have not yet materialized." These include future market lock-ins and platform dominance, a precaution rooted in past experiences with winner-takes-all platforms' dynamics. Besides, the impact of DI regulation will not be immediate, as the field remains complex and is in an early stage of development, as considered by Policymaker 3.

As emphasized by Policymakers 1 and 3, the DGA positions DIs as credible market alternatives by establishing consistent, transparent, and neutral rules. These regulatory safeguards are designed to counterbalance the dominance of large service providers and promote more equitable participation in the data economy. Furthermore, both Policymakers 1 and 2 acknowledged that the DGA and the Data Act are vital in raising awareness that data sharing can benefit smaller actors like farmers, not just large corporations. However, much depends on the sector's actions, and farmers may not yet be ready to engage in these changes, as noted by Policymaker 2. Notably, the DGA also provides clear operational boundaries for DIs, requiring them to facilitate data transactions without owning or monetizing the data themselves, thereby reinforcing their neutrality and trustworthiness within the ecosystem.

However, policymakers also acknowledged that operating under the DGA framework can be challenging for Data Intermediaries. A central concern is the business model: while the DGA encourages DIs to focus on facilitating transactions, the current scale of data sharing activity may not yet support financial sustainability. The regulation also narrows the range of permissible services, which can make it more challenging to design flexible and adaptive operations. In addition, the lack of widely tested or scalable models adds further complexity to business planning. Policymakers recognized that regulating a market still in its early stages introduces additional risks, and some noted that the DGA's constraints might limit innovation in DI models more than intended.

Another challenge lies in market visibility and understanding. The concept of Trusted Data Intermediaries under the DGA is still relatively new and less familiar to many market players, especially compared to more established digital platforms. They noted that the definition of DIs under the DGA remains unclear, causing hesitation among market

players about how exactly they can operate. As one participant stated, DGA attractiveness is further weakened by legal uncertainty around business opportunities for certified DIs, with many actors seeing no clear benefits from certification. Therefore, policymakers imply that regulating a market that is still in early development brings some constraints for the DIs market development.

Beyond the regulatory foundations, policymakers pointed to practical hurdles preventing DIs from seeking DGA recognition. Policymaker 1 remarked that awareness of the DGA among stakeholders remains limited, and noted that several EU countries, including Germany, still lack registration mechanisms. Even for those aware of the DGA, Policymaker 2 observed there is "conceptual confusion," with many questions about its meaning and benefits. Since DIs are usually small firms, they often lack the capacity to manage the administrative process. As Policymaker 2 put it, "technical assistance is needed," because these organizations "don't have necessarily huge capacities," making support essential to help them comply.

Considering the regulatory compliance context, policymakers see the upcoming review of the Data Governance Act as a crucial opportunity to adjust the regulation based on early lessons. Interviewees 1 and 2 emphasized the importance of the early review clause, given that the DGA was designed as a forward-looking framework to accommodate market feedback. A key expectation is to reduce the burdens placed on small actors, as Policymaker 1 noted that most DIs are small firms with limited capacity to meet complex regulatory demands. Policymakers 2 and 3 highlighted the need to reassess the restrictions on business models, which currently limit the ability of DIs to operate sustainably. At the same time, all three policymakers implied that any adjustments should preserve the core goal of neutrality, ensuring that DIs remain trusted actors in the data economy.

5.3   Market Fit

Market Fit, in this study, refers to how DIs understand and navigate the agriculture data-sharing market in the European Union. This includes their perspectives on the business model that suits the market and promotes their economic sustainability in a growing and regulated setting. Data Intermediaries' leaders were questioned about their views on the data sharing market, business model advancements, challenges in forming a strong value proposition, and expectations for the data intermediation development market. The interview data were organized into these codes:

Assessment: interpretations and judgments regarding the agriculture data sharing market.
- *Agriculture Data Sharing Market Perceptions:* views on the current and future state of the EU agriculture data sharing market.

- *Business Model Perceptions:* views on their own neutral data sharing business model situation.

Response: actions, reactions, and business model choices to cope with the agriculture data sharing market scenario

- *Market Alignment Responses:* actions to cope with the overall agriculture data sharing market conditions.
- *Business Model Choices:* reactions and business model choices to succeed in agriculture data sharing market conditions.

From this clusterization, the DIs leader's insights are presented in **Table 6.**

Category	Code	Subcodes (Interviewee)
Assessment	*Agriculture data sharing market perceptions*	• Limited data sharing appeal 　o Limited market incentives for farmers to share data (4,5) 　o Neutral Data Intermediary is not widely valued (5) • DIs constrained by the dominant market structure 　o Dominated by big players building closed ecosystems (4,5) 　o Binding effects limiting farmers' choices for data sharing (4) 　o The agriculture sector is fragmented and decentralized (5) • Future trends will be driving the DIs market uptake 　o AI development will push for transparent data sharing (5) 　o Sustainability will push data sharing forward (4)
	Business model perceptions	• Actors influencing farmer data sharing are the users driving DIs uptake (4,5) • The funding structure is market-dependent (4,5) 　o Funding mainly from the market users/owners 　o Difficulty for DIs to access EU or public funding • Business models need credibility drivers (4,5) 　o Smooth and reliable data exchange platform 　o Trust mechanisms, such as inclusive governance 　o Fair pricing
Responses	*Market alignment responses*	• Emphasizing differentiation from traditional platforms 　o Platform architecture for decentralization (4,5) 　o Interoperability as core function (4) 　o Strict neutrality policy (4) • Motivating Data Providers and Consumers (4,5) 　o Simplify the data sharing process for farmers (4) 　o Educating farmers about data sharing 　o Engage with the downstream value chain data consumers 　o Promote the view of gains in the networked economy
	Approaches for business model success	• Leveraging internal capacities (4,5) 　o Platform robustness and readiness 　o Strong internal expertise in the sector 　o Organizational agility (4) • Serving diverse users' needs (4,5) 　o Platform responsive to the scattered data landscape 　o Tailored pricing adapted to user diversity needs • Addressing users' trust concerns 　o Built trust mechanisms into the service offer (4,5) 　o Transparency and fairness in DI's operation (4,5) 　o Alignment with regulatory and trust standards (5) • Validating business applicability 　o Build use cases to validate the business model (5)

Table 6.　　　Structural Coding of Market Fit

5.3.1   Assessing Data Sharing Market Fit as a Data Intermediary

Assessing the agricultural data-sharing market, DI leaders express similar views on the lack of a data-sharing culture in the sector. They observe that farmers often do not see clear, direct economic or practical benefits from sharing their data. Ms. Sinipuro highlights a cultural tendency among farmers to preserve their data rather than share it. Similarly, Mr. Sonnen emphasizes that, without clear external incentives, farmers struggle to see the value in participating in data-sharing initiatives: "farmers only share data when there is a 'must'." He identified farmers' motivations as primarily linked to "optimizing production processes," "fulfilling governmental requirements," or "meeting demands from food retailers or producers."

In a context where data sharing is limited, the idea of neutral, non-profit Data Intermediaries is neither compelling nor widely understood, as noted by Ms. Sinipuro. She explained that "It's a brand-new business area and most of the service providers are still thinking, and also policymakers are thinking in traditional terms about platforms." She added that even when the concept is explained, it does not lead to adoption or a willingness to pay.

Furthermore, the market for data intermediation services is challenged by the concentration of farmers' data within major agricultural companies. Mr. Sonnen observes that "bigger stakeholders... try to bring more and more data into their platform", which can result in increased farmer reliance on their services. For him, this creates data lock-ins and limits the farmer's freedom to choose how and through whom their data is shared. Ms. Sinipuro also noted that an established user base and technical capabilities of large platforms create competitive challenges for emerging DIs. At the same time, she points out that the sector's fragmentation, with many small actors and varied data types, makes data integration technically and operationally demanding for DIs.

While facing hurdles to gain market relevance, both DIs leaders are optimistic about the future of neutral data sharing, which external drivers might lead to, and for which they believe they are prepared from a technical perspective to accommodate. Ms. Sinipuro expects this momentum to come from advances in AI, mentioning that "all this buzz around AI and European developments" might require "more European approaches to data sharing just to ensure the transparency and security when training AI models." Mr. Sonnen, in contrast, sees regulations tied to sustainability and subsidies as strong incentives for farmers to share data. For him, it will drive demand for structured data sharing, indirectly boosting the need for DIs.

Reflecting on their business model approaches, both leaders revealed that the primary customers or target users for these DIs are not the farmers themselves, but the actors who

need farmers' data, creating the needs for farmers to engage in data sharing, such as machinery manufacturers and food retailers and processors (DKE-Data), as well as service providers (DataSpace Europe). They also implied these users are better positioned to pay for neutral data-sharing services provided by DIs, as they gain more immediate value from the data, such as customer retention (DKE-Data), and are often larger and more structured organizations. For instance, in DKE-Data's model, farmers do not pay for the service, while in DataSpace, the service is designed to be accessible and low-cost for farmers, with the main costs covered by service providers.

For both DIs, economic sustainability relies on the revenues from their service offer, underscoring that external source of funding, such as EU-level ones, have been challenging to acquire given the complexity and burden of navigating the existing opportunities. So, in DKE-Data's case, this comes from integration fees paid by companies that connect to their platform, while DataSpace Europe uses a tiered pricing model based on the complexity and diversity of data accessed or exchanged by users, typically service providers. As a result, DIs remain under pressure to demonstrate their value in a still developing and uncertain market.

In assessing their business models, both interviewees identified key drivers for building legitimacy among users. A reliable, easy-to-use platform is foundational for demonstrating service value, and both organizations have made dedicated investments in developing strong technical infrastructures to meet broader, more complex market demands. However, they recognize that technology alone is insufficient. They also pointed out as key drivers, the mechanisms show that DIs are not biased and protect stakeholder interests. DKE-Data adopts and enforces a non-discriminatory governance model to ensure equal participation and transparency, especially for smaller actors and data providers like farmers. DataSpace Europe, operating as a social enterprise, similarly adopted a fair and inclusive pricing model to enable smaller actors to also participate in data sharing.

5.3.2 Responding to the Data Sharing Market Fit as a Data Intermediary

With their business model and market assessment, DIs have implemented responses to meet existing needs. Both have positioned their business models against dominant centralized data platform models by emphasizing their decentralized architecture, interoperability drive, and strict neutrality. They inform their users that no revenue is generated from business transactions occurring inside the platform, nor do they act as competitors or interfere in the business of service providers. Additionally, Mr. Sonnen emphasized that their data exchange service is designed to connect and disconnect easily with any data consumers, rather than being controlled by one major player. Meanwhile,

Ms. Sinipuro states that DataSpace Europe focuses on platform decentralization and neutrality, but with a stronger emphasis on technical architecture and data sovereignty.

DKE-Data and DataSpace Europe informed the efforts to meet the needs of a two-sided market, with data providers (mainly farmers) on one side and data consumers (service providers) on the other. Especially encouraging adoption, particularly among farmers who are hesitant about data sharing. Mr. Sonnen highlighted their work to build a platform that makes data sharing simple and easy to use. As he explained, "For the farmer, it seemed to be very simple that he just granted… and we made all the work in the background." Also, both leaders indicated employment of efforts to communicate the benefits of data sharing to farmers, who are most unfamiliar.

Furthermore, DataSpace Europe and DKE-Data are actively engaging downstream actors such as food companies and industry players to align with growing demand for agricultural data and reinforce the role of DIs in service ecosystems. Ms. Sinipuro and Mr. Sonnen both highlight the benefits for data providers and users of being able to easily connect and disconnect from various partners, giving farmers and service providers flexibility and control. Their platforms are designed to support decentralized data sharing, promoting open networks as an alternative to centralized, closed systems.

The DIs outlined practical strategies to ensure their Data Intermediaries thrive in the complex and emerging agricultural data market. They leverage their internal strengths, including a regularly updated data exchange platform that caters to the evolving needs of users. Additionally, they highlighted the benefits of having strong internal expertise and a close connection to the agricultural sector, which contributes to a sector-sensitive strategic approach. This connection is evident in their organizational history, platform design, and deep understanding of market needs. Mr. Sonnen sees that running a small four-person team has been crucial to their ability to make fast decisions and adapt quickly.

Another strategy in the business response to the market consists of serving a diverse spectrum of agricultural market players. This is expressed in their service design, an interoperable and modular platform, which is open to all participants and aims to accommodate different users' needs. Both DIs have also adopted transparent, adaptable pricing models that reflect the market power and resource levels of different user groups, reinforcing their commitment to openness and inclusivity. Furthermore, DIs outlined efforts to address trust issues among its users, especially farmers, which are delaying data sharing engagement. These efforts include embedding technical and governance mechanisms that enhance user control and transparency over data flows. For example, Mr. Sonnen emphasized that *Agrirouter* does not store data itself. Ms. Sinipuro described a consent-layer functionality that requires farmer approval for any secondary data use.

Their governance structures align with the trust-building strategy. As Mr. Sonnen noted, "Each company only has one vote, regardless of how much money they pay," while Ms. Sinipuro highlighted that being a social enterprise reflects their focus on "giving the methods to control who are the actual data holders and this kind of thinking. "She goes further, informing that aligning the platform architecture with regulatory and ethical standards, such as the Gaia-X framework and Finland's Fair Data rulebook, is also a deliberate strategy to build credibility and make users feel secure in managing their data.

DataSpace Europe also emphasized that demonstrating the practical and economic value of data intermediation as essential for developing a viable business model. Ms. Sinipuro explained that they have invested in testing real-world use cases, notably through the Potato-X pilot, conducted in partnership with a Belgian DI. The pilot aimed to validate both the technical functionality and business relevance of the platform under real agricultural conditions in a cross-border set. It also served to show how the platform operates across borders and accommodates multiple types of users, reinforcing its flexibility and potential for broader adoption. Ms. Sinipuro highlighted the Potato-X pilot, run with a Belgian partner, as a way to test the platform in real agricultural settings and demonstrate its technical feasibility and business relevance across borders and user types.

5.3.3 Data Intermediaries from the EU Policymaker's Market View

Policymakers reviewed the agricultural data-sharing market and the development of DIs. They recognized challenges and offered insights into potential future developments. The insights are shown in **Table 7.**

Theme	Subthemes (Interviewees)
DIs fulfilling a market need	• Connect a fragmented data sharing ecosystem (1,2) • Separate data layer from the application layer (1) • Translators and multipliers of EU data regulations (2)
DIs Producing Social Value	• Promoters of a fair, decentralized, and ethical data sharing economy (1, 3) • Support farmer data sovereignty (1, 2, 3) • Offer simple and trustworthy access to data management (2, 3)
Challenges Hindering DI's Market Development	• DIs as an unknown or difficult to explain concept (1) • Agriculture data concentrated with big agribusiness players (2) • Varied scenarios of farm technology adoption (1) • Farmers' emergent readiness to invest in neutral data sharing (2, 3) • Data sharing market maturity might take a long time (1, 3)
Challenges for DI's Business Model	• No clear long-term model ensuring economic viability (1, 2, 3) • Data exchange volumes are currently low (1) • No widely recognized success case in agriculture (2, 3) • Neutral business model economic returns vague (1)
Measures to Support Neutral DIs Uptake	• Identify users willing and able to pay (2, 3) • Demonstrate concrete benefits of data sharing to farmers (1, 3) • Clarify and communicate gains to farmers and all stakeholders (1) • Maintain close engagement with practitioners (1, 2, 3)

DIs Uptake Beyond Policy Push	• DIs need to fulfill a market need (1, 2, 3) • Value by practitioners' view, not only the policy push (1, 2)

Table 7.   Thematic Analysis of Market Fit

Policymakers approached the economic functions and the social value of DIs in the EU data sharing market. In the fragmented nature of the agricultural sector, all with their own systems, DIs fulfill a role of organizing and facilitating data flows, as noted by Policymaker 1. Who goes further saying "DIs are necessary... if you believe that the economy should be distributed... not vertical integration like the tech giants.". In the same direction, Policymaker 2 argues that "the need for trustworthy data sharing in agriculture is high", once DIs can rebalance data market concentration among manufacturers that hold most of the agricultural data. As a result, DIs support farmers in protecting their data against being monopolized by big companies and consequently act against the harms to market competition and innovation, according to Interviewee 3.

Policymaker 1 also sees DIs fulfilling a role that might still be in development: a bridge to help disconnect the data from companies' apps and put farmers back in control. He said that today, apps like farm management systems or machine apps control both the application and the data, meaning farmers' data gets "locked" inside specific apps. DIs could break this pattern by keeping the data independent, so that multiple apps could access the same farmer's data, giving control back to the farmer. The policymaker understood that such a model is "not where we are" and "the transition is hard," but DIs can be the tool to achieve this change, rebalancing power away from big companies toward the farmers.

Policymakers 2 and 3 also highlighted the practical role of DIs as translators, helping farmers and companies understand complex EU data regulations, including rights that farmers may not be aware of. However, Policymaker 2 noted that this role depends on the DIs' own capacity to navigate regulations and invest in farmer education. This is particularly important given that legal language is often difficult to understand, and farmers typically lack the time to engage in it. In addition, DIs can provide user-friendly platforms that shield farmers from complex legal and technical requirements. Policymaker 3 share this view, comparing DIs to basic public utilities like roads or electricity, services that should be trusted, simple, and widely accessible.

While policymakers view DIs as important, they acknowledge that these organizations face significant market challenges. First, the concept of DIs remains abstract and difficult to communicate, particularly to farmers and companies. As Policymaker 1 noted, few people have seen a DI operating in practice, which limits understanding and trust. DIs also compete with large machinery manufacturers that already control much of the

agricultural data through direct relationships with farmers. Additionally, farmers differ in their levels of technology adoption and familiarity with data sharing, requiring DIs to adapt their solutions to diverse needs, as the same interviewee observed.

Policymakers also recognized that farmers often lack a direct incentive to engage in neutral data sharing. It mostly appears to them as a complex or abstract concept. As small business owners with limited IT knowledge, many farmers do not see clear value in investing time or money in something as intangible as data sharing, as Policymaker 2 observed. Policymaker 3 noted that farmers often prioritize sharing data with large companies due to the immediate benefits they receive, such as access to advanced machinery. For many farmers, the urgency of maintaining data control may be overshadowed by these practical advantages, and the potential risks of data concentration among a few providers may not yet be a primary concern in their day-to-day operations.

Policymakers described the neutral data-sharing market in agriculture as still nascent, emphasizing that its development will likely be a gradual process. The structural features of the sector itself shape this slow progression. As Policymaker 2 explained, agriculture remains a complex and traditionally slow-moving domain, constrained by small-scale operations and farmers' limited digital skills. These conditions not only delay the sector's digital transformation but also hinder the adoption of data-sharing practices. Policymaker 1 added that the current volume of data transactions might be too low to sustain DIs, raising concerns about their long-term financial viability. Both agreed that, in the short term, DIs are unlikely to overcome these foundational business model challenges.

Reflecting this broader uncertainty, the agricultural data ecosystem remains in an early and fragmented stage, with most initiatives still operating as pilots and no widely established or scalable economic models in place. The limited number of successful cases underscores the ongoing challenges, as noted by Policymakers 2 and 3. Within this evolving context, policymakers observed that the DGA's neutrality provisions introduce important safeguards for fairness and trust, but also bring additional considerations for Data Intermediaries, particularly regarding how they can structure sustainable revenue models. Policymakers 1 and 2 noted that while these rules aim to ensure neutrality and transparency, they may also limit certain monetization options at a time when data transaction volumes remain relatively low. Nonetheless, this regulatory approach may encourage the emergence of innovative, trust-based models that better align with long-term policy goals.

Meanwhile, Policymaker 3 points out that in the absence of a viable business case, DIs may need to rely on a public–private partnership to remain operational. Moreover, Policymakers 1 and 2 implied the need to explore value models involving other actors in

the value chain, as farmers may not be in a strong position to engage with or pay for DIs. At the same time, Policymaker 3 highlights the need for DIs to clearly demonstrate the benefits of data sharing to their users while also explaining their role, as many stakeholders still don't understand what DIs do, as stressed by Policymaker 1. Concluding by reinforcing the need for DIs to be closer practitioners, such as farmers' associations, is key for a market-sensitive and practical DIs service offer.

Policymakers recognized that while EU data policies promote the role of Data Intermediaries, their value and market development ultimately depend on addressing the practical needs of agricultural data-sharing stakeholders. Policymaker 1 emphasized the importance of aligning public initiatives with real demand, cautioning that investments disconnected from user needs may fail to deliver meaningful outcomes. In their view, the success of DIs depends on financial sustainability and grounded use cases. Without a viable model or active market engagement, they noted, even well-intentioned policy efforts may have limited effect. This reflects a broader view shared among the interviewed policymakers: while regulatory foresight can create enabling conditions, the long-term viability of DIs hinges on clear use cases, demonstrated demand, and alignment with practitioners' realities.

5.4   Ecosystem Building

In this study, Ecosystem Building refers to how DIs understand and navigate strategic stakeholder relationships to build their data sharing ecosystem. This includes their perspectives on relevant partnerships and their benefits, as well as their approaches for building their own ecosystems in the broader EU agriculture data market. Data Intermediaries' leaders shared their strategies for managing stakeholders and understanding user needs. They emphasized collaboration with data sharing partners, assessed policymakers' support, and offered insights on EU Data Spaces. The interview data were organized into these codes:

Assessment: insights, perspectives, and assessments about the EU agriculture data sharing ecosystem
- *Agriculture data sharing ecosystem perceptions:* views of the EU agriculture data sharing ecosystem, opportunities and challenges, and their position within it
- *Strategic stakeholders' evaluation:* views of key partners in the EU agriculture data sharing ecosystem

Response: actions, reactions to leverage strategically the agriculture data sharing ecosystem stakeholders
- *Efforts for navigating the EU agriculture data sharing ecosystem*: actions to align with the EU agriculture data ecosystem needs.

- *Approaches for a functional data sharing ecosystem*: responses to establish and sustain their own functional data-sharing ecosystem.

From this clusterization, the leader's insights are presented in **Table 8.**

Category	Code	Subcodes (Interviewee)
Assessment	*Agriculture data sharing ecosystem perceptions*	• Neutral data sharing as a distinct market player (4,5) • Neutral data sharing fulfills existing market needs (4,5) • Neutral data sharing beyond technical functionality (4,5)
	Strategic stakeholders' evaluation	• Food retailers and producers drive farmers to share (4) • Machinery manufacturers as clients for connectivity (4) • Farmers' unions support building the trust of farmers (5) • Communities of practice for networking (4,5) • Regional data sharing initiatives for collaborations (5) • Service Providers and Startups as data consumers (5) • Government influences data sharing ecosystem (4,5) • EU Data Spaces lacks practical gains (4, 5) • EU Data Space participation as credibility-building (5)
Responses	*Actions for navigating the EU agriculture data sharing ecosystem*	• Enterprise structure/governance promoting trust (4, 5) • Partnerships to navigate common needs (4, 5) • Promoting easy access to a networked economy (5)
	Approaches for a functional data sharing ecosystem	• Users' business embedded participation (4, 5) • Clear agreements with the "game rules" (4, 5) • Platform addressing users' fears and knowledge gaps (4, 5)

Table 8.   Structural Coding of Ecosystem Building

5.4.1   Assessing Ecosystem Building as a Data Intermediary

DIs leaders see their organizations as distinct market players in the data sharing market, with a focus on neutrality, user control, deep agricultural understanding, flexibility, and opposition to platform lock-in models. Therefore, alternatives to large data platforms that pursue vendor lock-in and control over farmer data should be established. Furthermore, they described the origin and design of their organizations as revealing their direct response to specific gaps and demands in the agricultural data-sharing market. Mr. Sonnen explained that machinery manufacturers established their DI to address a technical challenge of enabling data exchange across different brands. Farmers were struggling with incompatible systems, making neutrality essential to prevent any single brand from dominating or excluding others. Similarly, Ms. Sinipuro described their DI as a response to trust and governance issues. Farmers needed control over data access, while service providers required secure, compliant data flows. This demand led to the development of a consent-based, transparent data exchange mechanism.

The leaders reflected on strategic stakeholders in building their data sharing ecosystem. Mr. Sonnen emphasized that food retailers and producers are pushing data sharing by demanding "more and more data" from farmers and warning, "if you don't deliver data,

you won't deliver the goods." This creates market pressure to comply. He also identified machinery manufacturers as key enablers, embedding data exchange services into equipment. The formation of DKE-Data and *Agrirouter* was driven by these manufacturers, recognizing that connectivity is essential for selling modern machinery.

Similarly, Ms. Sinipuro informed that service providers, such as agritech startups and software vendors, are also central stakeholders, as they drive demand for data: they can "promote their services, identify themselves, and tell that this is the type of data that I need." In addition to service providers, Ms. Sinipuro identified several other key stakeholders involved in the development of DataSpace Europe. She emphasized the importance of collaborating with farmers' unions to build trust and demonstrate that the intermediary prioritizes farmers' interests and control over data. The value of working with communities of practice, such as GAIA-X, to strengthen credibility within the ecosystem was also mentioned. Finally, she highlighted the contribution of regional data-sharing initiatives as partners in piloting and increasing the platform's visibility.

Both leaders see the public sector, EU and/or National Governments, as key for pushing data sharing in the agriculture sector, by fostering farmers' engagement. Mr. Sonnen emphasized that national subsidy models linked to smart farming technologies are practical tools for promoting data sharing, and cited Denmark as a positive example, where CO_2 taxes and subsidies encouraged the use of smart machinery and data sharing. Ms. Sinipuro also highlighted the public sector's role in supporting Data Intermediaries, especially in terms of credibility and funding. She also valued the involvement of the DGA Authority in Finland in supporting the registration process. She noted that public funding bodies such as Business Finland and the Finnish Climate Fund were essential for sustaining R&D and early operations at DataSpace. While both recognize the government as a key player, their views on the effectiveness of support differ. Ms. Sinipuro sees active involvement from Finnish institutions as a success factor, whereas Mr. Sonnen reported a perceived lack of support from the EU and national authorities.

Furthermore, DKE-Data and DataSpace Europe see themselves as more than just technical tools in the data-sharing ecosystem, as their role goes far beyond simply enabling data exchange. Ms. Sinipuro, for instance, emphasized that DIs are about "raising the negotiating power for farmers" and helping them control who uses their data. Mr. Sonnen, in turn, sees DKE-Data structuring collaboration across the entire agricultural value chain through governance structures and legal agreements that allow companies to interact through the platform.

When asked about European Union initiatives to promote data sharing, such as Data Spaces, both leaders expressed skepticism about their practical impact. Mr. Sonnen

acknowledged being aware of the Data Space initiative but remarked, "today that influenced us not very well." He was concerned with a clear practical orientation, commenting, "From my perspective… that is more university-driven… I don't think that has a big influence for the farmer." Similarly, Ms. Sinipuro observed that, at this stage, the primary value of EU Data Spaces lies in building credibility, with broader market contributions still emerging.

5.4.2   Responding to Ecosystem Building as a Data Intermediary

Data Intermediary leaders view participation in data-sharing initiatives as essential for navigating technical challenges and strengthening their position in the ecosystem. Ms. Sinipuro highlighted that involvement in the cross-border data-sharing pilot not only enhances visibility and credibility but also reinforces their identity as a farmer-centric and trustworthy intermediary. For Mr. Sonnen, engagement in initiatives like the Agricultural Interoperability Network supports direct technical integration with machinery and software providers, enabling the development of practical, cross-platform solutions.

Both leaders refer to tools and features that support connections between data providers, such as farmers, and data users, such as service providers, as key features for promoting the value of their services in the market, particularly through the lens of a networked economy. Mr. Sonnen emphasizes *Agrirouter*'s ability to enable simple, flexible data exchanges, where farmers can easily connect to any integrated service provider, and service providers only need to integrate once to access multiple farmers' data (with permission). Ms. Sinipuro also builds on this logic by incorporating matchmaking dashboards and consent-based data flows, which support the creation of new service bundles and business opportunities, not only between farmers and providers but across the broader agriculture data value chain.

Finally, for keeping their own data ecosystem flourishing, these DIs emphasize that building a functional agricultural data sharing ecosystem relies on staying close to their users' needs. DKE-Data manages user embeddedness through a nonprofit structure with equal voting rights and a platform that gives farmers control over their data connections. DataSpace Europe does so via a consent-based service model and governance rooted in the farmers' union, aligning operations with user control and interests. Also, reaching out to the many stakeholders across the ecosystem and designing their platforms to ensure neutrality, transparency, and fairness. Mr. Sonnen relies on legal structures, including shareholder agreements, business partner agreements, and antitrust rules, to increase trust. Ms. Sinipuro highlights a technical and consent-based model, ensuring that all data flows are permissioned and under user control.

Both leaders agree on the importance of investing in user-friendly tools to support stakeholder understanding of the benefits of neutral data sharing. They each emphasize platform design as a form of embedded learning. Mr. Sonnen argues that DKE-Data's approach centers on letting users learn by doing, without pressure. Ms. Sinipuro similarly explains that the data exchange platform was intentionally designed to make the data sharing process understandable, particularly for farmers unfamiliar with the concept, promoting transparency and user agency.

5.4.3 Data Intermediaries from the EU Policymaker's Ecosystem View

Looking at the agricultural data-sharing ecosystem and the evolving role of Data Intermediaries, policymakers emphasized DI's position, challenges, and opportunities in their ecosystem-building strategies. The insights are combined in **Table 9**.

Theme	Subthemes
Data Intermediaries unlocking the data sharing ecosystem	• Providing technical infrastructure for data sharing (1, 2, 3) • Promoting farmers to benefit from their data (1, 2, 3)
Power in the agriculture data sharing ecosystem is imbalanced	• Service providers' dominance (1, 2) • Limited neutral data sharing initiatives (2)
DIs need to address the needs of a multistakeholder ecosystem	• Find many stakeholders, not only farmers (1, 2, 3) • Act on existing market needs (1, 3) • Align technically with industry providers (2) • Make the multi-stakeholders' benefits clear to them (3)
EU Data Spaces and DIs are both still in development	• DIs as tools to support participants of data spaces (1, 2) • New arena to offer services (1) • Path to development is uncertain at this early stage (2, 3)
EU support for the DIs' development in the ecosystem	• Promoting the use cases for DIs (1, 3) • Providing market trust and branding DIs (1, 2) • Forming partnerships for market development (3) • Raising awareness of data sharing benefits (1,3) • Refining DGA using market feedback (1, 2, 3)

Table 9.   Thematic Analysis of Ecosystem Building

Policymakers looking at the overall data sharing ecosystem positioned DIs as foundational entities that enable distributed sectors like agriculture to participate in the data economy. They offer trustworthy and standardized mechanisms for sharing data between organizations, enabling the ecosystem to develop and scale. While also empowering farmers, helping them reclaim access, understand the value of their data, and selectively share it. On the other hand, policymakers noted that DIs operate in a highly concentrated market, which restricts the availability of ecosystem participants. Policymakers 1 and 2 note that machinery manufacturers and agritech service providers hold significant control over agricultural data because of their direct link to farmers and their ownership of the data infrastructure, which gives these large private actors leverage over smaller players. Also, while there are local or national data-sharing initiatives, Policymaker 2 notes that neutral DIs are few, and their ability to balance market power is

still limited: "It's great to see regional or national data-sharing initiatives... But if you look at the data volume… manufacturers still play a central role."

Policymakers stressed that DIs should position themselves within a broader, multi-stakeholder ecosystem to ensure long-term relevance and sustainability. Rather than focusing solely on farmers, they argued, DIs should actively engage a wide range of actors across the value chain, including input providers, agribusinesses, and tech companies. Policymakers 1 and 3 emphasized the importance of grounding DI development in concrete, existing market needs, while also recognizing the broader role of policy in setting strategic direction. This means identifying real problems and offering data-enabled solutions that stakeholders already recognize as valuable. Policymaker 2 further noted that technical alignment with industry players is not optional but essential, particularly in agriculture, where dominant firms often determine how data is structured, exchanged, and stored. Finally, Policymaker 3 stressed that DIs should make the benefits of data sharing clear and concrete for all participants. This includes showing stakeholders, through practical examples, how access to large data pools can enable the creation of new services or startups that address specific sectoral challenges.

Considering the influence of the EU Data Spaces push, policymakers found DIs and EU Data Spaces as strategic but experimental constructs for data sharing that are expected to evolve together. Policymaker 1 emphasized that DIs are functionally necessary to make Data Spaces work, particularly in distributed ecosystems like agriculture. He sees DIs as entities that can offer essential services, such as data discovery, within Data Spaces. However, it is also acknowledged that this role depends on Data Spaces reaching operational maturity. Policymakers 2 and 3 noticed DIs and Data Spaces as emerging models still taking shape, evolving through ongoing learning and collaboration. Policymakers 3 noted that even after preparatory actions, many stakeholders still find the framework complex and undefined and are waiting to see how it will develop in practice.

Finally, those policymakers pointed out that the European Union offers multiple forms of support to unlock data sharing and directly and indirectly promote neutral data sharing business models. Promoting use cases plays a foundational role in helping DIs become viable entities within emerging data-sharing ecosystems, and Policymaker 1 links this to the public investment in data spaces, for which "at some point, intermediaries will just become a necessity." Discussing the "chicken and egg" problem in the data-sharing ecosystem, the policymaker emphasized that the practical value of DIs will increase as structured, cross-organizational data becomes essential for advanced services like AI. He positioned DIs as a necessary layer in future digital infrastructures, especially as the EU is developing technical frameworks, such as AI factories linked to supercomputing centers, which rely on pooled, accessible data to function effectively.

Besides, Policymaker 3 views that automated data exchange in the public sector could be a key policy direction for supporting data sharing and enhancing the role of neutral data sharing. The public sector's need for automated compliance, subsidy reporting, and digital farm passports creates a demand for trusted entities to manage and securely share data for farmers, a role that DIs can fulfill. Policymakers 1 and 2 also see the DGA certification as a way to give DIs a market-recognized trust label that signals credibility. Legal clarity and recognition could help DIs operate with greater user and market trust, particularly if farmers or service providers are uncertain about whom to trust with their data, as noted by Policymaker 2. But Policymaker 1 recognizes that branding alone isn't enough unless the label becomes well-known and valued.

Policymaker 3 views the public sector as having an essential role in enabling the development of neutral Data Intermediaries. He stresses that DIs cannot scale without strong public-private collaboration, particularly in a market that currently lacks sufficient transaction volumes to sustain purely private models. They argue further that private investors are unlikely to back DIs unless the EU steps in to help create viable business conditions, which include risk-sharing and benefit-sharing mechanisms. To that end, he supports the idea that policy efforts consider collaborative pilot projects that bring together multiple actors to share costs, technical expertise, and adoption risks.

Policymakers 1 and 3 agreed that raising awareness about Data Intermediaries and the benefits of data sharing is crucial in agriculture. They see the EU's role as promoting this through supportive policy frameworks and pilot initiatives that showcase tangible value. At the same time, they acknowledged the limitations of what policy alone can achieve, particularly in encouraging companies to digitize and collaborate. One policymaker noted that, beyond creating enabling conditions, the EU can only encourage such transitions, as the actual uptake depends heavily on market readiness and stakeholder engagement. Despite these constraints, all three policymakers expressed optimism that the upcoming DGA review in 2025 could offer an opportunity to refine the regulation to better support the uptake and sustainability of DI business models. Policymakers 1 and 2 emphasized the need for more clarity and flexibility in the regulatory framework, primarily to support smaller or newer DIs. Policymaker 3 also highlighted the importance of technical assistance and practical guidance, particularly in sectors like agriculture.

6   Discussion

6.1   Regulatory Compliance Assessments and Responses

Regulatory compliance with EU data regulations is highlighted in the DKE-Data and DataSpace Europe narratives as an area of attention for their operations, but not as a primary driver of their business development. They identified DGA and the Data Act as regulations of interest; however, their assessment and responses to them vary. DataSpace Europe regards the DGA as strategic for building trust in their business model and aligned to their practices, which already follow neutrality principles, with registering as a DGA-compliant DI as a natural path. The DGA's rules on neutral data-sharing business models are seen as distinguishing Data Intermediaries from large commercial platforms, supporting their role as credible and trustworthy facilitators of secure, permissioned data exchange, as discussed in the literature (Bobev et al. 2023; Micheli et al. 2023; Von Ditfurth and Lienemann 2022). In the agricultural sector, this view appears particularly relevant, as DataSpace Europe observes that farmers are often concerned about losing control over business-critical data and remain skeptical of data-sharing benefits, reflecting issues reported in prior studies (Brown et al. 2023; Ryan et al. 2024; Sullivan et al. 2024; Wolfert et al. 2024).

In contrast, DKE-Data views the DGA more as a signaling mechanism and not a priority for their operation, as they see little contribution to their core mission: meeting the needs of shareholder machinery manufacturers for better connectivity and data exchange. They further assess, as also does DataSpace Europe, that the Act lacks demonstrable benefits from compliance; while also pushing business model restrictions, neutrality requirements may hinder monetization options, and in a market that lacks maturity and clear demand. Another concern is that the DGA concept of Data Intermediary is unclear, and it is hard to communicate its benefits, particularly to farmers, who do not understand the role and see little incentive to engage. These several challenges have already been mapped in the literature as hurdles for DIs to structure the model around DGA push (Bobev et al. 2023; Carovano and Finck 2023; Richter 2023; Von Ditfurth and Lienemann 2022), while the demanding obligations and high compliance costs for compliance did not appear as a problem for the interviewed DIs.

DKE-Data did not pursue DGA registration, citing the absence of a functioning national authority and limited relevance to their industry-driven model. In contrast, DataSpace Europe registered as a DGA data intermediary, supported by an active national authority in Finland that facilitated the process. Reinforcing the view that DGA Authorities could take proactive support, such as guidance on eligibility or registration procedures

(Verstraete et al. 2023; Von Ditfurth and Lienemann 2022) to support DIs to navigate regulatory opportunities.

In assessing the upcoming Data Act case, these organizations also look at this through a market alignment view, rather than a mere regulatory compliance need. Both see it as relevant to bring market demand for their services as it may create opportunities for their service offering, as facilitators aiming to support other actors, such as data holders and users, in navigating the new legal obligations associated with data sharing. While DataSpace Europe notes likely compliance needs from their side, they believe their business model is technically ready to accommodate. Overall, neither of them reported concerns or specific compliance actions in preparation for the Act. This approach aligns with the literature, suggesting that the Act may enhance data sharing opportunities across sectors (Brunori et al. 2025). This contrasts with concerns that the Data Act could impose regulatory burdens and fail to address agricultural needs (Carovano and Finck 2023; Ryan et al. 2024; Turpeinen et al. 2024) and has not motivated DIs to act in accordance with the Act.

Both DKE-Data and DataSpace Europe indicate that neither the DGA nor the Data Act provides direct benefits for encouraging businesses to engage in data sharing. These DIs note, in line with existing sectoral studies (Brown et al. 2023; Sullivan et al. 2024; Van der Burg et al. 2021), that farmers often lack a culture of data sharing due to limited awareness of its value, low digital skills, and the absence of immediate, tangible benefits. They reinforce many scholars' critiques that those regulations establishing legal and structural conditions for data exchange may benefit from a focus on stakeholder engagement and behavioral change necessary for a neutral, trust-based data-sharing culture (Bobev et al. 2023; Micheli et al. 2023; Ryan et al. 2024; Schweihoff et al. 2024; Wolfert et al. 2024). In this context, neither the organization views the DGA nor the Data Act as primary market drivers and notes that efforts to build data-sharing awareness, particularly among farmers, come from their own actions rather than from regulatory intervention.

Despite these regulatory assessment accounts, both DIs have several strategies to respond to regulatory needs, mostly by incorporating their demands into their businesses and technology architectures once they align with their existing business model needs. However, DIs demonstrated different approaches based on how they position regulation support for market development. DKE-Data primarily treats data regulation as a compliance obligation rather than a strategic opportunity, following a reactive approach. In which regulatory requirements are addressed only when compliance is necessary. Their focus remains on regulatory monitoring, supported by internal legal expertise, while

governance structures, such as shareholder agreements, follow principles of fairness and trust common in industry collaborations. In contrast, DataSpace Europe adopts a proactive stance, treating regulations as strategic tools for building market credibility and trust, while not directly fostering demand. They proactively implement established market frameworks for secure data exchange, built by the data sharing communities, which have contributed to prior alignment with regulatory requirements, including DGA and Data Act. They also maintain ongoing engagement with policy and regulatory actors, leveraging existing collaborations and learning with the agricultural data sharing community of practice.

Nevertheless, for both DIs, compliance is not a priority until it directly influences their business needs, as the response to the forthcoming Data Act shows. For instance, since both DKE-Data and DataSpace Europe are focusing on building farmer engagement and overall demand, and do not perceive immediate compliance obligations under the Data Act, they do not prioritize it in their current strategies. Overall, as the DGA and Data Act responses shows, both DIs rather than finding ways outside the regulation due to obligations and constraints that are outweighing the potential their economic viability (Bobev et al. 2023), they instead are selectively engaging with them as they perceive direct alignment to their business needs, and support for data sharing market development, having the ecosystem and institutional support as means for legal clarity as shown in the DataSpace Europe case.

6.2   Market Fit Assessments and Responses

When evaluating the agriculture data sharing market in which they operate, both DIs noted challenges that complicate their development, as many scholars have also noted. A key issue is the sector's early stage of maturity, where farmers often fail to perceive the benefits of data sharing (Brown et al. 2023; Van der Burg et al. 2021; Wolfert et al. 2024). The sector remains highly fragmented, with diverse sharing needs and systems, requiring neutral data-sharing services to be highly adaptable (Micheli et al. 2023; Sullivan et al. 2024; Turpeinen et al. 2024). The current market structure tends to be dominated by large data providers who manage significant portions of agricultural data (Martens et al. 2020; Richter and Slowinski 2019; Sullivan et al. 2024), which might constrain the demand for alternative solutions like DIs. Besides, such a concept remains difficult to convey for potential users, further challenging DI's attractiveness in the market in which other forms dominate connections with those users (Carovano and Finck 2023; Verstraete et al. 2023).

As a consequence, in the current scenario, DIs face limited market uptake while having a service offer that can rebalance power disparities and make data sharing practices fairer and more transparent (Brown et al. 2023). They lack direct market incentives, awareness

of DIs' benefits, trust in how their data will be used, and the digital capabilities needed to engage with complex platforms. Farmers often do not perceive clear, immediate value in sharing data and are more likely to engage only when external forces, such as government subsidies, regulatory requirements, or demands from food retailers, make it necessary. These challenges, identified by Data Intermediaries, are consistent with findings in the sector's literature (Brown et al. 2023; Ryan et al. 2024; Sullivan et al. 2024; Wolfert et al. 2024; Wysel et al. 2021), which highlights the need for data intermediary platforms to operate "on the ground." This involves offering practical support, advice, and technical services directly to farmers, thereby acting as trusted entities that bridge the knowledge and trust gap, while aligned to fair governance practices.

In fact, to respond to the current market needs, both DIs' strategies evolve around addressing trust issues and increasing awareness and incentives for data sharing. On one hand, DKE-Data and DataSpace Europe reinforce neutrality principles and articulate a clear communication that distinguishes them from dominant market players to alleviate users' concerns regarding potential conflicts of interest, data lock-ins, and lack of control over data usage (Micheli et al. 2023; Richter and Slowinski 2019; Ryan et al. 2024). DataSpace Europe particularly emphasizes DGA recognition as a trust-building asset, framing it as a social enterprise focused on protecting farmers' data rights and demonstrating farmers' engagement. This supports the view that regulatory alignment can enhance credibility in low-trust environments (Verstraete et al. 2023; Von Ditfurth and Lienemann 2022). Mostly both DIs embedded trust mechanisms, such as including interoperability standards and data-sharing consent systems, to support user control, legal clarity, and secure data exchange (Brown et al. 2023; Micheli et al. 2023; Wysel et al. 2021).

On the other hand, DKE-Data and DataSpace Europe combined trust-building efforts with targeted market strategies to strengthen their market presence. They positioned their data exchange platforms, *Agrirouter* and *Tritom*, respectively, not merely as technical tools, but as core representations of their service value and potential. These platforms were designed to address the needs and concerns of both data providers and consumers by offering the necessary structures and functionalities for effective data exchange. This approach was reinforced by their deep understanding of agricultural workflows and stakeholder dynamics, supported by in-house agricultural expertise that informed service design and ensured alignment with user requirements. Together, these actions support Richter and Slowinski's (2019) claim that trust must be reinforced by operational and economic alignment with user realities to ensure large accessibility and value. And reflect the view that DIs succeed when user-centric service models are grounded in domain expertise (Micheli et al. 2023; Schweihoff et al. 2023).

Additionally, to allow participation from a wide range of data providers and consumers, from small farmers to large machinery manufacturers and service providers, in data intermediation services, they offered pricing models adapted to users' capacities. By addressing payment disparities through flexible pricing, they respond to structural barriers in the agricultural data economy (Brown et al. 2023; Farrell et al. 2023; Wysel et al. 2021), while alleviating farmers' concerns about the unequal distribution of costs and benefits of the data shared with data consumers, such as agribusinesses (Sullivan et al. 2024). Therefore, they account for sector-specific adaptations and incentive alignment in trust-deficient and fragmented markets like agriculture (Brown et al. 2023; Kalmar et al. 2022), in which stakeholders' needs vary widely.

However, both Data Intermediaries recognized that a trust-based, farmer-centered approach was insufficient on their own. To scale their services more effectively, they adopted a dual market perspective, identifying data consumers, such as downstream industry actors, as more strategic entry points. This shift aimed to address the common "chicken-and-egg" dilemma in platform development (Srinivasan 2021; Tiwana 2014b), where farmers are reluctant to share data without seeing concrete benefits, while data consumers remain hesitant in the absence of sufficient farmer participation, despite being more open to engagement. By targeting data consumers who can more immediately perceive the value of DI services, such as machine connectivity or access to agricultural data for application development, both organizations sought to generate real-world use cases.

These use cases, developed by data consumers, could then be leveraged to demonstrate tangible benefits to farmers, such as smart services that enhance decision-making and operational efficiency. This strategy supports the creation of stronger network effects, widely recognized as essential for sustaining markets in the data intermediary space (Richter and Slowinski 2019; Schweihoff et al. 2023; Verstraete et al. 2023). This consumer-oriented approach is particularly critical given that both DIs operate primarily on market-based revenue models and depend on user payments. Securing alternative funding, whether through private investment or complex EU funding mechanisms, remains difficult, especially for small firms (Verstraete et al. 2023; Von Ditfurth and Lienemann 2022).

Their focus on data consumers is particularly strategic given that these DIs rely heavily on market-based revenue models, primarily deriving income from user payments. In this context, data consumers typically possess greater financial capacity to pay for services compared to data suppliers, especially in sectors like agriculture. Moreover, accessing external resources, whether through private investment or navigating complex EU

funding mechanisms, remains challenging, particularly for smaller and early-stage firms (Verstraete et al. 2023; Von Ditfurth and Lienemann 2022). As several scholars have emphasized, platform-based business models need, especially in their early stages, to prioritize the side of the market where the value offered can be more readily monetized (Muzellec et al. 2015; Srinivasan 2021). Consequently, targeting data consumers enables DIs to establish a more viable revenue base, stabilize operations, and progressively build the trust and participation of data providers.

Overall, DIs' market strategies to build demand have focused on creating clear incentives to enhance user engagement, with efforts directed at balancing value propositions across both sides of the market, a key approach to gaining traction in platform-based ecosystems (Micheli et al. 2023). Their narratives emphasize the benefits of decentralized and connected data sharing, aiming to eliminate vendor lock-ins and promote a more open data economy in which both data providers and users can benefit from diverse ecosystem opportunities. This approach aligns with the EU Data Strategy's strategic objective of fostering decentralized, transparent, and competitive data spaces that support service diversity and user empowerment (Bobev et al. 2023; Carovano and Finck 2023). Furthermore, they focus on educating the participants to recognize the advantages of neutral, interoperable, and permissioned data flows. Reinforcing DIs' need for clearly communicating the value of data sharing and creating demand-side activation strategies in nascent markets (Brown et al. 2023; Micheli et al. 2023; Ryan et al. 2024; Schweihoff et al. 2023). Positioning DIs in the market as facilitators of understanding around data sharing, not merely technical tools (Richter and Slowinski 2019; Schweihoff et al. 2023).

Looking forward to their future market development, both DKE-Data and DataSpace Europe identify emerging trends as significant future drivers of demand for data intermediation services: *AI* and *sustainability*. DKE-Data anticipates that regulatory and supply chain requirements related to sustainability will increase the need for farmers to share operational data. DataSpace Europe expects that the growth of AI applications will generate demand for high-quality, permissioned datasets to support model development and meet compliance standards. While both organizations report being technically prepared to support these developments, only DataSpace Europe explicitly links this readiness to enabling B2B data exchange in line with the Data Act.

Nevertheless, both emphasize that the main challenge lies not in technological capacity but in stimulating effective demand. They suggest that when external incentives, such as regulatory push or sustainability reporting, create tangible data-sharing needs, their platforms are well-positioned to operate accordingly. DKE-Data highlights Denmark as an example, where a CO_2 tax reduction linked to smart farming creates direct economic

incentives for data use. In contrast, Germany's focus on mandatory compliance, without comparable financial drivers, is seen as less effective in promoting engagement. This supports the view that exogenous incentives are essential for Data Intermediaries to overcome regulatory burdens and immature markets (Von Ditfurth and Lienemann 2022). Nonetheless, DKE-Data and DataSpace Europe interpret these trends as opportunities to develop their business models. For which assessing and building a data sharing ecosystem of stakeholders is crucial.

6.3   Ecosystem Building Assessments and Responses

Evaluating the agricultural data sharing landscape, DKE-Data and DataSpace Europe present themselves as necessary alternatives for data sharing, fulfilling the sector's needs for a fair and reliable option that empowers farmers with data ownership and allows data consumers secure access to interoperable, standardized channels for data retrieval, ensuring benefits are transparent and compliant. In this context, both DIs increasingly assume the role of orchestrators in agricultural data ecosystems, coordinating interactions among diverse actors and enabling structured, rule-based data exchanges (Brousseau et al. 2024; Schweihoff et al. 2024).

DKE-Data and DataSpace Europe, while having different businesses focus, both identified similar stakeholders as strategic partners for their business development, mapping their necessary value exchange. From a direct user's perspective, both informed farmers and downstream industry players are, respectively, their main data providers and consumers. On the consumer side, DKE-Data emphasized that food retailers and producers are primary drivers of data sharing, as they increasingly require farmers to provide specific data on practices such as fertilization, crop protection, and soil preparation to access their markets. This demand compels farmers to adopt data-sharing tools, making these actors essential to the DI's operational relevance. Likewise, machinery manufacturers, who require connectivity for their equipment, function both as contributors, by integrating their machines with the platform, and consumers, by accessing shared data, positioning them as central stakeholders in the data exchange ecosystem. For DataSpace Europe, service providers, startups, and actors across the food value chain are identified as key data consumers, as they need permissioned access to farm-level data to deliver or enhance products or services to the sector.

On the provider's side, while DKE-Data reinforces its data consumer strategy by relying on an indirect model, where farmers are onboarded through the connectivity features embedded in agricultural machinery sold by manufacturer partners, DataSpace Europe seeks farmer uptake, having the farmers' union involved in its ownership. This partnership is central to building trust with farmers and increasing their negotiating power regarding

their data. The union helps communicate the platform's benefits and ensures that farmers feel secure in sharing their data.

To navigate the broader challenges of the data-sharing ecosystem, DKE-Data and DataSpace Europe both emphasized the importance of participating in communities of practice as a strategic means of networking, co-developing solutions, and gaining visibility. For DKE-Data, this includes involvement in the Agricultural Interoperability Network, which supports cross-platform connectivity. DataSpace Europe, on the other hand, engages with initiatives such as Gaia-X and IDSA, and has participated in cross-border pilots like the Potato-X. These communities enable both DIs to stay connected to broader innovation ecosystems and policy developments, thereby enhancing their credibility and ability to adapt to evolving requirements in the agricultural data space. Furthermore, DataSpace Europe highlights regional collaborations as a mechanism for piloting interoperability and testing cross-border data exchange. These initiatives provide practical avenues to validate the DI model and demonstrate value in localized agricultural contexts.

Moreover, both Data Intermediaries recognize the government's role in shaping the regulatory landscape and suggest that more direct action, particularly in the form of incentives to promote data sharing, would be more effective. DataSpace Europe emphasized the importance of government support in legitimizing and enabling DIs, particularly through regulatory frameworks and public funding. In contrast, DKE-Data views government influence as most effective when tied to economic incentives supporting farmer adoption, especially in light of the absence of EU funding mechanisms and regulatory ambiguity. These assessments align with recent literature suggesting that regulatory recognition alone, under the DGA, may not be sufficient to ensure neutral and effective data sharing (Brown et al. 2023; Carovano and Finck 2023). Instead, market-led incentives are likely more impactful, particularly in agriculture, where farmers remain cautious due to concerns over data misuse and unclear value returns (Sullivan et al. 2024; Van der Burg et al. 2021).

Overall, the assessment of relevant users, such as farmers and their unions, supply chain actors including food retailers and technology providers, and public authorities and government bodies, has been identified in the literature as key to understanding demand uptake, credibility, and data-sharing practices (Brown et al. 2023; Kalmar et al. 2022; Ryan et al. 2024; Sullivan et al. 2024). In addition, DIs contribute to this perspective by highlighting the role of communities of practice in navigating market needs and anticipating future market trends.

When exploring data spaces for which literature observed (Deroo and Maes 2023; DSSC 2024; Farrel et al. 2023) could provide opportunities for development services, they expressed skepticism about practical results. DKE-Data found the process confusing, while DataSpace Europe recognized an opportunity to build market credibility, although it was not their top priority. This reinforces the idea that DIs remain primarily focused on building and delivering value within their existing networks (Martens et al. 2020; Schweihoff et al. 2024). DKE-Data and DataSpace Europe are concentrating on developing their data ecosystems to meet user needs. They emphasize creating trust by design within their business framework, promoting open participation rather than profit-driven transactions. In doing so, they aim to reinforce their fairness and accountability (Kalmar et al. 2022; Ryan et al. 2024) and support the creation of inclusive and credible data-sharing environments, which literature suggests are essential for long-term ecosystem engagement and innovation in agriculture (AgriDataSpace 2024; Sullivan et al. 2024).

Their strategy includes the development and testing of concrete use cases to demonstrate the practical value and technological maturity of their services. This approach is seen as essential for increasing awareness and driving engagement in the market (Eisenträger et al. 2024; Micheli et al. 2023; Schweihoff et al. 2024). A key example is the Potato-X pilot, led by DataSpace Europe, which tested cross-border data sharing between Belgian machinery and Finnish farm systems to align their services with user needs and facilitate seamless connections between independent organizations, ensuring that each party retains full control over its own data and systems. In the case of DKE-Data, this is achieved through the development of interoperable data flow solutions, taking steps toward cross-platform interoperability by participating in the Agricultural Interoperability Network, an industry-driven initiative designed to technically connect different platforms across the agricultural sector. Such partnerships reflect a broader trend in the agricultural data ecosystem where legitimacy is built through coalition efforts and participation in pilot initiatives, which help intermediaries align with sector expectations and test data-sharing functionalities in real use cases (Deroo and Maes 2023; Eisenträger et al. 2024).

Beyond building their ecosystem, DIs also engage in strategies to maintain a functional ecosystem by staying close to the agricultural sector, employing staff with agricultural expertise, and engaging directly with farmers and other stakeholders to understand their operational needs. This proximity supports relational trust and sector alignment, which literature identifies as essential for overcoming adoption barriers in agricultural data sharing (Brown et al. 2023; Van der Burg et al. 2021). Additionally, by providing a platform that supports user learning, including on consent mechanisms and data rights, they address the documented need for awareness-building and data literacy in agricultural

ecosystems with diverse needs (Kalmar et al. 2022; Sullivan et al. 2024), overcoming knowledge gaps regarding data rights, without compromising on neutrality or user control. Therefore, it shows the value of DIs not merely as technical facilitators but as strategic enablers of user agency and trust within data-sharing environments.

6.4   Assessments and Responses in a Dynamic and Platform-Based Context

In addressing regulatory compliance, market fit, and ecosystem development, DKE-Data and DataSpace Europe implicitly reflect elements of Teece et al. (2007)'s Dynamic Capabilities, *sensing, seizing, and reconfiguring*, though the degree and focus of these capabilities vary. They also recognize both the opportunities and constraints inherent in a platform-based organizational model. These efforts reflect a deliberate strategy to respond to the evolving agricultural data-sharing landscape challenges by shaping business models that balance responsiveness to market demands with a clear commitment to neutrality, compliance, and stakeholder trust.

To understand the operating environment and identify opportunities and threats in regulations, markets, and the ecosystem landscape, the DKE-Data and DataSpace Europe narratives outlined several *sensing* actions. Starting with regulatory scanning, as both DIs identified and interpreted the primary EU regulatory instruments, DGA and Data Act influencing neutral data intermediation (Carovano and Finck 2023; Fassnacht et al. 2024; Micheli et al. 2020; Verstraete et al. 2023; Wolfert et al. 2024). They assessed the implications of these regulations using legal monitoring (DKE-Data) and network support (DataSpace Europe) within their respective business models. For example, decisions such as pursuing DGA registration were based on perceived regulatory value and the level of policy support available.

They also actively interpreted the market context, identifying challenges such as immature demand from farmers, limited incentives for data providers to share data, low general awareness of neutral data intermediation, and large providers' data concentration. At the same time, they recognized opportunities, including emerging demand triggers, AI and sustainability pressures, and the potential of external incentives to shift stakeholder engagement. Their insights were grounded in domain expertise, which supports alignment between service design and agriculture-specific workflows and needs.

Additionally, both actors demonstrated awareness of their business model needs and strengths. They positioned their models as alternatives to dominant commercial actors, emphasizing neutrality as a key differentiator within the ecosystem. Also, they recognized their role as two-sided platforms requiring them to deliver value to both data providers and data consumers while addressing trust concerns and adhering to neutrality principles such as avoiding data monetization and storage. In parallel with their regulatory and

market analyses, they conducted ecosystem assessments, identifying target users and strategic partners within the agricultural data-sharing network, such as communities of practice, to support them in sensing the market needs. These sensing capabilities were highly accurate in supporting their chosen position in an emergent data-sharing market, such as identifying market gaps they could address, fulfilling regulatory obligations they must meet, and providing ecosystem support to enhance their market credibility and uptake. As noted by scholars analyzing evolving businesses (Achtenhagen et al. 2013; Lin et al. 2020; Liu and Yu 2021; Teece 2018), such behavior is key for enabling organizations to shape their business models to achieve sustained and attractive value creation.

However, those DIs could benefit from a foresight approach for trend analysis, horizon scanning to anticipate future disruptions, or latent needs, as an emerging business. At the same time, the sensing activities observed were primarily focused on present conditions, with limited emphasis on foresight methods such as trend analysis or horizon scanning. In dynamic and uncertain environments, the ability to anticipate future disruptions or latent stakeholder needs is increasingly viewed as critical (Zollo et al. 2016). While it is inherently difficult to predict all future developments, combining short-term responsiveness with forward-looking capabilities can strengthen adaptability. In emerging industries, where the most effective business model is not always evident at the outset, iterative learning and strategic experimentation, supported by informed projections, are essential for long-term success (Teece 2010).

Nevertheless, DIs also demonstrated *seizing* capabilities through their ability to act on regulatory, market, and ecosystem needs and opportunities, primarily to support business model development. In regulatory matters, both adopted pragmatic approaches, adapting their models where regulations offered practical contributions to market advancement. However, their seizing orientations diverge: DKE-Data adopts a compliance-driven, risk-averse strategy aimed at mitigating regulatory risks, while DataSpace Europe takes a more strategic stance, using regulatory frameworks, such as DGA recognition, to enhance credibility and build trust, particularly with farmers.

In their *seizing* approach to the agriculture data sharing market, both implemented targeted actions to tailor their business models to the user and market needs. They employed pricing models responsive to users' financial capacities to broaden stakeholder engagement. Similarly, they strategically targeted user groups to leverage network effects, focusing on onboarding data consumers to develop use cases that could illustrate value to hesitant data suppliers, an approach that strategically addresses platform scaling dilemmas. Alongside, they invested in raising awareness on both sides of the market about

the benefits of neutral data sharing, highlighting trust mechanisms and mutual gains in a networked data economy, such as diversified services for farmers and broader data access for consumers.

On the demand side, these actions included investments to improve the technical performance and relevance of their platforms, *Agrirouter* and *Tritom*, providing responses to users' needs: interoperability in DKE-Data's case, and in DataSpace Europe's, an encrypted, cost-efficient data exchange combined with data discovery tools. Their platforms also functioned as educational tools, promoting user autonomy and transparency, offering structured guidance to support data control and literacy. These efforts were explicitly aimed at building trust and improving usability in response to immature market demand. In doing so, both DIs emphasized their value over traditional data sharing platforms operated by large service providers, offering unique services that assure users control and freedom over their data. DataSpace Europe advanced this trust-building approach by validating the use cases for their business model in different scenarios, including cross-border exchanges.

Both DIs also embraced an ecosystem *seizing* strategy to enhance market positioning. They maintained close ties with key stakeholders by designing business models that enabled active user participation in platform operations and governance. This included transparent data-sharing agreements and inclusive shareholder structures, such as machinery manufacturers in DKE-Data and the Farmers Union in DataSpace Europe. They further leveraged collaborations with agriculture-sector stakeholders, including other DIs and communities of practice, to align with emerging data-sharing standards and strengthen their models' market credibility.

Thus, their *seizing* actions, focused on achieving business model–market fit, were closely aligned with their broader goal of differentiating themselves from traditional data-sharing services, attracting targeted users, and building trust-based market credibility. This approach reflects Teece et al. (1997)' argument that in immature markets, organizations can gain an advantage by developing reputations and offering services that are not easily replicated. Furthermore, their active engagement with user stakeholders and ecosystem partners to address agricultural data-sharing challenges was critical. As noted by Liu and Yu (2021), Teece (2010, 2018), and Zollo et al. (2016), such engagement is essential for testing business model assumptions, adapting governance structures and platform functionalities, and strengthening legitimacy in emerging markets.

However, similar to their *sensing* orientation, their *seizing* strategies remain somewhat reactive. While both organizations have mapped out future trends, such as sustainability and AI, they have not translated these insights into concrete preparations or strategic

changes in their business models. There is no clear evidence that these DIs have implemented structured mechanisms to systematically experiment with or refine their business models, pricing strategies, or value propositions. This limitation restricts their capacity to pursue long-term strategic opportunities and indicates unexploited potential for innovation and growth (Teece 2007; Teece et al. 1997). Additionally, their approach to scaling remains largely implicit. They did not mention an articulated roadmap or strategic plan for ecosystem mobilization aimed at broader market adoption. Current *seizing* strategies remain centered on bottom-up engagement by current user groups, and with investments focused predominantly on improving and maintaining existing platform functionalities for those groups. Although such updates are important to sustain operational fit and user relevance (Lin et al. 2020), they may limit the exploration of new service models and strategic directions that could widen their users' possibilities, considering, for instance, their mapped future drivers (AI and Sustainability).

Nonetheless, their reactive *seizing* approach should not be seen as a lack of strategic orientation. Rather, their emphasis on short-term results and two-sided engagement reflects a pragmatic response to economic constraints. With limited resources, small teams, and reliance on market-led funding, both organizations are compelled to prioritize immediate, practical actions, such as engaging data consumers, enhancing platform usability, and building trust mechanisms, to sustain operations and generate value. As Achtenhagen et al. (2013) note, there is no universal model for dynamic capabilities; effective strategies need to be context-specific, shaped by each organization's constraints, stage of development, and strategic priorities.

In parallel, both organizations demonstrated emerging *reconfiguring* capabilities, though mainly in incremental forms. These were oriented toward adapting business models and platform structures to meet evolving stakeholder needs and regulatory demands, embedding trust-enhancing features in their platforms, including neutrality-based governance and transparent data-sharing agreements. Mechanisms essential in low-trust data environments, supporting long-term collaboration and user confidence. Moreover, both also engaged in sector-specific collaborations to boost user adoption, enhance market credibility, and align with data-sharing standards, such as interoperability. These actions reflect coordination capabilities essential for navigating multi-stakeholder environments and responding to new opportunities (Teece 2007). Additionally, both operated with lean structures, prioritizing efficiency in platform development and management. DKE-Data, for instance, viewed its small team as a source of agility, enabling responsiveness and operational focus. Such efficiency supports ongoing business model reconfiguration and allows targeted investments in areas of direct market relevance (Achtenhagen et al. 2013). However, despite recognizing the challenges of

attracting investor funding, DI has not outlined a clear strategy to overcome this constraint, which can limit their capacity to explore new markets.

Besides, in the regulatory domain, their reconfiguring capacity remains limited. While DKE-Data monitors regulatory developments and DataSpace Europe aligns with emerging standards such as DGA registration, neither organization has adopted a systematic or continuous approach to interpret, anticipate, or shape regulatory frameworks. Given the high degree of regulatory ambiguity and complexity they face, this lack of structured engagement constrains their ability to integrate regulatory foresight into long-term planning. As Teece (2018) argues, in dynamic environments, reconfiguration should go beyond ad hoc adaptations. Regulatory clarity and proactive alignment are key to enabling organizations to adapt to the market accordingly (Liu and Yu 2021). Nonetheless, their current actions should be viewed as part of a broader learning trajectory. Teece (1997) notes that reconfiguring capabilities is refined through practice. With ongoing user engagement, regulatory awareness, and clear operational focus, DKE-Data and DataSpace Europe can progressively strengthen their adaptive capacity in the agricultural data-sharing market.

Ultimately, the strategic responses of DKE-Data and DataSpace Europe reflect the inherent tensions faced by early-stage Data Intermediaries operating in a volatile and underdeveloped data-sharing market. Their current practices demonstrate a predominantly reactive orientation, favoring regulatory alignment, trust-building, and targeted platform development over anticipatory planning or long-term strategic transformation. This orientation, while limiting their present capacity for foresight, experimentation, and innovation, must be interpreted within the constraints of small-scale operations, market immaturity, and regulatory ambiguity (Liu and Yu 2021; Teece 2007; Zollo et al. 2016).

Finally, within the agriculture sector, where data-sharing ecosystems are still developing and trust remains a key barrier (Brown et al. 2023; Van der Burg et al. 2021), their focus on addressing present needs may serve as a critical foundation for establishing legitimacy and fostering adoption. Over time, these organizations may gradually transition from reactive to proactive actors, as they gain experience, consolidate stakeholder relationships, and institutionalize learning processes (Achtenhagen et al. 2013; Teece 2010). In this sense, their current strategies represent an early phase in a broader trajectory, one that, if supported by sustained engagement and adaptive capacity, could lead to more sustainable, scalable, and foresight-driven data intermediation within the agricultural domain (AgriDataSpace 2024; Kalmar et al. 2022; Micheli et al. 2023).

6.5 Policy Context for Agriculture Data Intermediaries Regulations, Market, and Ecosystem Strategies

Policymakers' narratives position DIs as key emerging actors in the data-sharing market. European Union Policymakers' discourse provided insight into the current and future development of Data Intermediaries, operating in neutrality principles, fostered by the DGA. They note that their business model development in sectors like agriculture relies on their ability to serve market needs while fulfilling policy principles for trustworthy data sharing. However, they acknowledge that in this early data sharing market stage, they might still struggle with the low demand and transaction volume, unclear business models under neutral restrictions, and regulatory uncertainties. Mostly, they recognize that as these entities are still in an early phase, there is no clarity on how their role or sustainability will evolve in the future.

When assessing the roles of Data Intermediaries under the EU policy perspectives, policymakers shared similar views with the interviewed DIs and the academic literature examining the DGA. Rather than merely serving as neutral data-sharing tools, DIs are framed as mechanisms to foster a fair and trustworthy data economy (European Commission 2020; Micheli et al. 2023; Schweihoff et al. 2024). The Act promotes a type of DI positioned as an alternative to dominant service providers that concentrate data for competitive gain (Bobev et al. 2023; Carovano and Finck 2023; Von Ditfurth and Lienemann 2022). This role is particularly significant in agriculture, where data control is centralized and farmers often lack awareness of their rights or the value of sharing (Brown et al. 2023; Van der Burg et al. 2021). DIs are thus portrayed as instruments to support more inclusive data-sharing practices, helping small stakeholders, such as farmers, retain control and reduce dependence on proprietary systems (Sullivan et al. 2024; Ryan et al. 2024). They can also professionalize the sector by offering standardized data sharing services (Richter and Slowinski 2019; Schweihoff et al. 2023) while advancing the EU Data Strategy's goals of ethical data use and decentralized ecosystems (Bobev et al. 2023; Farrell et al. 2023).

Policymakers have a positive perception of having set out a legal framework for neutral Data Intermediaries. For them, the regulation affirms the relevance of these entities as key enablers of trustworthy and neutral data sharing in distributed ecosystems, particularly in sectors like agriculture, where power imbalances and data fragmentation persist. The DGA's rules, such as neutrality restrictions on monetization, are intended to prevent platform-like structures and lock-in effects, distinguishing DIs from dominant digital platforms that concentrate data. Policymakers see the Act as a means to support DIs' market differentiation, propose the boundaries of acceptable business models, and enable registered DIs to be formally recognized as credible and trusted market actors.

However, despite considering similar benefits of the DGA, particularly in the case of DataSpace Europe, where it supported a trust-based positioning strategy, the interviewed DIs found many drawbacks in the regulation in supporting neutral data intermediation models. It lacked practical incentives for data providers, such as farmers, and a clear business model outcome for DIs, given the imposed restrictions, and a DIs concept that is complex and difficult to convey its value to DIs' potential users. These factors, as noted in the DKE-Data case, are driving their reluctance to seek formal recognition while they already operate on a neutral basis. In the context of immature market demand, both DIs value trust-building elements, such as neutrality, as being central to their business model's credibility. However, not all considered the DGA a strategy for this.

The DIs' findings suggest that while they value the regulatory principles underpinning neutral data sharing, they expect more direct policy support to stimulate data-sharing demand and clarify the tangible benefits of operating under a neutral business model. DIs see these factors as critical for fostering market maturity. Policymakers acknowledged these concerns as valid obstacles limiting the adoption of the DGA framework. They indicated that such issues might be addressed in the upcoming DGA review, where market feedback will be collected to correct conceptual ambiguities or disproportionate burdens in business model rules, while preserving the policy goals of fair and trustworthy data-sharing practices.

They also emphasized that the DGA is both foundational and piloting, representing the first regulatory effort to address DIs, introduced before a fully developed market existed. At this early stage, it is considered a necessary starting point for guiding market practices and shaping sustainable, fair, and competitive data-sharing models, aimed at preventing data monopolies similar to those found in big-tech platforms. The regulation is understood more as a strategic investment in shaping future markets than as a direct response to current market limitations. This perspective was shared by some scholars who pointed out the limits of DGA in achieving its objectives, given its limited support for driving DIs' market uptake (Richter 2023; Von Ditfurth and Lienemann 2022). From the policymakers' perspective, while regulatory compliance with DGA establishes the foundation rules for neutral data sharing, the market fit of neutral DIs should be achieved by their own strategies as actors fulfilling a market need.

Nevertheless, policymakers, in line with the DIs' perspective, recognized that the agricultural data-sharing market presents challenges for neutral data-sharing businesses. These include competition from large service providers that concentrate on agricultural data and demand, limited understanding or appreciation of the neutral DI concept among stakeholders, and a general need for incentives for data-sharing engagement. In this

context, to establish successful business models, DIs should differentiate themselves from traditional players, identify users willing to engage and pay for their services, develop relevant service offerings, communicate their value clearly, and stay close to demand to better understand user needs. Most importantly, they need to identify practical use cases that address specific needs and contexts, making their value visible and recognized by their stakeholders.

Policymakers, in line with scholars, noted that DIs hold market potential, especially in fragmented and decentralized sectors like agriculture (Carovano and Finck 2023). They see DIs as connectors between diverse data providers and users, helping to enable data flows and prevent concentration by dominant players (Carovano and Finck 2023; Micheli et al. 2023). DIs can support smaller actors, such as farmers, in navigating complex digital systems and regulations (Brown et al. 2023; Sullivan et al. 2024). They are expected to simplify data-sharing rules, though this depends on their ability to interpret and apply regulations. Under the Data Act, for example, DIs may help farmers access and transfer machine-generated data and understand new contractual terms (Richter 2023).

However, as reflected in the experiences reported by DIs, tailoring their services to meet agricultural data-sharing demands, such as machine connectivity in the case of DKE-Data and trust-based data exchange across the food value chain for DataSpace Europe, alongside various market positioning strategies, has not fully addressed concerns about low demand and limited market fit. These strategies included targeting data consumers, developing user-friendly and technically reliable platforms, maintaining close engagement with users such as farmers and machinery providers, embedding trust mechanisms in governance, applying consent-based data-sharing technologies, and offering fair, transparent agreements through horizontal structures. While these efforts contributed to building credibility, they did not appear sufficient to generate strong or sustained demand.

These cases seem to align with policymakers' views that market maturity, particularly on the demand side, may take an unclear time to develop, and suggest that the challenge of mature demand is structural and may not be fully addressed through the efforts of individual DIs alone. As a result, as noted by those DIs and some scholars assessing the market development of DIs (Micheli et al. 2023; Schweihoff et al. 2023; Von Ditfurth and Lienemann 2022), there may be a need to explore more targeted policy measures to address incentives for stakeholders, in sectors like agriculture, to engage in data sharing. An approach especially relevant given that the DGA has predominantly focused on enabling trust and neutrality, giving less attention to economic and operational factors that influence participation (Martens et al. 2020; Richter 2023).

In fact, policymakers closely assess the needs of DIs in building strong and expanding data-sharing ecosystems. Similar to DIs, they emphasize that this development depends on presenting DIs as technical alternatives for structuring a trustworthy and decentralized data-sharing environment, balancing power asymmetries, and supporting an inclusive data-sharing market. Policymakers reflect on actions that might support DI ecosystem building, including addressing the needs of diverse stakeholders to serve unmet market demand, identifying qualified demand that both requires and can pay for services, and staying aligned with service providers' technological needs to connect with industry priorities. Building on these strategies, DIs also included engaging with communities of practices related to data sharing and forming partnerships with other DIs, as in the case of DataSpace Europe. This showcases their concern for staying updated about market demands and opportunities while market integration for creating viable paths forward in the face of unclear policy support and limited immediate demand (Bobev et al. 2023; Schweihoff et al. 2023; Teece 2007).

Conversely, for policymakers, policy support in this early market stage can be helpful in increasing trust and promoting neutral data sharing practices: DGA's DI recognition as a trust-building and the Act business model boundaries, especially with the upcoming review potentially addressing disproportionate regulatory burdens that hinder DIs' value propositions. The EU Agricultural Data Spaces were also cited as a possible avenue for service development, though Policymakers, in line with DI's views, acknowledge that this concept is still evolving (Turpeinen et al. 2024) and offers limited immediate potential.

Overall, DIs' ecosystem-building strategy aligned closely with those recommended by policymakers, as they employ both trust and market strategies to increase their uptake. While for the former, both DIs chose different actions, seen in a varied adoption of DGA recognition, for the latter, both implemented similar strategies, while also stressing again that policy support could be improved. DIs emphasize the importance of direct market incentives for data providers, such as farmers, to engage in data sharing, particularly as the Data Act may already incentivize data consumers like machine providers. In considering future policy directions, policymakers mention potential areas such as AI-driven use cases, automated data-sharing needs, and collaborative public-private partnerships to support DIs' visibility and credibility. However, these remain forward-looking rather than concrete strategies. As with DIs' own views on future market drivers, policymakers do not clarify the pathway for how DIs will benefit from these opportunities. This reveals a policy scenario in which, while policy fosters DIs as valuable mechanisms for data sharing, DIs should establish their own market presence and relevance to survive long-term.

7 Conclusion

This study explored, through a qualitative and exploratory method, combining the experiences of DKE-Data and DataSpace Europe, **how European Data Intermediaries in the agriculture sector are assessing and responding to the nascent and regulated EU data sharing market and building their data sharing ecosystems.** Moreover, EU policymakers' perspectives provided essential context for interpreting DIs' strategies. The following paragraphs offer insights into the three dimensions of the research question.

For **Regulatory Compliance,** it looks at **how DIs assess and respond to EU data sharing regulations.** DIs recognize the DGA and the upcoming Data Act as setting the principles and technical standards for B2B data exchange. They see potential for these regulations to position DIs as trustworthy and distinct from dominant platforms. For example, the DGA contributes to market branding, while the Data Act may create technical needs that align with DI services offerings. However, both regulations are seen as lacking direct incentives for businesses to share data, especially in the agricultural sector, where farmers are reluctant to share data without tangible benefits. DI responses vary based on their assessment of each regulation's relevance to their business models, clarity of expected benefits, and perceived strategic value. Regarding the Data Act, both organizations are in a monitoring phase, assessing potential market opportunities without taking specific compliance actions. For the DGA, responses diverge. DataSpace Europe viewed it as strategically aligned with its mission and existing practices, using it to build market credibility and thus pursued registration. In contrast, DKE-Data found limited value for its industry-driven model and opted not to register, though it continues to track developments that require compliance. Regardless of the DGA recognition, both emphasize that neutrality, fairness, and transparency are foundational to their operations, not as a regulatory response, but as intrinsic to their differentiated service approach.

For **Market fit,** it looks at **how DIs assess and adapt their business models in light of the nascent and regulated nature of the data sharing market.** DKE-Data and DataSpace Europe view their market position as not only serving as technical tools but also enabling fair and beneficial agricultural data exchange. But they identify several structural barriers, including limited incentives for data sharing, particularly among farmers, and the dominance of large platforms that centralize control over data. DataSpace Europe further emphasizes the conceptual complexity of DIs and the fragmented digital infrastructure, both of which demand diverse and tailored service offerings. Although both organizations recognize that broader trends such as AI and sustainability may drive future adoption, they stress the need to establish immediate market relevance. This involves differentiating from dominant platforms, embedding trust mechanisms, and applying fair pricing strategies.

In adapting to those market conditions, both DIs have tailored their business models accordingly. DKE-Data, not pursuing DGA certification, maintains neutrality by avoiding revenue from data transactions and focusing on machine interoperability. DataSpace Europe, as a DGA-certified intermediary, centers its platform on decentralization and secure consent-based data flows. These approaches aim not only to meet legal requirements but also to foster trust and legitimacy in a market that is still uncertain about the value of data sharing. To further address the challenge of limited farmer engagement, both DIs prioritize demonstrating the practical value of data sharing. Recognizing that farmers are motivated by clear, tangible benefits, they initially target data consumers who are more ready to adopt data-sharing practices. These consumers benefit from improved data access and networked services, and their participation helps validate the platforms, build broader credibility, and generate network effects that may later encourage wider adoption among farmers. Internal capabilities further strengthen how each DI addresses market fit. Both emphasize platform reliability, responsiveness to user needs, and strong sector expertise. DKE-Data highlights its small, agile team as an asset for quickly responding to market signals. Their platforms are designed for inclusivity, supported by governance models that ensure equal participation and pricing adapted to user capacity. Trust remains a core principle for both organizations, reflected in their commitment to transparency, neutrality, and user control.

For **Ecosystem Building,** it looks at **how DIs assess and respond to strategic stakeholder relationships to build their data-sharing ecosystem.** Data Intermediaries assess their role as neutral and trustworthy actors in response to a clear gap in agriculture: the need for fair, transparent, interoperable mechanisms for agriculture data sharing. They understand that building an effective ecosystem depends on trust and credibility, especially in a fragmented sector with limited incentives for voluntary data exchange. To address this, DIs identify key stakeholders whose involvement is essential to legitimizing their role and promoting adoption. For instance, DataSpace Europe collaborates with farmers' unions to build trust among data providers, while DKE-Data, supported by machinery manufacturers, aligns with operational needs and strengthens credibility among data users. Both also engage in data-sharing communities, DKE-Data to improve technical compatibility, and DataSpace Europe to increase visibility. The latter also sees Agricultural Data Spaces as a potential channel for market recognition. However, both acknowledge ongoing uncertainty around its scope and implementation. Additionally, they recognize the value of governments in enhancing incentives for data sharing among businesses and in promoting neutral data-sharing services.

In response to these assessments, DIs adopt organizational structures that promote inclusive governance, transparent rules, and data control mechanisms, because trust is a

precondition for participation in data sharing, especially from risk-averse actors like farmers. Their platforms are designed to orchestrate interactions between data providers and users without exerting control over the data itself, ensuring that participants retain autonomy and reduce perceived risks. This operational neutrality is not just regulatory; it is a core strategy to attract and retain diverse stakeholders who might otherwise hesitate to share data. Aware that the market is still immature and fragmented, DIs also engage with institutional frameworks (DKE-Data) and pilot projects (DataSpace Europe) to gain visibility, signal credibility, and validate their value proposition in real-world contexts. These efforts are essential for building the critical mass of trust and participation needed to sustain their role as independent connectors in the agricultural data-sharing ecosystem.

From a theoretical perspective, the findings demonstrated that DIs employ Dynamic Capabilities, with varied intensity and approaches, when assessing and responding to data regulations, market, and ecosystem demands, and adopting also Platform Business Models strategies. They showcase accurate sensing capabilities, reflecting on the agricultural data-sharing environment by interpreting regulations, making sense of their practical benefits for their business models, scanning and reflecting on market structural constraints and demands, mapping stakeholders, and understanding their ecosystem position. Furthermore, both exhibit pragmatic seizing capabilities by adapting business models to align with data-sharing market standards stemming from regulations or the market community to legitimize their business models, leveraging their two-sided platform dynamics, fostering network effects, and improving platform usability and trust. Besides, they focused on their market differentiation from traditional platforms, focusing on proximity to users, agriculture expertise, building trust through transparency, education, and inclusive governance. Finally, they demonstrate emerging reconfiguring capabilities by incrementally adjusting their platforms and operations based on users' needs, embedding trust mechanisms into their functioning, operating with lean teams for agility and efficiency, and collaborating with agriculture stakeholders to align with standards and boost adoption.

While DIs showed their dynamic capabilities-related strategies are key to legitimizing their models and supporting their uptake, their strategic orientation, while responsive, remains centered on immediate operational demands. Although they effectively address current regulatory and market conditions due to the immaturity of the data-sharing market and limited resources, long-term strategic planning appears underdeveloped. Emerging trends such as AI and sustainability are acknowledged but not yet reflected in concrete initiatives. Similarly, despite expressing optimism about market prospects, their narratives lack clarity on scaling or experimentation strategies. This limited engagement with foresight may hinder their ability to shape a data-sharing landscape grounded in

neutrality and trust. A more proactive stance may help DIs position themselves as central actors, thereby increasing their long-term resilience and influence. However, it is important to stress that the experiences of DIs interviewed in this study serve illustrative purposes and reflect broader trends in the field, rather than critiques of specific organizational performance.

Nevertheless, study findings showcased that the development of DIs in the European data-sharing market, when considering those operating under the neutrality principles fostered by the DGA, is also a policy concern. EU policymakers share a similar perspective to that of DIs regarding their importance for fostering a fair data-sharing economy, especially in the agricultural context, the belief in trust and neutrality in business models as essential for their market uptake, and the importance of building a diverse data-sharing ecosystem. However, they also share concerns: the DGA, while aiming to support neutral DIs, requires practical incentives and offers limited clarity on viable business models. Moreover, the concept of DIs remains complex and difficult to communicate with potential users. In the agricultural sector, despite some growth, the data-sharing market remains immature, with limited demand and low stakeholder awareness, posing additional challenges to the uptake and sustainability of neutral DIs.

Policymakers' views correlate with several of the DIs' strategic reactions to their environment. They stress the importance of DIs differentiating themselves from dominant data platforms by building trust through neutrality, a stance supported by DGA recognition. For market strategy, policymakers underscore the need for DIs to effectively communicate the benefits of neutral data sharing to both data providers, like farmers, and data consumers. This requires tailoring services to user needs through engaged stakeholder collaboration. They also recommend prioritizing trust-building, user-focused service design, and adaptability to changing technology and regulations. Finally, they highlight the necessity of ecosystem-building strategies, including partnerships, governance based on trust, and active participation in data-sharing communities, to achieve long-term credibility, sustainability, and integration in the fragmented data economy.

Although policymakers and DIs share a common understanding of market conditions and strategic challenges, their approaches to early-stage policy support vary. Policymakers stress the foundational efforts, such as setting guiding principles and promoting a neutral business model through DGA, as key measures to build trust and visibility for neutral DIs. But, while acknowledging the relevance of these trust-oriented initiatives, DIs emphasize the need for policy support that also addresses practical and structural barriers, such as the weak data-sharing cultures, especially in agriculture settings in which a lack

of clear benefits limits farmers from engaging. From the DI's perspective, as trust and neutrality are already embedded in their models in response to market expectations, rather than as a result of policy incentives, practical, immediate, and demand-driven policy measures to support their long-term development are needed. These distinct yet complementary perspectives reflect a shared commitment to supporting the emerging data-sharing ecosystem and highlight an opportunity to strengthen dialogue between policy design and market realities to identify more responsive pathways for advancing the EU Data Strategy's goals of an inclusive and trustworthy data economy.

The study's findings point to two key propositions. First, DIs could strengthen their long-term strategic planning to shape market demand for neutral data sharing. Second, targeted policy incentives might be necessary to encourage hesitant businesses to participate more broadly in data sharing, especially among those who do not see clear and immediate value. Moreover, this research contributes to the limited empirical literature on agricultural DIs by moving beyond definitions to examine their strategic responses to regulation, market fit, and ecosystem pressures. It also advances understanding of how these entities leverage capacity-building and platform-based strategies to navigate evolving and complex environments.

Nonetheless, the study's findings and recommendations should be interpreted with caution. The research does not aim to represent all EU scenarios for neutral data sharing. Based on in-depth interviews with a select group of DIs and policymakers, the insights reflect context-specific experiences and individual perspectives. As such, the identified actions and consequences may capture only a narrow part of the broader reality, as interviewees may not have conveyed the complete range of strategies and views currently in play. Therefore, the study offers a focused rather than comprehensive view of current strategies and policy positions. Still, the results provide valuable direction for identifying strategic gaps, anticipating regulatory developments, and refining ecosystem approaches. They also offer policymakers a clearer understanding of how existing regulations are perceived and where adjustments may be necessary.

Building on these insights, future research could explore how Data Intermediaries can proactively shape the EU data-sharing ecosystem, particularly within agriculture. As the study shows, DIs are currently responding to immediate regulatory and market pressures, but long-term planning and foresight remain a path for exploration. Future studies could examine how DIs might evolve their business models beyond compliance and adaptation, toward anticipating trends such as AI integration, sustainability reporting, or sector-specific data mandates. Investigating these pathways could shed light on the mechanisms by which DIs can overcome structural barriers, gain scale, and enhance their role as key enablers of a trustworthy, inclusive, and data-driven data sharing economy in Europe.

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Appendix

A   Data Intermediaries and Policymakers Interviews Questionnaire

This document presents the questionnaire used to guide semi-structured interviews conducted with two key stakeholder groups: Data Intermediaries operating in the agricultural sector and European Union policymakers involved in data sharing and digital regulation. The aim of these interviews was to explore how Data Intermediaries assess and respond to regulatory requirements, market dynamics, and ecosystem-building challenges within the evolving EU data-sharing landscape.

<u>Disclaimer</u>

Please note that some of the questions included in this questionnaire were slightly adapted to align with the specific context, role, or expertise of each participant. These adjustments were made to ensure relevance and clarity while preserving the intent and comparability of the data collected. The focus or meaning of the questions was not changed. The adaptations aimed to capture the most relevant and comprehensive insights possible from each interviewee. Follow-up questions have also been asked during the interviews to deepen or clarify specific responses.

A.a   Data Intermediaries

Background

1. Can you briefly describe your organization's value proposition in the agricultural data-sharing ecosystem? And your role within it?

Regulatory Compliance

2. Have you considered to register as a recognized data intermediation service under DGA? What factors have influenced such a decision?

3. Which EU policies and technical standards have most impacted your organization's strategic operation as a data exchange platform in Europe, and in what ways?

4. What structured processes or activities does your organization use to track and understand problems and opportunities from the EU data-sharing policies?

5. What internal capabilities of your organization have been crucial to responding to the requirements of the EU data policies and standards?

6. How do you systematically manage regulatory restrictions (e.g., neutrality rules, data-sharing obligations) vis-a-vis the risk-taking advantages of innovation or differentiation in the service offer?

7. How does your organization prepare to act flexibly and quickly in responding to the current and upcoming regulatory pressures in the EU data market?

Ecosystem Building

1. How has the EU's push for Common Agriculture Data Spaces influenced your organization's strategy for development in the EU data-sharing market? If so.

2. How do collaborations or partnerships with other data-sharing initiatives contribute to enhancing your ability to interpret and implement changes regarding regulations and market shifts?

3. How do you assess the support from EU initiatives, such as funding mechanisms, to help your organization acquire the abilities needed to reach a mature level in the agri data sharing market?

4. Which types of stakeholder partnerships have been most valuable for your organization's positioning in the market?

5. Do you consider your platform's design, governance, or service structure to encourage the development of a scalable (network effects) data-sharing ecosystem?

Market Fit

1. How would you describe the evolution and market maturity of your organization since its foundation?

2. What opportunities or barriers have you encountered when trying to scale up your services?

3. What pricing models or funding strategies have proven beneficial for organizations in delivering an attractive value proposition with sustainable revenue and cost structures?

4. How would you evaluate the current demand for data intermediation services, such as yours, in the agriculture sector?

5. What are the challenges to make your value proposition attractive for both data providers and data consumers to achieve network effects?

6. What internal organizational capabilities have been most challenging to develop in scaling and strengthening your value proposition?

Closing Questions

1. How do you see the evolution of your business model in the next years, given the current scenario of data-sharing agriculture?

2. Is there anyone that you think I should speak with to gain a deeper understanding of the topics we discussed?

A.b   Policymakers Questionnaire

Background

1. Can you briefly describe your organization and your role in it?

Policy Expectations

2. How would you describe Data Intermediaries and their expected value for the EU B2B data-sharing ecosystem, especially in the agriculture sector?

3. What were the main policy challenges encountered when drafting and implementing regulations governing Data Intermediaries, such as the Data Governance Act and the Data Act?

4. From your perspective to what extent are the current agricultural data intermediation initiatives fulfilling their expected role in enhancing data-sharing practices?

Regulatory Compliance

1. How do you see horizontal EU policies such as DGA and Data Act shaping the business choices/value proposition of agri data intermediaries?

2. To what factors do you attribute few Data Intermediaries having requested recognition under the Data Governance Act framework so far?

3. How do policymakers assess the balance between ensuring compliance and allowing flexibility in Data Intermediaries' business models?

Market fit

1. Why do you think DGA Data Intermediaries, especially in agriculture, are still struggling to find a scalable business model despite offering value to data-sharing stakeholders and complying with EU regulations clarifying data ownership and governance?

2. Do you see any business model arrangements that could help those organizations fulfill their expected role in the EU Data Strategy?

3. What are some best practices or lessons from existing successful cases that could guide Data Intermediaries in agriculture in responding to constraints of the EU data-sharing context?

Ecosystem Building

1. The EU is promoting Data Spaces across various sectors, including agriculture, through initiatives like AgriDataSpace. How do these data spaces impact the necessity and function of Data Intermediaries? If so?

2. How do you perceive the positioning of Data Intermediaries within the agricultural data-sharing ecosystem, and to what extent are they integrated with or isolated from key stakeholders and data-sharing initiatives?

3. What important stakeholder collaborations should these organizations have to strengthen their contributions to the agri data-sharing ecosystem?

4. What supporting mechanisms (funding, guidance, networking opportunities) do you consider relevant to support Data Intermediaries in reaching maturity levels to foster data sharing in sectors such as agriculture?

Future Outlook

1. How do you anticipate the evolution of Data Intermediaries in the agriculture sector over the next few years, considering the impact of EU regulations and the agriculture sector's needs?

2. Is there anyone you think I should speak with to better understand the topics we discussed?

B   Research Methodology Summary

Figure 2 below summarizes the methodology of this study.
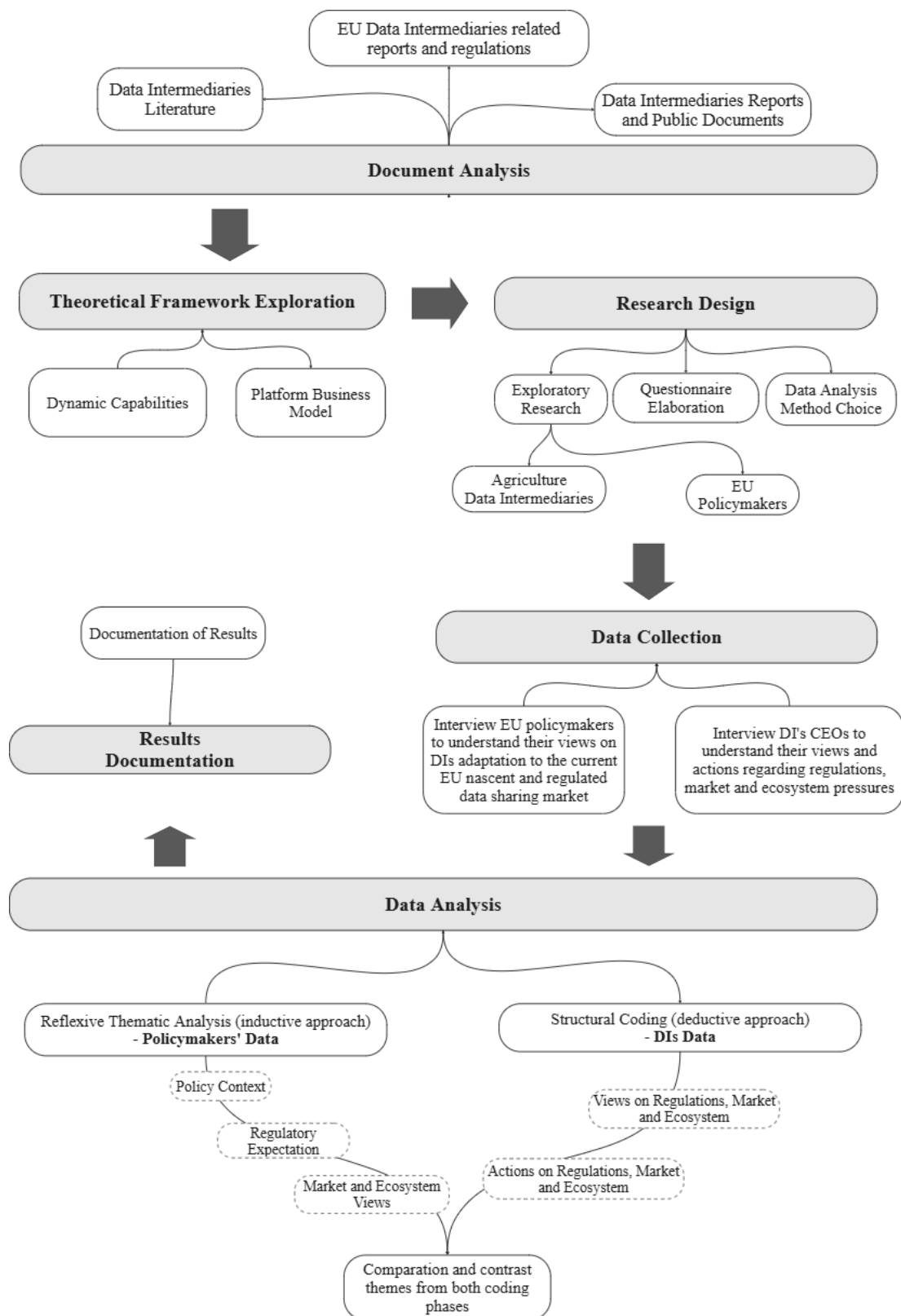
Source: Author's Elaboration

Figure 2.   Study Methodology Research Steps

Declaration of Authorship

I hereby declare that, to the best of my knowledge and belief, this Master's Thesis titled "STRATEGIC ASSESSMENT AND RESPONSES FOR REGULATORY COMPLIANCE, MARKET FIT, AND ECOSYSTEM BUILDING BY EUROPEAN AGRICULTURAL DATA INTERMEDIARIES" is my own work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references.

Leuven, 27 August 2025

Consent Form

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Title of the thesis: STRATEGIC ASSESSMENT AND RESPONSES FOR REGULATORY COMPLIANCE, MARKET FIT, AND ECOSYSTEM BUILDING BY EUROPEAN AGRICULTURAL DATA INTERMEDIARIES

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