

Pathways towards a fair, inclusive and innovative Data Economy for Sustainable Food Systems

Data4Food2030 Business Model Playbook

Lead Author: Christos Avdellas (RFF)
Contributors: Adrien Guichaoua (RFF), Mackenzie Baert (RFF), Harald Sundmaeker (ATB), Gunnar Große Hovest (ATB)



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Data4Food2030 Consortium

	Participant organisation name	Short name	Country
1	STICHTING WAGENINGEN RESEARCH	WR	NL
2	REFRAME FOOD ASTIKI MI KERDOSKOPIKI ETAIRIA (RFF)	RFF	EL
3	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT	INRAE	FR
4	EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK	EV ILVO	BE
5	INSTITUT FÜR ANGEWANDTE SYSTEMTECHNIK BREMEN GMBH	ATB	DE
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13	SZKOLA GLOWNA GOSPODARSTWA WIEJSKIEGO	SGGW	PL
14	FONDATION JEAN JACQUES LAFFONT, TOULOUSE SCIENCES ECONOMIQUES	TSE	FR
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Glossary of terms and abbreviations used

AMA	Amsterdam Metropolitan Area
AMAFLOW	Mapping and valorising food loss and waste data in the Amsterdam Metropolitan Area to improve the circular economy
API	Application Programming Interface
B2B	Business-to-Business
B2C	Business-to-Consumer
CODECS	Maximising the CO-benefits of agricultural Digitalisation through conducive digital ECoSystems
CS	Case Study
D	Deliverable
DaaS	Inter-sectoral Data as a Service
DADS	DIH Agrifood Data Space
DE4FS	Data Economy for Food Systems
DIH	Digital Innovation Hub
DIRECT	Real Time Fresh Data
EF	Environmental Footprint
EO	Earth Observation
EU	European Union
F2F	Farm to Fork
FAS	Focal Action Situation
FLW	Food Loss and Waste
GDPR	General Data Protection Regulation
HoReCa	Hotel, Restaurant, and Café/Catering
I4Data	Circular Economy 4 Tourism
IDSA	International Data Spaces Association
INAGEA	Agro-Environmental and Water Economics and Research Institute
IT	Information Technology
KGZS	Chamber of Agriculture and Forestry in Slovenia
M	Month
MilkBE	Trade organization for the Belgian dairy sector
MIMs	Minimal Interoperability Mechanisms
NGOs	Non-Governmental Organisations
PGC	Premium Grain Chain
PIGLink	From Farmers to Consumers
POI	Points of Interest
PSG	Project Steering Group
RDB	Relational Database
RTIs	Returnable Transport Items

SC	Supply Chain
SFSC	Short Food Supply Chain
SPOI	Smart Points of Interest
TEUDS	AgData Interoperability- Towards a European Data Space
THESIS	The Sustainability Insight System
UI	User Interface
WP	Work Package

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Executive Summary

The Business Model Playbook (BMP) has been developed within the Data4Food2030 project as part of Task 6.3, which aims to create an integrated toolset for multiplying the project's impact and supporting the long-term exploitation, continuity, and uptake of its results. In line with the objectives of the project, the Playbook provides a structured and practical reference framework for exploring innovative business models in the Data Economy for Food Systems (DE4FS).

The increasing availability of data across agricultural production, food supply chains, environmental monitoring, and digital services creates new opportunities for value creation, collaboration, and innovation. At the same time, the development of viable, fair, and inclusive business models for data reuse and data sharing remains a significant challenge for many stakeholders operating within the agri-food ecosystem.

Building on the experience generated through the Data4Food2030 case studies and related project activities, the Business Model Playbook consolidates lessons learned and translates them into a structured and accessible framework that can support the exploration, assessment, and adaptation of data-driven business models. The Playbook draws on insights from selected case studies addressing diverse challenges in the agri-food sector, including sustainable grain supply chains, real-time logistics monitoring, sustainability reporting systems, circular economy applications, and cross-sector data reuse. While Data4Food2030 includes a broader portfolio of case studies, the Playbook focuses on those that provide the clearest and most transferable illustrations of data-driven business model structures, governance approaches, and value creation mechanisms across the DE4FS landscape.

The Playbook does not aim to replace or replicate the individual business modelling activities developed within the case studies. Instead, it synthesises recurring patterns, strategic approaches, and operational insights emerging across the project in order to provide a transversal perspective on how data-driven business ecosystems can function in practice.

The document identifies key elements that shape data-driven business models, including value propositions, governance mechanisms, data-sharing arrangements, partnerships, interoperability considerations, and revenue structures. It also introduces a set of assessment indicators designed to support organisations in reflecting on the robustness, scalability, inclusiveness, and long-term sustainability of their business model configurations.

The Business Model Playbook is intended to support a broad range of stakeholders, including agri-food companies, digital solution providers, researchers, policymakers, innovation networks, Digital Innovation Hubs (DIHs), and organisations exploring participation in emerging agricultural data spaces and collaborative data-sharing ecosystems.

By consolidating experiences generated throughout Data4Food2030, the Playbook contributes to the wider adoption of data-driven approaches in food systems and supports stakeholders in navigating the evolving European data economy landscape. In this respect, it functions as an exploitation and reflection tool that can facilitate knowledge transfer, stakeholder capacity building, and the broader uptake and scaling of data-driven innovation approaches beyond the project lifetime.

The Business Model Playbook therefore contributes to the broader objective of Data4Food2030 to facilitate the uptake and scaling of digital and data technologies in food

systems while promoting openness, fairness, interoperability, and collaboration within the emerging European Data Economy for Food Systems.

1. Introduction

The increasing availability of digital technologies and data infrastructures across agriculture and food supply chains is transforming the way value is created, shared, and captured within food systems. Data generated through farming activities, processing operations, logistics, environmental monitoring, and digital services creates new opportunities for innovation, collaboration, operational optimisation, and improved sustainability performance.

However, the ability to transform data into economic and societal value depends not only on technological solutions, but also on the development of viable and inclusive business models that support data reuse, data sharing, and data-driven services. Many organisations operating within the agri-food ecosystem still face challenges in identifying approaches that allow them to exploit available or generated data while ensuring trust, interoperability, fair governance, and balanced value distribution among ecosystem actors.

Within this context, the Data4Food2030 project explores how digital and data technologies can contribute to the development of a Data Economy for Food Systems (DE4FS). Through a portfolio of interdisciplinary and multi-stakeholder case studies, the project investigates how data sharing mechanisms, governance frameworks, digital infrastructures, and interoperability approaches can enable new forms of collaboration and value creation across the food system.

The Business Model Playbook (BMP) has been developed as part of Task 6.3 under Work Package 6, which focuses on communication, outreach, and impact maximisation. In accordance with the Grant Agreement, the Playbook forms part of the integrated toolset designed to support the exploitation, continuity, and wider uptake of project results by facilitating the exploration of innovative business models based on the reuse and valorisation of data.

The Playbook should therefore be understood as a synthesis and reflection tool that consolidates transferable insights emerging from the project's case studies and related activities. It does not aim to provide fixed or commercially validated business plans, nor to replace the individual business modelling work carried out within specific case studies. Instead, it identifies recurring business model structures, governance approaches, value creation mechanisms, and operational considerations that may support organisations interested in developing or adapting data-driven services and collaborative data ecosystems.

By consolidating experiences generated throughout the project, the Business Model Playbook aims to provide a practical and accessible reference framework for organisations seeking to better understand how data can support innovation, collaboration, and sustainable value creation within food systems.

1.1 Purpose and Scope of the Playbook

The Business Model Playbook aims to consolidate knowledge generated within the Data4Food2030 project and translate it into a practical reference framework for exploring and assessing data-driven business models in food systems.

The rapid expansion of digital technologies and data infrastructures across the agri-food sector creates new opportunities for innovation, collaboration, and value creation. At the same time, organisations often face difficulties in identifying viable approaches to data reuse, data sharing, and data valorisation that can support sustainable and inclusive economic models.

The Playbook therefore seeks to provide stakeholders with a structured overview of business model patterns, governance mechanisms, and value creation approaches that can support the development of the Data Economy for Food Systems (DE4FS).

Rather than presenting detailed commercial business plans for each of the project's case studies, the Playbook synthesises insights from these practical experiments in order to identify recurring elements and mechanisms that enable value creation through data-driven collaboration and data reuse.

The objective is therefore twofold:

- to reflect the experience of the Data4Food2030 case studies, which explore different approaches to data sharing, governance, interoperability, and value creation across the agri-food sector; and
- to offer a practical reference framework that can inspire organisations to design, adapt, assess, or improve their own data-driven business models and ecosystem strategies.

The Playbook complements rather than replaces the individual business modelling activities carried out within the case studies. Its role is to provide a transversal perspective across the project by identifying transferable insights and strategic considerations emerging from multiple case study contexts.

By consolidating lessons learned across the project, the Playbook contributes to the long-term exploitation and continuity of Data4Food2030 results and supports the broader objective of enabling sustainable, fair, and inclusive data-driven innovation in food systems.

1.2 Methodology

The Business Model Playbook has been developed through a synthesis of knowledge generated across several activities of the Data4Food2030 project.

The analysis draws primarily on the work carried out within Work Package 3, which focuses on the development and implementation of case studies exploring data sharing and reuse in food systems. In particular, information from Deliverables D3.1, D3.2, D3.3 and D3.4 was analysed in order to identify how different stakeholders interact within emerging data ecosystems and how data can support new forms of value creation.

These case studies provide practical insights into the organisational, technological, governance, and interoperability dimensions of data-driven innovation across agriculture and food supply chains.

Additional insights were gathered through project workshops, stakeholder interactions, consortium exchanges, and activities related to innovation management, exploitation strategies, and the development of agricultural data spaces.

Based on this material, recurring elements of data-driven business models were identified and structured using a Business Model Canvas-inspired analytical framework. This approach enables the systematic analysis of key components such as customer segments, value propositions, key resources, partnerships, governance arrangements, revenue streams, and cost structures.

The Playbook therefore does not present prescriptive, standardised, or fixed business models. Instead, it offers illustrative examples and analytical tools that can support organisations in

reflecting on their own strategic choices when developing data-driven services, collaborative ecosystems, and data-sharing initiatives.

In line with the internal and sensitive nature of certain project materials, the Playbook synthesises case study insights at an analytical level and does not reproduce confidential operational, commercial, or partner-specific information. The objective is to translate project experiences into transferable business model insights while respecting the confidentiality constraints associated with certain project outputs.

The selection of case studies included in the Playbook was based on their ability to provide representative and transferable examples of business model structures across different dimensions of the DE4FS landscape, including data interoperability, governance, sustainability, circular economy applications, logistics, and cross-sector data reuse. Collectively, the selected case studies provide broad coverage of the technological, organisational, and ecosystem-related dimensions explored within Data4Food2030.

In addition, the Business Model Playbook is conceived as an exploitation and impact support tool within Data4Food2030. By translating case study experiences into structured and transferable business model insights, it contributes to the project's pathways to impact by facilitating the uptake of data-driven solutions, supporting stakeholder capacity building, and enabling the continuation and scaling of project results beyond the project lifetime.

1.3 The Data Economy for Food Systems in the European Context

The development of innovative business models for data reuse and data sharing takes place within the broader evolution of the European data economy.

In recent years, the European Union has launched several initiatives aimed at strengthening the availability, accessibility, and responsible use of data across key sectors. The European Strategy for Data has laid the foundation for the creation of common European data spaces, including the emerging Common European Agricultural Data Space, which aims to facilitate trusted data sharing across the agri-food ecosystem.

These policy developments are complemented by regulatory frameworks such as the Data Governance Act and the Data Act, which aim to strengthen trust, facilitate data sharing between actors, and enable the development of fair and interoperable data-driven ecosystems across Europe. Together, these developments create both new opportunities and new structural requirements for business model innovation, particularly in relation to governance, interoperability, access conditions, and value-sharing mechanisms. They also reinforce the importance of trusted governance mechanisms, data sovereignty, and interoperable infrastructures as foundational elements of emerging agricultural data ecosystems.

In parallel, initiatives such as GAIA-X, the European Open Science Cloud (EOSC), and sector-specific projects such as AgriDataSpace and DIVINE are contributing to the development of interoperable infrastructures and governance frameworks that support data-driven innovation.

Within this evolving landscape, Data4Food2030 contributes by exploring practical mechanisms for data sharing, interoperability, and value creation in the context of food systems. The project's case studies provide concrete examples of how collaborative governance models, digital infrastructures, and data-sharing approaches can support the emergence of new forms of economic and societal value.

The Business Model Playbook builds on these experiences and aims to translate them into transferable insights that can support the wider adoption of data-driven approaches across the agri-food sector.

1.4 How to Use This Business Model Playbook

The Business Model Playbook is designed as a practical support and reflection tool for stakeholders seeking to explore, adapt, and implement data-driven business models within the Data Economy for Food Systems (DE4FS). Rather than prescribing fixed solutions, it provides structured insights, illustrative configurations, and analytical perspectives that can support strategic decision-making.

Different stakeholder groups can use the Playbook in complementary ways:

- Consortium partners can use the Playbook to support the exploitation of project results, identify follow-up opportunities, and position their solutions within broader data ecosystems.
- Case study actors can use the presented models to reflect on their current business configurations, identify gaps, and explore pathways for scaling, replication, or long-term sustainability.
- Stakeholder networks and innovation actors such as clusters, Digital Innovation Hubs (DIHs), and AKIS networks can use the Playbook to support advisory activities, capacity building, and the design of data-driven services.
- External organisations, including agri-food companies, technology providers, researchers, and public authorities, can use the Playbook as a reference framework to design or adapt their own business models, drawing on lessons learned and transferable approaches emerging from the Data4Food2030 case studies.

The Playbook can be used in three main ways:

1. **Exploration:** identify relevant business model configurations based on specific strategic objectives, such as improving data sharing, creating new services, or enhancing sustainability performance.
2. **Assessment:** use the proposed indicators to evaluate the strengths and weaknesses of an existing business model, including its scalability, inclusiveness, interoperability, and data valorisation potential.
3. **Adaptation and innovation:** combine elements from different models and tailor them to specific operational, sectoral, or regional contexts, taking into account governance structures, stakeholder incentives, and ecosystem requirements.

In this sense, the Playbook functions as a decision-support and reflection tool, helping organisations move from conceptual understanding towards the practical exploration and development of data-driven business models and collaborative data ecosystems.

2. From Case Studies to Business Models

The Data4Food2030 project investigates the development of the Data Economy for Food Systems (DE4FS) through a portfolio of case studies that explore how data can be generated, shared, reused, and valorised across different segments of the agri-food sector. These case studies operate as interdisciplinary and multi-stakeholder experimental environments where new forms of data-driven collaboration, governance arrangements, interoperability approaches, and digital services are explored and tested in real-world contexts.

Each case study addresses a specific challenge or opportunity related to the use of data within food systems, ranging from supply chain transparency and sustainability monitoring to logistics optimisation, circular economy applications, regional development, and cross-sector data reuse. Through these activities, the project generates valuable practical insights into how data ecosystems emerge, how stakeholders interact within them, and how value can be created through the reuse and sharing of data.

While the case studies differ in terms of technological focus, organisational structure, stakeholder composition, and operational maturity, they also reveal a number of recurring patterns in the way data can support new forms of economic and societal value creation. These patterns relate to how organisations capture value from data, establish governance mechanisms, develop trusted data-sharing arrangements, structure partnerships, and design services that rely on interoperable digital infrastructures.

The Business Model Playbook builds upon these experiences by analysing the broader business model structures and mechanisms underpinning these initiatives. In line with the objectives of Task 6.3, the Playbook aims to support the exploitation, continuity, uptake, and scaling of project results by translating case study experiences into structured and transferable business model insights.

Rather than presenting detailed or commercially validated business plans, the Playbook identifies illustrative business model configurations that reflect how data-driven services, collaborative ecosystems, and governance approaches can function in practice within the DE4FS landscape. The Playbook therefore complements rather than replaces the individual business modelling activities carried out within the case studies themselves.

The examples presented in the following sections draw inspiration from selected Data4Food2030 case studies while focusing on the broader business model logic that enables organisations to create, deliver, and capture value from data. These examples should therefore be understood as analytical and illustrative representations designed to support reflection, strategic thinking, and stakeholder learning. They do not constitute prescriptive models or final operational business plans.

The selection of the six business model configurations presented in this Playbook was based on their ability to collectively provide representative coverage of the different dimensions of the DE4FS explored within Data4Food2030. The selected examples were chosen for their capacity to illustrate distinct and complementary business model dimensions rather than to imply prioritisation among case studies. Together, the selected examples cover a broad spectrum of themes, including sustainability monitoring, logistics and traceability, circular economy applications, interoperability, governance structures, regional development, and cross-sector data reuse, while also reflecting both vertical and horizontal dimensions of emerging food system data ecosystems.

By synthesising insights across these different contexts, the Playbook provides a transversal reference framework that can help organisations, policymakers, researchers, and innovation actors better understand how data can support the development of collaborative ecosystems, sustainable value chains, and new forms of data-driven innovation within food systems.

The following sections present six illustrative business model configurations derived from the Data4Food2030 case studies. Each configuration is described using a structured analytical framework covering stakeholder segments, value propositions, governance and infrastructure components, operational mechanisms, and financial viability considerations. The implementation maturity and replication considerations presented in the following sections reflect the analytical assessment developed for the purposes of this Playbook, based on the information available from the selected case studies. They should not be interpreted as formal evaluations, technology-readiness assessments, or official positions of the individual case studies or their partners.

3. Business Model: Premium Grain Chain (PGC)

The following business model configuration is not presented as a fixed or fully commercialised business model developed by the case study itself. Rather, it represents an analytical abstraction derived from the experience, governance arrangements, and data-sharing mechanisms explored within the Premium Grain Chain case study. The objective is to illustrate transferable value creation patterns that may support reflection, adaptation, and replication in other agri-food data ecosystems.

3.1 Overview

The Premium Grain Chain (PGC) business model illustrates how data-driven collaboration can support the development of sustainable and value-oriented approaches within the agri-food sector. The model is based on an open ecosystem concept that emphasises collective value creation among ecosystem participants rather than focusing solely on individual actors' interests.

Within this framework, the case study explores how data space principles can be applied in practice to support trusted data sharing, improved transparency, and collaborative governance in the grain value chain. By enabling the exchange and reuse of data among different stakeholders, the ecosystem creates opportunities for additional economic, operational, and sustainability-related value from agricultural data.

Multiple user groups may benefit from the ecosystem logic reflected in the Premium Grain Chain model. Farmers can leverage production data collectively and strengthen their market position through data-driven collaboration. Food processing companies can verify sustainability and quality claims based on trusted data, thereby supporting product differentiation and market value. Agricultural machinery manufacturers and digital technology providers can develop and operate services within the data ecosystem and expand their business opportunities.

In this respect, the model illustrates how trusted data sharing, interoperability mechanisms, and collaborative governance structures can support the broader objectives of the Data4Food2030 project by enabling the reuse and valorisation of data within food systems.

By analysing the organisational, technological, and governance dimensions of the case study, the model provides insights that may support the adaptation and replication of similar data-driven approaches in other food system contexts.

3.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The Premium Grain Chain ecosystem involves several stakeholder groups, each with specific objectives, challenges, and expected benefits. The table below summarises the key actors participating in the model and the value that the ecosystem may generate for each of them.

Table 1: Stakeholder segments and indicative value creation mechanisms in the Premium Grain Chain ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (Pains)	Resolution from the Offers (Gains)
Farmers	• Prove sustainability by accurately measuring and reporting environmental impact. • Optimise sales by coordinating large and consistent grain lots for the market.	• Inaccurate reporting: difficulties calculating precise carbon footprint using generic data. • Unrealised deals due to lack of verified sustainability data. • Low margins • Fragmentation: limited ability to coordinate data sharing and collective market positioning.	• Economic reward through higher margins for premium quality grain verified by data. • Precise environmental reporting based on production data. • Collective power through data-driven collaboration and coordinated grain sales.
Food Producers	• Verify market claims regarding product quality and sustainability. • Boost sales and exports through trusted product verification.	• Traceability gaps across the supply chain. • Brand risk due to the inability to verify sustainability claims.	• Verifiable quality labels and improved traceability. • Increased consumer trust and improved export opportunities.
System Providers	• Develop digital services and precision farming features. • Ensure interoperability of digital solutions within the ecosystem.	• Fragmented markets and unclear data monetisation rules.	• Increased demand for precision farming services. • New market access through participation in the data ecosystem.
Data Ecosystem (Data Sharing Services)	• Facilitate fair and secure data exchange between actors. • Establish governance rules and pricing mechanisms for data use.	• Lack of trust in existing data-sharing mechanisms. • Difficulty defining transparent rules for data monetisation.	• Transparent and interoperable system for data monetisation. • Shared knowledge and peer learning through rule-based data exchange.

3.3 Core Needs Satisfied

The Premium Grain Chain model addresses several key needs within the agri-food ecosystem.

For **farmers**, the model provides opportunities to obtain higher margins for premium grain products whose sustainability or quality characteristics can be verified through production data. This creates an economic incentive for data sharing and collaboration.

For **food producers**, the model supports the verification of sustainability and quality claims, thereby strengthening product differentiation, increasing consumer trust, and supporting export opportunities.

For **data ecosystem actors**, the model demonstrates the importance of fair, transparent, and interoperable systems for data exchange and monetisation. Through shared governance rules and trusted infrastructures, the ecosystem can support the development of a functioning data economy within the grain value chain.

3.4 Problem Scenarios Addressed

The Premium Grain Chain model addresses several practical challenges within the agri-food sector.

One key application concerns the calculation of carbon footprints based on production process data and traceability of grain sales lots. By integrating production data into digital monitoring systems, the model enables more accurate environmental indicator calculations and allows data sharing and optimisation across participating actors, such as farming cooperatives.

The availability of reliable production data can also support improved food traceability services throughout the supply chain, allowing consumers and market actors to access verified information regarding product origin and sustainability attributes.

In addition, data sharing within farmer groups enables the coordination of common grain sales, addressing challenges such as ensuring consistent grain quality across different producers, identifying shared interests, and supporting collective decision-making. This also contributes to peer learning and the creation of shared knowledge among farmers.

3.5 Business Model Structure

3.5.1 The Customer

Customer Segments

The Premium Grain Chain model targets a multi-sided market within the agricultural data ecosystem. Key customer and user groups include farmers and their cooperatives seeking stronger market power; food producers and exporters requiring verifiable quality claims; system providers offering digital agriculture services; and data sharing services that facilitate trusted data exchange. Regulators and public actors may also benefit from the governance framework, which supports the digital transformation of the sector.

Channels

The ecosystem relies on several channels to reach its stakeholder groups. Data exchange is facilitated through data intermediation services such as Tritom by Dataspace Europe. Verified product information can be communicated through traceability applications used by food producers and consumers. Farmers access digital tools through precision farming platforms and/or FMIS systems, while collaboration and governance activities are supported through workshops and joint projects involving stakeholders across the ecosystem.

Customer Relationships

Relationships within the ecosystem are based on collaborative development and fair governance principles. A central element of the model is the creation of a Rulebook, developed through collaboration among more than twenty stakeholders. This rulebook establishes transparent rules for data sharing and data monetisation.

The ecosystem also promotes community building and peer learning, particularly among farmer groups that share production data in order to improve decision-making, coordinate production activities, and strengthen collective interests.

3.5.2 The Offering

Value Propositions

The Premium Grain Chain model illustrates how a traditionally fragmented grain supply chain can move towards a data-verified, transparent, and collaborative ecosystem.

This transformation is supported through several core value propositions. First, the model enables precision sustainability reporting, allowing more accurate calculation of environmental indicators based on production data. Second, it supports end-to-end product traceability, enabling consumers and market actors to verify product origin and sustainability characteristics. Finally, the model strengthens collective market power for farmers, allowing them to coordinate production data and pursue premium positioning for verified grain products.

3.5.3 The Infrastructure

Key Resources

The model relies on a combination of technological, organisational, and governance resources. A central component is the Fair Data Economy Rulebook, developed with national support, which defines principles governing data exchange within the ecosystem.

Key technical resources include the data intermediation service Tritom by Dataspace Europe, environmental indicator calculation models developed by research organisations such as Luke, and grain traceability services supporting supply chain transparency. Human expertise from research organisations, technology providers, and agri-food actors also plays an essential role.

Key Activities

Core activities include facilitating data intermediation and exchange, implementing governance rules for fair data economy practices, and integrating environmental indicator calculation models into the data ecosystem. Significant effort is also dedicated to value chain collaboration and pilot implementation, including pilot activities carried out within the Data4Food2030 project.

Key Partners

The model relies on a broad ecosystem of partners, including technology providers such as Dataspace Europe, Second Thought; research institutions such as Luke and VTT; food industry actors; data sharing experts such as 1001 Lakes; and policymakers including the Finnish Ministry of Agriculture and Forestry. Connections with broader European initiatives, including AgriDataSpace and CEADS, also support interoperability and alignment with emerging data space approaches.

3.5.4 Operational and Financial Sustainability

Revenue Streams

Revenue generation within the ecosystem may emerge from the value created through verified data. Farmers may benefit from higher margins for premium grain whose sustainability characteristics are verified through trusted production data and may also benefit from potential licensing or compensation mechanisms linked to secondary uses of their data.

System providers may generate income through licensing fees for digital services and precision farming solutions, while data sharing services such as Tritom may charge subscription or usage-based fees for facilitating data exchange between actors.

Cost Structure

The primary cost elements relate to technological development and ecosystem governance. These include investments in data infrastructure, integration of digital services, and the development and maintenance of governance mechanisms such as the rulebook. Additional costs arise from coordination activities, stakeholder engagement, and the personnel required to manage interoperability challenges within the ecosystem.

Overall, the Premium Grain Chain model demonstrates how data-based services, trusted governance arrangements, and collaborative infrastructures can support long-term value creation and enable wider adoption of data-driven solutions within food systems.

3.6 Implementation and Scalability Considerations

- **Maturity Level:** Early deployment phase, with governance structures, data-sharing mechanisms, and pilot implementations established and tested within the grain value chain.
- **Link to Data Ecosystem:** Strong alignment with European data space initiatives, particularly AgriDataSpace and CEADS, and based on trusted data-sharing frameworks, interoperability mechanisms, and governance models such as the Fair Data Economy Rulebook.
- **Replication Potential:** High potential for replication across commodity-based supply chains, such as cereals and oilseeds, where standardisation, traceability, and sustainability verification can support premium market positioning and data-driven collaboration.

4. Business Model: DIRECT – Real-Time Fresh Data

The following business model configuration is derived from the DIRECT case study and is presented as an analytical representation of the business logic, stakeholder interactions, and value creation mechanisms explored within the project. It should not be interpreted as a fixed commercial blueprint, but rather as a transferable model illustrating how real-time data exchange and sensor-enabled infrastructures may support data-driven innovation in fresh produce supply chains.

4.1 Overview

The DIRECT case study explores how real-time data exchange can improve transparency, efficiency, and quality monitoring within the European fresh produce supply chain. The model focuses on enabling seamless data exchange from farm to retail through the integration of sensor-enabled logistics infrastructure and digital data platforms.

The central objective of the case study is to facilitate the proper use, reuse, and redistribution of real-time data across the supply chain. This is achieved through the deployment of smart trays, namely Returnable Transport Items (RTIs) equipped with sensors capable of capturing and transmitting environmental and logistical information throughout the transport process.

The use of smart trays allows supply chain stakeholders to access reliable real-time data without requiring extensive additional hardware integration or complex system deployment. This approach reduces the need for additional operational steps and helps avoid fragmentation in data collection processes.

By replacing paper-based or delayed reporting mechanisms with digital monitoring solutions, the system supports improved supply chain visibility, more reliable quality verification, and better operational decision-making across the distribution chain.

In this context, the DIRECT model illustrates how digital infrastructures and sensor-based logistics systems can support the emergence of data-driven services in food supply chains, contributing to improved transparency, operational efficiency, and reduced food waste.

4.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The DIRECT ecosystem involves several stakeholder groups across the fresh produce supply chain. Each group interacts with the system in different ways and may derive specific benefits from improved access to real-time data.

Table 2: Stakeholder segments and indicative value creation mechanisms in the DIRECT ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (pains)	Resolution from the Offers (Gains)
Suppliers / Producers (e.g., Farmers)	• Provide proof of product quality (e.g., temperature compliance).	• Paper-based data exchange prone to errors and fraud. • Difficulty differentiating produce based on verifiable quality.	• Ability to prove quality requirements to customers. • Differentiation of produce based on verified data. • Access to real-time delivery information.

Retailers / Customers (later steps in the chain)	• Assess quality of incoming produce and compliance with requirements. • Optimise operational processes such as stock management.	• Fragmented data along the supply chain makes quality assessment difficult. • Unexpected deviations causing food waste are difficult to detect.	• Access to detailed real-time delivery data. • Improved planning and handling of fresh produce. • Identification of systematic issues that may cause food waste.
Euro Pool System (EPS)	• Improve the efficiency of RTI supply management across Europe. • Expand service portfolio with data-driven services.	• Need to balance desired digital features with ICT infrastructure complexity.	• Optimised RTI supply management through location monitoring. • Creation of new revenue streams through value-added services.
Regulators	• Verify compliance with regulatory requirements (e.g., supply chain due diligence). • Support food safety and traceability monitoring	• Difficulty verifying product origin and identifying suppliers through traditional communication channels.	• Extended data exchange enabling origin verification and supplier identification. • Improved data availability for food safety monitoring and strategic planning.

4.3 Core Needs Satisfied

The DIRECT model addresses several operational and regulatory needs within the fresh produce supply chain.

For producers, the system supports the verification of product quality conditions such as temperature compliance, allowing them to demonstrate adherence to specific quality requirements and potentially differentiate their products in the market.

For customers and retailers, the availability of real-time logistics and quality data can support improved supply chain management, earlier identification of deviations, and optimisation of operational processes.

For Euro Pool System (EPS), the system provides a technological foundation for improving the distribution and management of returnable transport items across Europe, while also creating opportunities for additional value-added digital services.

4.4 Problem Scenarios Addressed

The DIRECT model addresses several practical challenges related to fresh produce logistics and data exchange.

One important application concerns real-time monitoring of product quality conditions, such as temperature throughout the supply chain. Continuous monitoring enables the detection of unexpected deviations that may compromise product quality or contribute to food waste.

The system also supports improved supply chain visibility and logistics management. By monitoring the location of returnable transport items, the system can enable better balancing of RTI stocks across depots and improve the efficiency of logistics operations.

Finally, the model demonstrates how improved data exchange and transparency across supply chain actors can support more integrated information flows. Suppliers may provide real-time delivery data to downstream stakeholders, overcoming limitations associated with fragmented communication mechanisms.

4.5 Business Model Structure

4.5.1 The Customer

Customer Segments

The DIRECT ecosystem targets several stakeholders within the fresh produce supply chain. Key customer and user groups include suppliers such as farmers, retailers and downstream customers, as well as Euro Pool System's operational services. Regulators and researchers may also benefit from access to verified supply chain data supporting food safety monitoring and due diligence requirements.

Channels

Data exchange and monitoring are enabled through smart trays (RTIs) equipped with sensors and IoT communication devices. The system relies on Euro Pool System's existing ICT infrastructure and digital applications, which support both internal operational processes and potential value-added services offered to supply chain stakeholders.

Customer Relationships

Customer relationships are primarily structured through existing contractual arrangements related to RTI usage. Euro Pool System manages customer relationships through its asset management services and may offer optional digital services, such as temperature tracking solutions, based on specific customer demand.

4.5.2 The Offering

The DIRECT model illustrates several potential value propositions.

First, it enables near real-time data exchange across the fresh produce supply chain through sensor-enabled transport items. Second, it supports continuous supply chain monitoring without requiring fixed infrastructure, allowing stakeholders to track product conditions throughout transport. Third, the system may enable the identification of unexpected deviations in temperature or logistics conditions, helping stakeholders prevent quality deterioration and reduce food waste.

Finally, the system may allow suppliers to differentiate products based on verifiable quality data, thereby strengthening market trust and transparency.

4.5.3 The Infrastructure

Key Resources

The DIRECT ecosystem relies on several technological and organisational resources. These include smart trays (RTIs), sensor and IoT communication technologies, and the underlying ICT infrastructure supporting data exchange.

The FriDa platform supports context-based data exchange, while stateless mobile applications enable data access and monitoring across supply chain actors.

Key Activities

Key activities include the integration and consolidation of multiple data sources, the collection and aggregation of sensor data, and the analysis of IoT device capabilities and associated costs.

The system also involves the enhancement of ICT infrastructure in order to support data space architectures and interoperability, including alignment with the FIWARE Data Space Connector.

Key Partners

The ecosystem relies on collaboration between IoT and service providers, supply chain stakeholders participating in pilot deployments, academic organisations supporting validation activities, and technology clusters facilitating innovation.

Collaboration with related initiatives such as the FriDa project also contributes to the development and validation of the ecosystem.

4.5.4 Operational and Financial Sustainability

Revenue Streams

Revenue opportunities may emerge primarily through the expansion of Euro Pool System's service portfolio. These may include all-inclusive digital service extensions for customers and optional subscription-based services, such as temperature monitoring solutions.

In addition, the system may generate operational value through improved internal efficiency and optimisation of RTI logistics.

Cost Structure

The main cost components relate to the deployment and maintenance of smart trays and associated IoT infrastructure, as well as investments in ICT systems required for data exchange and monitoring.

Balancing these costs against expected operational benefits and value-added services represents an important consideration in the deployment strategy of the DIRECT ecosystem.

4.6 Implementation and Scalability Considerations

- **Maturity Level:** Demonstration to early deployment phase, with validation through pilot implementations involving smart trays and IoT-enabled logistics.
- **Link to Data Ecosystem:** Builds on FIWARE-based components and aligns with emerging European data space approaches, particularly in relation to agri-food data sharing and interoperability standards.
- **Replication Potential:** High potential for replication across perishable supply chains, such as dairy, meat, and fisheries, where real-time monitoring and traceability are important for quality assurance and waste reduction.

5. Business Model: THESIS – The Sustainability Insight System

The following business model configuration is derived from the THESIS case study and is presented as an analytical representation of the governance structures, sustainability data flows, and value creation mechanisms explored within the project. It should not be interpreted as a fixed commercial model, but rather as a transferable framework illustrating how data-driven sustainability assessment systems may support transparency, benchmarking, and decision-making across supply chains.

5.1 Overview

The Sustainability Insight System (THESIS) business model illustrates how data-driven tools can support improved sustainability monitoring and decision-making across consumer product supply chains. The system aims to create clearer demand signals that enable retailers, manufacturers, and suppliers to benchmark, quantify, and address critical sustainability issues within their operations and supply networks.

THESIS is designed as a flexible system that integrates both secondary data derived from Life Cycle Assessment (LCA) models and primary data provided by suppliers. By combining these data sources, the system enables the identification and prioritisation of environmental hotspots while maintaining usability across varying levels of data maturity.

A key objective of the system is to reduce the reporting burden on supply chain actors while improving the comparability and credibility of sustainability information. This is achieved through harmonised methodologies, modelled datasets, and verification mechanisms that allow sustainability indicators to be calculated even when primary data is not fully available.

In addition, THESIS incorporates mechanisms intended to encourage continuous improvement in sustainability performance. These include incentive structures, benchmarking tools, and recognition mechanisms such as product category performance badges that support business-to-business communication of sustainability achievements.

Through this approach, the model illustrates how digital platforms and harmonised sustainability metrics can facilitate more transparent and data-informed sustainability management across complex consumer product supply chains.

5.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The THESIS ecosystem involves several groups of stakeholders participating in sustainability reporting, benchmarking, and improvement activities within consumer product supply chains.

Table 3: Stakeholder segments and indicative value creation mechanisms in the THESIS ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (pains)	Resolution from the Offers (Gains)
Retailers / Buyers (Users of THESIS)	• Prioritise sustainability issues across product portfolios. • Strengthen sustainability demand	• Numerous and inconsistent sustainability data requests across supply chains.	• Quantifiable prioritisation of sustainability issues. • Harmonised and comparable sustainability scores.

	signals within supply chains. • Set improvement targets and recognise leading suppliers.	• Difficulty comparing product categories based only on primary data.	• Contextual company-level information supporting decision-making.
Suppliers / Manufacturers (Respondents to THESIS)	• Measure and communicate sustainability performance. • Improve product-level environmental performance. • Respond to sustainability requirements from buyers.	• High administrative burden for collecting and reporting sustainability data. • Limited incentives for reporting. • Uncertainty regarding trust in scores derived from incomplete primary data.	• Reduced reporting burden through the use of modelled secondary data. • Clear roadmap for sustainability improvement. • Product category performance badges supporting B2B communication.
THESIS / The Sustainability Consortium (TSC)	• Expand the reach and quality of the THESIS system. • Ensure the long-term operational and financial sustainability of the system.	• Significant workload required to map, assess, and transform secondary datasets. • Potential bias in supplier responses or interpretation of sustainability data.	• Diversified use cases and improved supplier engagement through company-level insights. • Financial sustainability through licence-based access to the system.

5.3 Core Needs Satisfied

The THESIS model addresses several needs related to sustainability monitoring and reporting within consumer product supply chains.

For retailers and buyers, the system enables the prioritisation of sustainability issues across product categories using quantifiable and comparable indicators. This supports more informed procurement decisions and helps strengthen sustainability demand signals within supply chains.

For suppliers and manufacturers, the system provides mechanisms that may reduce the administrative burden associated with sustainability reporting. By incorporating modelled secondary data and harmonised reporting structures, the system allows suppliers to participate even when detailed primary data is not readily available. At the same time, it provides guidance and improvement pathways intended to support sustainability performance enhancements.

For participating actors more broadly, the model contributes to the development of harmonised methodologies and verification mechanisms that may improve the credibility, transparency, and trustworthiness of sustainability assessments.

5.4 Problem Scenarios Addressed

The THESIS model addresses several practical challenges related to sustainability data collection, benchmarking, and reporting.

One important issue concerns the administrative burden associated with sustainability reporting. By enabling the use of secondary LCA data when primary data is unavailable, the system reduces the amount of information suppliers may need to collect and report while still allowing sustainability scores to be generated.

Another challenge relates to the prioritisation of sustainability issues across product categories. The integration of modelled secondary data allows retailers to benchmark environmental hotspots across product categories and support strategic decision-making.

The system also addresses challenges related to the credibility and verification of sustainability information. Verification mechanisms, such as greenhouse gas (GHG) verification questions and additional validation approaches, contribute to improving the reliability of reported sustainability indicators.

5.5 Business Model Structure

5.5.1 The Customer

Customer Segments

The THESIS ecosystem primarily targets final goods manufacturers (suppliers) and retailers or buyers participating in consumer product supply chains. Additional stakeholders, such as government agencies, non-governmental organisations (NGOs), and certification programme owners, may also contribute to the development and application of the system.

Channels

THESIS is delivered through a web-based platform developed by SupplyShift/Sphera, operating as a Software-as-a-Service (SaaS) solution. Data collection and interaction occur through online questionnaires or through file uploads, such as Excel-based templates. Key performance indicators and analytical results may also be communicated through exported documents such as Excel or PDF reports.

Customer Relationships

Customer relationships are primarily managed through the SupplyShift/Sphera web platform, which supports both self-service and managed interactions. The system is developed collaboratively with stakeholders including NGOs, government bodies, and industry actors.

Suppliers retain control over the visibility of their results, while the platform may provide automated recommendations intended to support sustainability performance improvements.

5.5.2 The Offering

Value Propositions

The THESIS system provides sustainability performance scores for products and supply chains based on a combination of secondary LCA data and primary supplier data.

The system offers a harmonised methodology that may reduce the reporting burden for suppliers while enabling retailers and buyers to obtain comparable sustainability indicators across product categories.

Additional value may be created through company-level contextual information and recognition mechanisms such as product category performance badges, which allow suppliers to communicate sustainability achievements in business-to-business contexts.

5.5.3 The Infrastructure

Key Resources

The system relies on several key resources, including primary data from suppliers, secondary LCA datasets such as Agribalyse and footprinting tools (ecolabeling), verification mechanisms for greenhouse gas (GHG) data, and the SupplyShift/Sphera web platform that hosts the system.

Human expertise in LCA, sustainability modelling, and data management also plays an important role in maintaining and improving the system.

Key Activities

Core activities include mapping and linking LCA secondary datasets to THESIS environmental hotspots, developing scoring systems that function across varying levels of data maturity, and maintaining the data structures and models underlying the system.

Additional activities include the development of questionnaires and reporting instructions that guide suppliers in providing sustainability information.

Key Partners

Key partners supporting the system include The Sustainability Consortium (TSC) and Wageningen University & Research (WUR), which contribute expertise in sustainability research and data modelling.

The SupplyShift/Sphera platform provider supports the technological infrastructure, while retailers, government agencies, NGOs, and certification programme owners contribute to the development, validation, and adoption of the system.

5.5.4 Operational and Financial Sustainability

Revenue Streams

Potential revenue generation may be supported through annual licence fees paid by suppliers, manufacturers, producers and buyers participating in the THESIS system. Additional financial support may also be provided through contributions from members of The Sustainability Consortium.

Cost Structure

The main cost components relate to the development and maintenance of the THESIS platform, including the mapping and transformation of secondary sustainability datasets, platform operation, and the personnel required to manage sustainability analyses, coordination activities, and system improvements.

The annual licence fee required for system participation may also represent an adoption barrier for some potential users, particularly where reporting resources are limited.

5.6 Implementation and Scalability Considerations

- **Maturity Level:** Early deployment phase, with an operational SaaS platform (SupplyShift/Sphera) and ongoing refinement of scoring methodologies, verification mechanisms, and stakeholder engagement processes.
- **Link to Data Ecosystem:** Connected to broader sustainability data initiatives and aligned with Life Cycle Assessment (LCA) databases and emerging standards for sustainability reporting within the European data landscape.

- **Replication Potential:** High potential for cross-sector replication beyond agri-food, particularly in consumer goods industries requiring harmonised sustainability assessment, reporting, and benchmarking across complex supply chains.

6. Business Model: I4DATA – Circular Economy for Tourism

The following business model configuration is derived from the I4DATA case study and is presented as an analytical representation of the cross-sector data-sharing mechanisms, stakeholder interactions, and value creation approaches explored within the project. It should not be interpreted as a fixed commercial business plan, but rather as a transferable example illustrating how agricultural data reuse may support both agri-food digitalisation and tourism-related innovation.

6.1 Overview

The I4DATA case study explores how data sharing can support improved decision-making in agriculture while simultaneously creating new opportunities for the tourism sector. The initiative focuses on the Balearic Islands, where the agri-food sector currently makes limited use of digital data for operational decision-making and where connections between agriculture and tourism remain relatively underdeveloped.

The main objective of the case study is to promote the use of data sharing to increase efficiency and sustainability within the agri-food sector, while also enabling the development of new tourism services linked to local agricultural production. By facilitating the exchange and reuse of agricultural data, the system aims to support farmers in improving operational practices, particularly in areas such as plant health management and environmental performance.

At the same time, the initiative explores how agricultural data can be connected to the tourism ecosystem in order to create new visitor experiences linked to local food production. These experiences may include activities associated with seasonal harvesting periods, local product traceability, or gastronomic tourism initiatives.

Through this approach, the I4DATA model illustrates how data-driven services may contribute to the wider adoption of digital practices in the agri-food sector while fostering stronger connections between agriculture, gastronomy, and tourism. The model also supports regional authorities in promoting agricultural digitalisation and sustainability objectives.

6.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The I4DATA ecosystem involves several stakeholder groups representing agriculture, tourism, and public governance. Each group interacts with the system in different ways and may benefit from improved access to agricultural data and cross-sector collaboration.

Table 4: Stakeholder segments and indicative value creation mechanisms in the I4DATA ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (pains)	Resolution from the Offers (Gains)
Farmers / Cooperatives	• Improve decision-making mechanisms, particularly regarding plant health and crop management. • Comply with digital farm log requirements.	• Limited use of data in daily agricultural decision-making. • Limited awareness of digitalisation opportunities. • Perceived high cost	• Increased use of data for operational decision-making. • Improved efficiency and environmental performance. • Support from cooperatives,

	• Reduce environmental footprint.	of digitalisation and unclear benefits.	local innovation actors, and public authorities.
Tourism Sector (Hotels, Agencies)	• Develop new tourism services and experiences linked to local agriculture. • Attract visitors during the low tourism season. • Provide authentic gastronomic and cultural experiences.	• Weak connections with the agri-food sector. • Lack of real-time or detailed information on agricultural activities.	• Creation of new tourism experiences linked to agricultural activities (e.g., almond or grape harvesting). • Access to information about product origin and production conditions for gastronomic tourism offers.
Regional Government / Regulators	• Promote digitalisation and sustainability in the agri-food sector. • Monitor environmental impacts and sector performance.	• Limited data availability for evaluating sector sustainability. • Difficulty fostering collaboration between agriculture and tourism sectors.	• Access to improved data on environmental impacts. • Support for sector digitalisation and cross-sector collaboration.

6.3 Core Needs Satisfied

The I4DATA model addresses several needs related to digitalisation, sustainability, and cross-sector collaboration.

For farmers and agricultural cooperatives, the system supports the wider adoption of data use in agricultural decision-making. Improved access to data may enable better management of plant health, improved operational efficiency, and reductions in environmental impact.

For the tourism sector, the model provides opportunities to develop tourism services linked to agricultural production cycles and local gastronomy. These services may help attract visitors outside peak tourist seasons and strengthen connections between tourism and local food systems.

For regional authorities, the system supports policy objectives related to digitalisation, sustainability, and regional economic development. Improved access to agricultural data may help policymakers better understand environmental impacts and encourage stronger collaboration between economic sectors.

6.4 Problem Scenarios Addressed

The I4DATA model addresses several practical challenges related to the adoption and use of data in agriculture and its integration with other sectors.

One challenge concerns the limited use of digital data in agricultural decision-making. By facilitating access to agricultural datasets and supporting data-sharing mechanisms, the system helps farmers incorporate more data-driven practices into their operations, potentially improving efficiency and sustainability outcomes.

Another challenge relates to the limited connections between agriculture and tourism. By sharing information on agricultural activities such as harvesting periods or product origins, the system enables the tourism sector to explore new experiences and services linked to local food production.

The model also supports the development of gastronomic tourism offers by linking information on agricultural production with local food products and culinary traditions. This contributes to stronger connections between agriculture, tourism, and regional cultural identity.

6.5 Business Model Structure

6.5.1 The Customer

Customer Segments

The I4DATA ecosystem involves several categories of stakeholders, including farmers producing almonds or grapes, agri-food cooperatives supporting agricultural production, tourism sector organisations such as hotels and tourism agencies, and regional public authorities. Research groups and innovation organisations also contribute to the development and validation of the system.

Channels

The system relies on the NADIA platform, which is based on FIWARE technologies, to facilitate data sharing and access. Technical integration options under consideration include FIWARE connectors and ECLIPSE connectors to support interoperability with other systems.

In addition to digital infrastructure, the initiative also relies on events, workshops, and communication activities to engage farmers, cooperatives, policymakers, and tourism actors. Social media and related communication channels support outreach and dissemination activities.

Customer Relationships

Customer relationships are primarily built through collaboration with agri-food cooperatives, which serve as intermediaries connecting the system with farmers. Agreements are also being explored with wine appellations such as Wine DOs and Vi de la Terra.

The longer-term objective is to ensure that digitalisation services remain accessible to agricultural stakeholders through a low-cost access model following the completion of the project.

6.5.2 The Offering

Value Propositions

The I4DATA model illustrates several value propositions.

First, it supports more data-driven agricultural decision-making, enabling farmers to improve efficiency, manage plant health, and potentially reduce environmental impacts.

Second, the system enables the development of tourism services by linking agricultural data with tourism-related activities. For example, information about harvest periods may be used to create tourism experiences associated with local agricultural traditions.

Finally, the system provides access to information on agricultural production and environmental conditions, supporting both sustainability monitoring and the development of gastronomic tourism initiatives.

6.5.3 The Infrastructure

Key Resources

Key resources include the NADIA platform, developed using FIWARE technologies, as well as agricultural datasets provided by wine appellations, agricultural cooperatives, and local producers.

Local innovation actors and early adopters also play an important role in demonstrating the benefits of digitalisation and supporting broader adoption.

Key Activities

Core activities include identifying relevant agricultural datasets, assessing possibilities for data sharing, analysing interoperability solutions such as FIWARE and ECLIPSE connectors, and developing connections between agricultural data and tourism applications.

Dissemination and engagement activities, including events and workshops, are also important for promoting adoption among farmers and tourism actors.

Key Partners

Key partners include agri-food cooperatives, which facilitate engagement with farmers; wine appellation organisations such as Wine DOs and Vi de la Terra; the regional Ministry of Agriculture; tourism cluster organisations such as TURISTEC; and research groups including INAGEA.

6.5.4 Operational and Financial Sustainability

Revenue Streams

Potential revenue opportunities include the development of tourism services that integrate agricultural experiences with tourism offers. In addition, a low-cost access model for the digital platform is foreseen after the completion of the project in order to support longer-term service continuity.

Cost Structure

The primary cost elements relate to the digitalisation of agricultural data and the development of the technical infrastructure required to support data exchange. The costs associated with digitalisation may represent a barrier for some users, particularly during early stages of adoption.

Additional costs are associated with technical evaluation and integration activities, such as the analysis and implementation of FIWARE connectors and other interoperability solutions.

6.6 Implementation and Scalability Considerations

- **Maturity Level:** Pilot phase, with ongoing testing of data-sharing mechanisms and interoperability solutions between agri-food and tourism sectors.
- **Link to Data Ecosystem:** Based on FIWARE architecture (NADIA platform) and exploring interoperability through FIWARE and ECLIPSE connectors, contributing to the development of regional data spaces and alignment with European data space principles.
- **Replication Potential:** Moderate to high potential in regions with strong agri-food and tourism interlinkages, particularly where seasonal tourism may be enhanced through data-driven services and cross-sector collaboration.

7. Business Model: ISDaaS – Inter-Sectorial Data as a Service

The following business model configuration is derived from the ISDaaS case study and is presented as an analytical representation of the inter-sectorial data-sharing approaches, stakeholder interactions, and value creation mechanisms explored within the project. It should not be interpreted as a fixed commercial business plan, but rather as a transferable example illustrating how agricultural data reuse may support regional product promotion, tourism-related services, and broader regional development objectives.

7.1 Overview

The Inter-Sectorial Data as a Service (ISDaaS) case study explores how improved data integration and reuse can support the promotion and sale of regional products while strengthening links between agriculture, tourism, and regional development.

The initiative focuses on improving the handling and utilisation of data related to regional product sales in the Czech Republic, particularly within short food supply chains and direct farm sales. These channels include farmyard sales and other forms of direct interaction between producers and consumers, which often remain underrepresented in existing digital data systems.

The central objective of the case study is to shift the focus from purely Farm-to-Fork (F2F) data flows towards broader inter-sectoral data utilisation. While F2F data exchange is already relatively well established within agricultural systems, the reuse of this data across other sectors, such as tourism, regional marketing, and local economic development, remains comparatively limited.

The ISDaaS model therefore aims to enhance data integration by leveraging existing datasets, including information from the Central Records of the Ministry of Agriculture, in order to improve the visibility and promotion of local producers. By enabling the reuse of these datasets across multiple sectors, the system supports the development of services such as gastronomic tourism, educational tourism, and regional product promotion.

Through this approach, the model illustrates how data platforms and inter-sectoral data reuse may support regional economic development, improve transparency for consumers, and strengthen market opportunities for small producers, while also reinforcing connections between agriculture and tourism.

7.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The ISDaaS ecosystem involves several stakeholder groups participating in regional food systems, tourism services, and data governance activities.

Table 5: Stakeholder segments and indicative value creation mechanisms in the ISDaaS ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (pains)	Resolution from the Offers (Gains)
Local Small Producers (Farms / Processors)	• Promote products and services directly to consumers.	• Inefficient use of data within the Farm-to-Fork chain and beyond.	• Improved promotion and visibility of regional products.

	• Increase credibility and visibility of farms. • Streamline data handling related to product information.	• Difficulty identifying the economic value of available data. • Strong competition from larger market actors.	• Increased credibility through publication of production process information. • Relationship models linking producers with sellers and consumers.
Tourism Sector (Information Centres, Travel Agencies)	• Attract visitors through unique regional experiences. • Develop new tourism activities based on local products and traditions.	• Weak connection between local food production and tourism activities. • Limited access to comprehensive information on farm activities and regional products.	• Promotion of gastro-tourism and educational tourism experiences. • Expanded information on local products, attractions, and activities. • Cooperation mechanisms for developing tourism routes and workshops.
Consumers	• Make informed purchasing decisions regarding regional food products. • Connect with local producers and food sources.	• Limited access to detailed product information such as origin, transport conditions, and production methods. • Difficulty identifying where to purchase products from specific producers.	• Increased transparency and product information availability. • Relationship models that facilitate direct purchasing from producers.
Regulators (Ministry of Agriculture)	• Support regional development and digitalisation initiatives. • Generate market insights for policy development.	• Limited requirements and mechanisms for managing data flows within the Farm-to-Fork chain. • Legal and regulatory complexity, including data protection requirements.	• Improved utilisation of data from Central Records. • Reference data supporting regional development strategies. • Improved transparency and traceability within regional food systems.

7.3 Core Needs Satisfied

The ISDaaS model addresses several needs related to regional product promotion, data reuse, and cross-sector collaboration.

For local producers, the system provides tools that support the promotion and sale of regional products while strengthening the visibility and credibility of producers through the publication of production-related information.

For the tourism sector, the model provides mechanisms for incorporating agricultural data into tourism activities, enabling the development of gastronomic routes, farm visits, and educational tourism experiences linked to local food production.

For consumers, the system provides improved access to information about regional products, including origin, production conditions, and purchasing locations, thereby supporting more informed purchasing decisions.

7.4 Problem Scenarios Addressed

The ISDaaS model addresses several practical challenges related to the management and reuse of data across sectors.

One challenge concerns the limited integration of agricultural data beyond traditional Farm-to-Fork applications. By enabling the reuse of agricultural data in domains such as tourism and regional marketing, the system supports improved information flows and the development of new services.

Another challenge relates to the disconnection between local producers and potential markets. The creation of relationship models linking producers with sellers and consumers may help strengthen market access for small-scale producers.

The model also explores opportunities for thematic tourism development, using agricultural data to support the creation of gastronomic routes and educational tourism activities that highlight regional food production and cultural heritage.

7.5 Business Model Structure

7.5.1 The Customer

Customer Segments

The ISDaaS ecosystem targets several stakeholder groups, including farms and food processors providing regional products, shops and e-shops selling regional products, tourism actors such as information centres and travel agencies, consumers interested in regional food products, and public authorities such as the Ministry of Agriculture acting as both data provider and regulator.

Channels

The system relies on an Open Space data-sharing platform enabling the exchange and integration of data from different sources. Additional channels include the Farmer Portal, which provides access to registers managed by the Ministry of Agriculture, and tools developed within the Digital Innovation Hub (DIH) ecosystem, such as the Atlas of Best Practices and Smart Points of Interest (Smart POI).

Customer Relationships

Customer relationships are based on collaborative development with the Ministry of Agriculture for access to official datasets. Engagement with tourism actors, such as information centres and travel agencies, supports the development of tourism-oriented services.

Community engagement and continuous stakeholder feedback contribute to the evolution of the platform and the exploration of additional services and use cases.

7.5.2 The Offering

Value Propositions

The ISDaaS model illustrates several value propositions centred on data integration and cross-sector collaboration.

First, the system enables improved data integration across sectors, including agri-food production, tourism services, and regional development initiatives.

Second, the model introduces relationship mechanisms between producers and sellers, facilitating easier purchasing processes and potentially improving market access for local products.

Finally, the platform supports the promotion of regional products and experiences, including gastro-tourism and educational tourism activities linked to agricultural production.

7.5.3 The Infrastructure

Key Resources

Key resources include datasets from the Central Records of the Ministry of Agriculture, tools developed within the Digital Innovation Hub ecosystem, and data collected across different levels of the Farm-to-Fork chain.

Human expertise related to data analysis, system development, and model design also plays an important role in supporting the ecosystem.

Key Activities

Core activities include collecting and analysing data across different stages of the Farm-to-Fork chain, developing relationship models linking producers with sellers, and assessing the potential reuse of Central Records data.

Additional activities include developing tourism-oriented services such as gastronomic routes and reusing and updating Digital Innovation Hub tools.

Key Partners

Key partners include the Ministry of Agriculture acting as both regulator and data provider, local producers contributing primary data, tourism information centres and travel agencies participating in tourism-related services, and Digital Innovation Hubs supporting innovation activities.

7.5.4 Operational and Financial Sustainability

Revenue Streams

Potential revenue opportunities include the development of a data-driven marketing and advertising platform promoting regional products to consumers. Additional opportunities may include the creation of a marketplace that aggregates and curates data for product promotion and analysis, as well as collaborations with tourism actors that may generate revenue through tourism routes, workshops, or related activities.

Cost Structure

The primary cost components include the development and maintenance of the data platform or marketplace, personnel costs associated with data integration, analysis, and coordination activities, and legal and compliance costs related to regulatory requirements such as GDPR and data governance obligations.

7.6 Implementation and Scalability Considerations

- **Maturity Level:** Demonstration phase, with ongoing development of data integration models and initial use of Central Records data to support cross-sector services.

- **Link to Data Ecosystem:** Relies on national data infrastructures, including Ministry of Agriculture registers, and aligns with European data space principles, particularly in relation to cross-sector data reuse and interoperability.
- **Replication Potential:** High potential in regions with structured agricultural data registries and interest in linking agri-food data with tourism and regional development services, particularly in support of short supply chains and local product promotion.

8. Business Model: AMAFLOW – Mapping and Valorising Food Loss and Waste Data

The following business model configuration is derived from the AMAFLOW case study and is presented as an analytical representation of the data-sharing approaches, governance mechanisms, and value creation opportunities explored within the project. It should not be interpreted as a fixed commercial business plan, but rather as a transferable example illustrating how food loss and waste data may be reused and valorised to support circular economy strategies, policy development, and operational optimisation.

8.1 Overview

The AMAFLOW case study explores how data related to food loss and waste (FLW) can be mapped, analysed, and valorised to support circular economy strategies in the Amsterdam Metropolitan Area (AMA). The initiative focuses on transforming existing waste management data into actionable insights that can support policy development, operational optimisation, and sustainability improvements.

A central element of the case study is the use of highly sensitive data from the Landelijk Meldpunt Afvalstoffen (LMA), the Dutch national waste registry. These datasets provide detailed information on waste flows, which can be analysed to identify patterns and opportunities for improving the management and valorisation of food waste.

Rather than focusing solely on data collection, the AMAFLOW model applies advanced data analytics, artificial intelligence, and optimisation techniques to extract meaningful insights from these datasets. These analytical tools support the identification of food waste hotspots, the evaluation of potential valorisation pathways, and the optimisation of logistics for waste collection and processing.

Through this approach, the case study illustrates how governed data spaces and analytical models may generate high-value managerial insights for both public and private actors. These insights can support evidence-based policymaking, improved business planning, and more efficient waste management systems, thereby contributing to improved circularity and sustainability within the Amsterdam Metropolitan Area.

8.2 Stakeholder Segments, Customer Jobs, Pains and Gains

The AMAFLOW ecosystem involves stakeholders from public administration, waste management industries, and research organisations participating in the analysis and reuse of food loss and waste data.

Table 6: Stakeholder segments and indicative value creation mechanisms in the AMAFLOW ecosystem

Stakeholder Segment	Customer Jobs (Tasks to implement)	Difficulties Faced (pains)	Resolution from the Offers (Gains)
Policy Makers (e.g., Municipality of Amsterdam)	• Make evidence-based decisions regarding food waste policies. • Identify food waste hotspots and develop	• Limited availability of scientific evidence and spatially explicit information for policy design.	• Access to scientific evidence for policy-making. • Identification of food waste hotspots.

	targeted policy measures.		• Biodiversity footprint monitoring related to food loss and waste.
Waste Collection and Valorisation Companies	• Identify valuable sources of food waste for processing and valorisation. • Optimise collection logistics and operational planning.	• Limited information about potential input sources for food waste valorisation. • Logistics optimisation based only on current operational conditions.	• Identification of nutrient hotspots and promising valorisation pathways. • Reverse logistics optimisation model supported by machine learning forecasting. • More cost-effective collection and processing operations.
Data Ecosystem Actors (WUR, geoFluxus, AMS)	• Generate scientific insights and advanced data models. • Ensure long-term continuity of the data ecosystem.	• Complex legal procedures for user agreements related to sensitive datasets. • Challenges in securing resources for long-term system maintenance.	• Generation of valuable managerial insights through advanced data modelling. • Potential sustainable business model based on user contribution fees.

8.3 Core Needs Satisfied

The AMAFLOW model addresses several needs related to the management and analysis of food loss and waste data.

For policy makers, the system provides scientific evidence that supports the identification of food waste hotspots and the development of targeted policy interventions aimed at reducing waste and improving circularity.

For waste collection and valorisation companies, the system supports improved identification of valuable waste streams and contributes to logistics optimisation based on both current waste distribution patterns and predicted future developments.

For participating ecosystem actors, the system contributes to the development of a governed data ecosystem capable of generating analytical insights that support circular economy strategies and long-term sustainability improvements.

8.4 Problem Scenarios Addressed

The AMAFLOW model addresses several practical challenges related to the management and reuse of food loss and waste data.

One challenge concerns the limited availability of evidence-based information for policymaking. By transforming raw waste registry data into structured datasets and analytical tools, the system provides policymakers with insights that may support targeted interventions and policy development.

Another challenge relates to the identification of business opportunities within food waste streams. The system supports the identification of nutrient hotspots and potential valorisation pathways, helping waste management companies explore new business opportunities and improve resource recovery processes.

The model also supports future-oriented planning through predictive analytics. By integrating machine learning forecasting into optimisation models, the system enables stakeholders to anticipate future food waste distribution patterns and improve long-term operational planning.

8.5 Business Model Structure

8.5.1 The Customer

Customer Segments

The AMAFLOW ecosystem involves several groups of stakeholders, including policy makers such as the Municipality of Amsterdam, waste collection and valorisation companies operating in the region, research organisations including Wageningen University & Research and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS), and private companies contributing raw data through the national waste registry.

Channels

Data access is provided through a restricted data space environment, where authorised users can access datasets and analytical tools subject to login controls and user agreements. The ecosystem also includes several decision-support tools, including a Circularity Tool, an optimisation model, and a Biodiversity Monitor.

Standardised data formats such as JSON or XML support interoperability and controlled data exchange within the ecosystem.

Customer Relationships

The system relies on collaboration between participating stakeholders, including public authorities, research organisations, and private sector actors.

Due to the sensitive nature of the LMA datasets, access is governed through formal user agreements that may involve detailed legal and administrative arrangements. End users accessing derived datasets and analytical tools may be required to provide a financial contribution supporting the maintenance and operation of the ecosystem.

8.5.2 The Offering

Value Propositions

The AMAFLOW model provides several value propositions centred on the transformation of food waste data into actionable insights.

These include the identification of food waste hotspots supporting policy development, the analysis of nutrient flows and valorisation pathways that may create new business opportunities, and the implementation of reverse logistics optimisation models supported by machine learning forecasting.

Together, these capabilities support more informed decision-making regarding waste management, resource recovery, and circular economy strategies.

8.5.3 The Infrastructure

Key Resources

Key resources include datasets from the Landelijk Meldpunt Afvalstoffen (LMA) registry, data processing pipelines designed to transform raw datasets into structured information, and analytical models developed by Wageningen Food & Biobased Research.

Additional resources include reverse logistics optimisation models and analytical knowledge derived from artificial intelligence and text-mining techniques used to identify food loss and waste flows.

Key Activities

Core activities include managing legal arrangements for accessing sensitive LMA datasets, transforming raw waste data through analytical pipelines, and combining datasets with modelling tools to identify food loss and waste flows.

Additional activities include the development of analytical tools such as the Biodiversity Monitor and the Circularity Tool, which support decision-making for policymakers and businesses.

Key Partners

Key partners include the Municipality of Amsterdam, which supports policy implementation; geoFluxus, contributing expertise in waste data analysis; Wageningen Food & Biobased Research, providing modelling expertise; and the Port of Amsterdam, participating as a collaborating stakeholder within the regional circular economy ecosystem.

8.5.4 Operational and Financial Sustainability

Revenue Streams

Potential revenue streams may include contribution fees from end users accessing derived datasets and analytical tools within the data space. During early stages of system development, public subsidies or project-based support mechanisms may also contribute to the establishment and operation of the ecosystem.

Cost Structure

The main cost components relate to the development and maintenance of the data space infrastructure, the creation and operation of analytical tools, and the legal and administrative processes required to manage user agreements for sensitive datasets.

Additional costs arise from the development and operation of optimisation models, machine learning systems, and analytical technologies used to extract value from the data.

8.6 Implementation and Scalability Considerations

- **Maturity Level:** Pilot to early deployment phase, with advanced analytical models based on AI and optimisation approaches tested on sensitive food loss and waste datasets within a controlled data space environment.
- **Link to Data Ecosystem:** Strong alignment with urban and circular economy data space initiatives, relying on governed and restricted data-sharing environments for sensitive datasets and advanced analytical services.
- **Replication Potential:** High potential in metropolitan regions with access to structured waste management data and interest in circular economy strategies, particularly where policy-driven analytics and optimisation of waste flows are strategic priorities.

9. Business Model Categories

9.1 Overview

The business models explored through the Data4Food2030 project can be grouped into several broad analytical categories. These categories are intended to simplify navigation within the Playbook and support readers in identifying business model patterns that may be relevant to their own organisational or strategic context.

Rather than representing rigid or mutually exclusive classifications, the categories should be understood as analytical lenses that highlight different dimensions of data-driven business models. In practice, many initiatives combine elements from multiple categories depending on their governance arrangements, technological architecture, stakeholder structure, and value creation logic.

The categories presented below are derived from the analysis of the selected Data4Food2030 case studies included in this Playbook. Together, these case studies cover a broad spectrum of data-driven approaches across the Data Economy for Food Systems (DE4FS), including governance-oriented ecosystems, sustainability intelligence systems, real-time logistics monitoring, circular economy applications, and cross-sector data reuse models.

The objective of this categorisation is therefore not to classify case studies into fixed business model types, but rather to identify recurring mechanisms and strategic approaches that may support the development, adaptation, and scaling of data-driven services and ecosystems in different operational contexts.

The categories focus on different components of business model structures, including customer segments, revenue generation approaches, collaborative value networks, and value propositions. By structuring the analysis in this way, the Playbook supports a more transferable understanding of how data-driven business models may emerge and evolve across food systems.

9.2 Categories of Data-Driven Business Models

Table 7: Categories of data-driven business models

Category	Goal	Description	Examples of Data4Food2030 Case Studies
Customer Segment Models	Focus on meeting the unique needs of target customers.	These models address the complexity of multi-sided markets, supporting participation from distinct stakeholder groups, such as farmers, processors, and system providers, each receiving tailored value and incentives to participate.	Premium Grain Chain (PGC); AMAFLOW
Revenue Stream Models	Focus on exploring different revenue streams to support long-term sustainability and operational continuity.	These models define how value is monetised across the ecosystem, often combining several revenue mechanisms such as licensing fees, premium margins, or collaboration-based contributions to ensure financial sustainability.	ISDaaS; AMAFLOW

Value Network Models	Focus on sharing resources and risks across a collaborative network.	These models emphasise the role of partnerships and shared resources in building complex data-sharing infrastructures, relying on governance mechanisms and knowledge exchange to reduce risks for individual actors.	Premium Grain Chain (PGC); THESIS
Value Proposition Models	Focus on continuously adapting and strengthening the core offering.	These models emphasise the development and refinement of value propositions that respond to evolving user needs and technological opportunities, ensuring that data-driven services remain adaptable to evolving stakeholder and ecosystem needs.	DIRECT; I4DATA

These categories demonstrate that data-driven business models may evolve around different strategic priorities depending on the ecosystem in which they operate, the governance arrangements in place, and the type of value generated through data sharing and reuse. In this sense, the categorisation presented in the Playbook supports a more structured understanding of how data-driven ecosystems can be designed, adapted, and potentially replicated across different food system contexts.

10. Assessing Business Models

10.1 Overview

In order to support the practical application of the Business Model Playbook, organisations may use a set of indicative diagnostic indicators to reflect on the robustness, scalability, and long-term sustainability of business models operating within the Data Economy for Food Systems (DE4FS).

The assessment framework presented in this chapter is not intended to function as a formal certification or benchmarking methodology. Instead, it provides a practical reflection and decision-support tool inspired by recurring business model dimensions, governance considerations, and ecosystem dynamics identified across the Data4Food2030 case studies and related project activities.

The indicators combine traditional business model considerations with factors that are particularly relevant for data-driven ecosystems, including interoperability, governance arrangements, data valorisation, ecosystem participation, and inclusiveness.

The framework is divided into two complementary parts:

- Part A – Business Model Robustness and Sustainability
- Part B – Data Economy Specific Factors

Each indicator can be assessed using a five-level scale ranging from low to high performance or maturity. The assessment process is intended to support reflection, comparison, and identification of potential areas for improvement when designing or adapting data-driven business models.

10.2 Part A – Business Model Robustness and Sustainability

These indicators assess the structural characteristics of a business model and its ability to generate sustainable economic and operational value.

Q1. Stickiness: How difficult/expensive is it for your customer to switch to a competitor's solution?

Extremely Easy / Inexpensive	Easy / Inexpensive	Moderate / Medium Cost	Difficult / Expensive	Extremely Difficult / Very Expensive
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q2. Scalability: How rapidly and easily can you scale your business model across new regions or segments?

Not at All	To a Small Extent	Moderately	To a Large Extent	To a Very Large Extent
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q3. Recurrence: Can your business model produce reliable, recurring revenues?

Not at All	To a Small Extent	Moderately	To a Large Extent	To a Very Large Extent
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q4. Cash Flow: Do you earn revenue before you incur or spend capital?

Never / Rarely	Infrequently	Moderately	Frequently	Always / Almost always
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q5. Leverage: How much do you get customers or third parties to do the work** (e.g., data input, community governance) **for free or through minimal incentives?

Not at All	Difficult	Medium	A Lot	Excellent/Easy
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

***Q6. Protection: How much does your business model protect you from competition** (e.g., through network effects, IP, or governance)?*

Not Protected	Weak Protection	Neither Strong Nor Weak	Sufficient Protection	Strong Protection
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q7. Efficiency: Is your cost structure better or more efficient than your competitors' structures?

Significantly Worse	Worse	Equal	Better	Significantly Better
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

10.3 Part B – Data Economy Specific Factors

These indicators focus on dimensions that are particularly relevant for data-driven ecosystems and data-sharing initiatives.

Q8. Data Interoperability: Are there new or emerging technical/semantic barriers preventing effective data sharing and interoperability between key system providers or partners?

Barriers that Forbid Data Sharing	Severe Barriers	Moderate Barriers	Minor Barriers	No Barriers
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q9. Value Attribution: Is the mechanism for data monetisation and value distribution among ecosystem partners** (e.g., licensing fees, higher grain margins) **still perceived as fair and motivating?

Not at All	Slightly	Moderately	Very	Extremely
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q10. Ecosystem Health: How many new partners or external initiatives (e.g., AgriDataSpace) have integrated or shown a firm interest in utilising the data ecosystem?

None	Very Few (1-2)	Moderate (3-5)	Large (6-10)	Very Large (10+)
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q11. Data Valorisation: Is the path from raw data to monetised value (or cost saving) clearly defined?				
Not Defined	Vaguely Defined	Moderately Defined	Largely Defined	Very Clearly Defined
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

Q12. Inclusiveness: Does the model allow smaller actors (e.g., smallholder farmers) to participate and benefit?				
No inclusion	Very Little inclusion	Moderate Inclusion	Large Inclusion	Very Large Inclusion
☆	☆☆	☆☆☆	☆☆☆☆	☆☆☆☆☆

The assessment indicators presented above are intended to support exploratory evaluation and strategic reflection rather than quantitative benchmarking. Depending on the operational context, organisations may prioritise different indicators or adapt them to sector-specific requirements. In this sense, the framework provides a flexible tool that can support the design, adaptation, and long-term sustainability of data-driven business models within evolving food system ecosystems.

The assessment outcomes are inherently context-dependent and should therefore be interpreted as indicative rather than comparative, predictive, or certifying in nature.

11. Business Model Innovation

11.1 Overview

To ensure that the business models and ecosystem configurations presented in this Playbook remain relevant over time, organisations should adopt an approach of continuous business model innovation and adaptation.

Data-driven ecosystems evolve rapidly as technologies, governance frameworks, regulatory environments, and stakeholder expectations change. Organisations therefore need to regularly review and adapt their business models in order to maintain operational relevance, ecosystem participation, and long-term sustainability.

Within the context of the Data Economy for Food Systems (DE4FS), business model innovation is not limited to technological development. It also involves governance arrangements, stakeholder collaboration mechanisms, interoperability approaches, data-sharing incentives, and value distribution structures.

Several strategic perspectives may support organisations in reflecting on how data-driven business models can evolve over time. The approaches presented below draw on established innovation and business model perspectives and are adapted here as indicative principles that may help stakeholders structure innovation processes, ecosystem collaboration, and long-term strategic development.

Table 8: Selected strategic approaches supporting business model innovation

Philosophy	Key Principles	Strategic Focus
Eric Ries' Lean Startup	**1. Validated Learning**: Prioritise learning through iterative experimentation and stakeholder feedback. **2. Build-Measure-Learn:** Develop and test early solutions, collect feedback, and refine them incrementally. **3. Innovation Accounting:** Use actionable indicators and evidence to monitor progress and guide adaptation.	*Agility and Evidence-Based Experimentation*
Alexander Osterwalder's Business Model Innovation Perspectives	**1. Explore:** Develop and test new value propositions and business models under conditions of uncertainty. **2. Exploit:** Manage, improve, and strengthen established business models and value-creation mechanisms. **3. Portfolio Management:** Balance exploration of new opportunities with the continuous improvement and renewal of existing activities.	*Business Model Exploration and Portfolio Development*
Henry Chesbrough's Open Innovation	**1. Outside-In Innovation:** Integrate external knowledge, ideas, technologies, and partnerships into innovation processes. **2. Inside-Out Innovation:** Enable internally generated knowledge or solutions to create value beyond their original organisational context. **3. Ecosystem-Oriented Innovation:** Recognise that innovation increasingly takes place across networks of organisations and complementary actors.	*Ecosystem Collaboration and Knowledge Exchange*

The approaches presented above illustrate that business model innovation within data-driven ecosystems is closely linked to experimentation, stakeholder collaboration, interoperability,

and continuous adaptation. In this sense, the Business Model Playbook should also be understood as a flexible reference framework that may evolve alongside emerging technologies, policy developments, and ecosystem practices.

12. Making the Most of the Business Model Playbook

The business model configurations presented in this Playbook should not be interpreted as rigid templates or fixed commercial solutions. Instead, they serve as analytical reference points and inspiration sources that organisations may adapt to their own operational, technological, and governance contexts.

The objective of the Playbook is not to prescribe a single pathway for data-driven innovation, but rather to support reflection on how different ecosystem configurations, governance approaches, and value creation mechanisms may contribute to the development of sustainable data-driven services and collaborations.

To maximise the practical value of the Playbook, several guiding principles may be considered:

- **Build on Existing Foundations**

The case studies presented in the Playbook can serve as starting points for further experimentation and adaptation. Organisations may build upon existing approaches and ecosystem structures rather than developing entirely new models from scratch.

- **Avoid Restrictive Sectoral Boundaries**

Many business model components and governance approaches may be transferable across sectors and operational environments. Innovation often emerges when existing structures are adapted to new contexts or combined with complementary ecosystem elements.

- **Regularly Review and Reassess Business Models**

The assessment indicators presented in this Playbook may be used periodically to reflect on the robustness, sustainability, and adaptability of existing business models and ecosystem arrangements.

- **Remain Flexible and Adaptive**

Business models operating within data-driven ecosystems should evolve alongside changes in technologies, user expectations, governance frameworks, and regulatory environments. Continuous stakeholder feedback and ecosystem learning processes may support future adjustments and improvements.

- **Consider Governance and Trust as Strategic Components**

In data-driven ecosystems, governance arrangements, interoperability, transparency, and trust-building mechanisms are often as important as technological capabilities. Long-term sustainability frequently depends on stakeholder confidence and fair value-sharing structures.

By approaching the Playbook as a flexible and evolving reference framework, organisations may use it to support experimentation, ecosystem development, and the exploration of new forms of collaboration within the Data Economy for Food Systems.

13. Conclusion

The Business Model Playbook developed within the Data4Food2030 project provides a practical and analytical reference framework for exploring how data can support innovation, collaboration, and value creation in food systems. By synthesising experiences generated through selected project case studies, the Playbook highlights different ways in which data sharing, governance mechanisms, and digital infrastructures may contribute to the emergence of new ecosystem configurations and data-driven services.

The case studies presented throughout the Playbook illustrate a broad range of approaches to data-driven innovation across the agri-food sector, including supply chain transparency, sustainability monitoring, circular economy applications, cross-sector data reuse, and real-time logistics monitoring. While each case study operates within a distinct operational and regional context, together they demonstrate how trusted data sharing and interoperable infrastructures may support collaborative and scalable ecosystem development.

Rather than presenting fixed or fully standardised commercial models, the Playbook translates project experience into transferable business model insights and analytical structures. In this respect, it complements the practical experimentation carried out within the Data4Food2030 case studies. It does so by identifying recurring patterns, governance considerations, and value creation mechanisms that may inform future initiatives.

The Playbook also introduces indicative assessment indicators and reflection tools that may support organisations in evaluating the robustness, adaptability, and long-term sustainability of their own data-driven initiatives. In this way, it contributes to stakeholder learning, ecosystem thinking, and the broader exploration of viable approaches to data sharing and reuse within food systems.

The Business Model Playbook therefore contributes to the wider objectives of Data4Food2030 by supporting the exploitation, continuity, and potential scaling of project results. By consolidating lessons learned across different ecosystem contexts, it provides a practical basis for future services, partnerships, governance approaches, and data-driven collaborations beyond the project lifetime.

Looking ahead, the continued evolution of the European data economy, including developments related to the Common European Agricultural Data Space and other sectoral data initiatives, is likely to create further opportunities for experimentation and innovation across food systems. The Business Model Playbook is intended to support stakeholders in navigating this evolving landscape with greater clarity, while contributing to more transparent, collaborative, and sustainable approaches to data-driven innovation in the agri-food ecosystem.