



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

**D4.1: Infographics about stakeholders of the  
DE4FS**

Lead Author: Sandra Šūmane (BSC)

Contributors: Maija Ušča, Tālis Tisenkopfs, Ilze Mileiko (BSC), Kelly  
Rijswijk (WR)



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## Data4Food2030 Consortium

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1	STICHTING WAGENINGEN RESEARCH	WR	NL
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## Glossary of terms and abbreviations used

List of Abbreviations and Acronyms	
AI	Artificial intelligence
CS	Case study
DE	Data economy
FS	Food system
FSS	Food system stakeholders
GAFA	Google, Apple, Facebook. Amazon
IT	Information technology
IOT	Internet of things
PEST	Political, economic, social, technological

## Executive summary

The aim of the Task 4.1. was to map the relevant stakeholders of the EU food system, to explore their values, needs, interests and concerns related to the data economy for sustainable food systems and to visualize the main findings and recommendations in an infographic. For this purpose, several research activities were carried out: mapping of relevant stakeholder types in the food system in data economy context; 22 qualitative interviews with stakeholder group representatives from various European countries; four focus groups with food system stakeholders carried out in Belgium, Latvia, The Netherlands and Poland; the development of a visual infographic which summarises the findings about stakeholder interests, values, power and influence regarding the development of a data economy for food systems.

To capture the whole environment and diverse factors that shape the data economy for food systems and stakeholder perceptions and experiences of it, five groups of factors were defined: technological, economic, legal, social and environmental. The stakeholder views of opportunities and challenges in the data economy for food systems were analysed according to these dimensions. The study also identified good practices and recommendations to improve the data economy for food systems in terms of fairness and inclusivity.

The results depict that stakeholder observations, experiences, and issues evoked regarding the data economy of food systems are complex, complementary, multi-faceted and sometimes contradictory. Results reveal different perspectives, pros and cons. Despite the different perspectives, there are eight overarching themes emerging from the stakeholders' discourses that reveal the key issues that the stakeholders associate with the development of data economy for food systems. These key themes entail internal controversies as stakeholder outlook on them often differs. Therefore, the key issues are represented in dialectic pairs, that highlight their multifaceted, complementary and sometimes contradictory character:

- **Inclusiveness:** There are *winner*s – the ones benefitting more from data economy in food systems due to the access to data and capability to make use of data, and *losers* – the ones who encounter more disadvantageous conditions in access to and use of data;
- **Enhancement:** This dialectic pair emphasises finding a balance between *data supported decisions* and *data overload* which undermines the effective and sound use of data in decision-making;
- **Innovation:** A dialectic pair of *tailored novelty* – the transformative potential of data to change food system participants' decisions, behaviours, practices towards more sustainable ones, the possibility to develop tailored, customized, personalized solutions and *data (in)capability* due to stakeholder varied access opportunities to data, appropriate digital infrastructure, equipment, tools, skills and data intelligence;
- **Transparency:** A dialectic pair that seeks to balance *data sharing* that is at core to improve transparency of data economy and *data control* that allows stakeholders to keep control over their data and the usage of it;
- **Interoperability:** A dialectic pair emphasises the need to harmonise *technical interoperability* that fosters effective use of data for innovations in food system and social and *legal interoperability*, which presumes the development of stakeholder joint vision and common public and private standards that enhance willingness to share data and trust in data sharing;

- **Balance:** A dialectic pair of *benefits* resulting from data-based improvements of food system assets, activities and outputs, and *costs* associated with technological (equipment, tools, devices, software etc.) and human (knowledge, skills) resources needed for operation with data;
- **Sustainability:** This dialectic pair exemplifies a choice between a *comprehensive approach* that would enhance data economy potential to improve functioning of the whole food system and enhance its economic, social and environmental outcomes, and economic focus which is centred on economic data, economic value generation, and data application for economic competitiveness and growth purposes;
- **Governance:** A dialectic necessity to balance *promotion of regulation* in data economy for food systems while simultaneously taking care of *protection* of rights of stakeholders.

The main themes of data economy of food systems are a matter of stakeholder choices, agreements or disagreements. They are those areas where more deliberation and social interaction is needed to make data economy for food systems more inclusive. There are no simple nor linear solutions towards a balanced and inclusive data economy. Our study revealed that food system stakeholders perceive themselves as mutually connected and interdependent in the data economy context. This forms good grounds for collaboration and joint solutions towards a fair and inclusive data economy for food systems.

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# 1. Introduction

In line with WP4 focus on the inclusiveness of the data economy (DE), Task 4.1 aimed to understand food system stakeholders (FSS) situation, perceptions and experience in the data economy. The specific objective of Task 4.1 was to map the relevant stakeholders of the EU food system, and to explore their values, needs, interests and concerns related to the data economy. For this purpose, a set of five subsequential research activities were carried out:

1. Mapping of relevant stakeholder-types in the food system (FS) considering data economy context;
2. Qualitative interviews with food system stakeholders to explore their interests, values, power and influence regarding the developing data economy;
3. Multi-stakeholder focus groups to enhance reflection between them and get a better perspective on their values and concerns;
4. An integrated analysis of interviews and focus groups data;
5. Developing a visual infographic reflecting the main findings and recommendations.

This document describes the conceptual and methodological approaches developed and implemented for the study of stakeholders in the data economy and the research results, including recommendations. It is a part of the deliverable and serves as a support material for the Infographics “What are the perceptions and experiences of food system stakeholders in the data economy?” which is a stand-alone and the central element of the deliverable and the ultimate result of this task in Section 5 of this document. This infographic is available also in an [interactive format](#) on the project’s website.

## 2. Food system stakeholder mapping

### 2.1. Method

To map food system stakeholders in the current European food system and specify how they are linked and affected by the data economy development in the food sector, three complementary sources of information were combined:

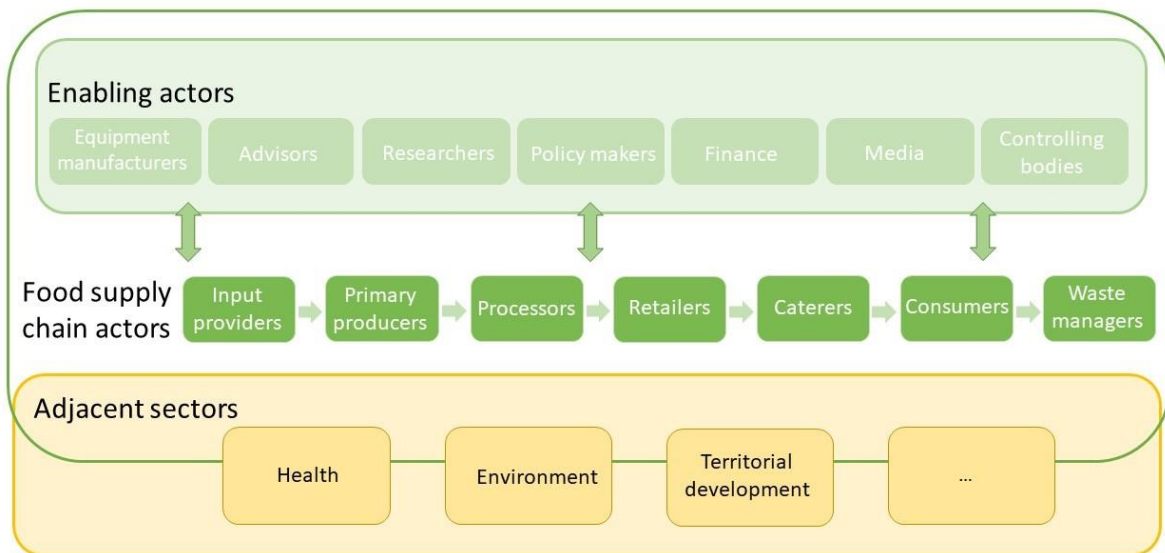
1. WP4 researchers' knowledge on food system composition, based on their previous work on the topic;
2. Data4Food2030 case studies: WP3 case descriptions were scrutinized to identify their key actors and stakeholder groups;
3. Research literature and institutional reports: (1) targeted rapid literature review on the base of selected articles at Scopus and Google Scholar data bases with keywords 'food system stakeholders' OR 'food system' AND 'actors' OR 'stakeholders', AND 'data economy'; (2) review of previous research projects and reports that apply food system approach (SALSA, SOLINSA, SUSFANS, EC Joint Research Centre, UN Food and Agriculture Organisation)

The initial stakeholder map was verified and complemented when compiling informants list and recruiting stakeholders for interviews and focus group discussions: informants and online sources (such as organisational websites) provided additional insights on the stakeholder composition.

### 2.2. Food system and data economy as multi-stakeholder systems

#### 2.2.1. Food system stakeholders

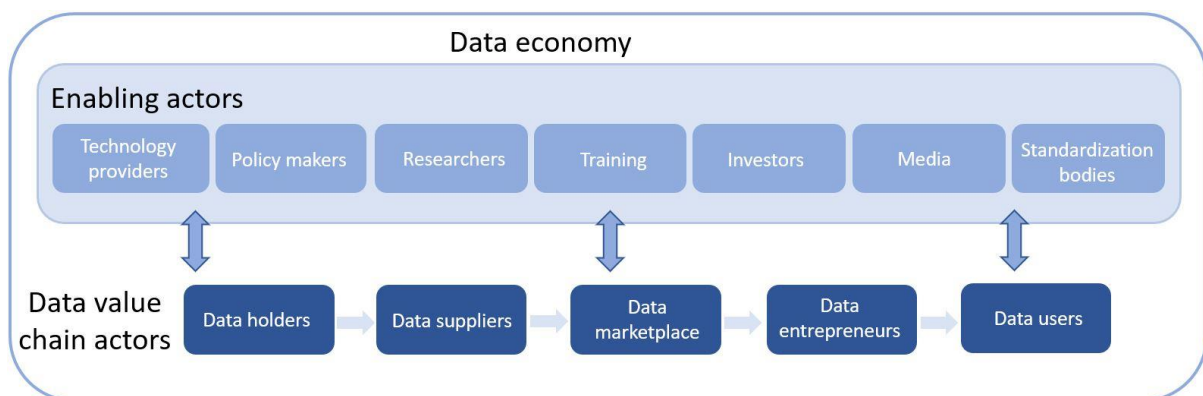
Food systems are complex multi-actor systems (Ericksen, 2008; Ruben et al., 2019; Díaz-Méndez and Lozano-Cabedo, 2020; Bock et al. 2022; Akočiuniene et al., 2022; UNEP, FAO and UNDP, 2023). They involve a broad range of interlinked stakeholders who perform different activities and roles to ensure the provision of food. We can distinguish between two key types of stakeholders in food systems (Figure 1). First, there are actors who are directly involved in the food production, processing and delivery. These are typical food supply chain actors, starting from primary producers and their input providers, to processors, retailers, catering companies, consumers and waste managers. Second, there are enabling actors or those who provide various types of services – such as advice, logistics, regulations, finance, publicity etc. – to food supply chain actors. Key stakeholders here are policymakers, controlling bodies, advisors, researchers, service providers, funding organisations, and media. In addition, there are actors from other sectors, such as health, tourism, environment, energy etc., who are connected to the food system and shape its development by influencing the food system activities, actor behaviour or institutional regulation.



**Figure 1 – Food system stakeholders** (Source: Authors)

## 2.2.2. Data economy stakeholders

A similar stakeholder map can be drawn for data economy. Data economy involves a range of stakeholders who are either directly involved in data value chain activities (i.e. producing, collecting, exchanging, analysing, storing and using data) or perform enabling functions by providing the needed resources such as technologies, knowledge, regulation etc. to data value chain actors. (See Figure 2 and Box 1). In Data4Food2030 project we are not aiming at comprehensive mapping of data economy actors. Instead, we select for mapping and interviewing those stakeholders who operate within the food system, introduce data economy principles and solutions in the food system and eventually influence relationships between ‘traditional’ food system actors.



**Figure 2 – Data economy stakeholders** (Sources: Data4Food2030 cases studies, Curry (2016))

**Box 1 - Data economy stakeholders: definitions**

**DATA VALUE CHAIN ACTORS**

**Data owners** (also data subject, data source or data originator) - people and organisations that serve as data sources, i.e., from whom data are collected.

**Data providers** (also data holder, data supplier, data vendor) - people and organisations that create, collect, aggregate data from different public and private sources (published (e.g. social media), requested (e.g. questionnaires), sensory (e.g. smart devices) etc).

**Data consumers** (also data buyer) - people and organisations that buy or get access to third-party data for their own use.

**Data end-users** - people and organisations that use data, data services, data-products for their advantage (for decision-making, development of goods, service-provision etc).

**Data intermediaries:** people and organisations that act as middlemen between data owners, providers and end-users by providing a range of data-related services, e.g.:

**Data marketplaces:** people and organisations that host data and offer it to consumers/ end-users

**Data entrepreneurs:** people and organisations that develop innovative data-driven technologies, products and services

**Data brokers:** people and organisations that collect, process and sell or share personal and business data with third parties

**DATA ECONOMY ENABLERS**

**Technology Providers:** organisations as providers of tools, platforms, services, and know-how for data management

**Researchers:** Investigate new algorithms, technologies, methodologies, business models, and societal aspects needed to advance big data.

**Regulators** for data privacy and legal issues.

**Standardisation Bodies:** Define technology standards (both official and de facto) to promote the global adoption of big data technology.

**Investors, Incubators and Venture Capitalists:** people or organisations that provides resources and services to develop the commercial potential of the ecosystem

**Media:** press, television, social media etc. that disseminate information and knowledge about data economy in the professional audience and the society in general.

Source: Curry (2016), Moise (2023) and authors

### 2.2.3. Food system stakeholders in data economy context

In the context of evolving data economy in food systems, two modifications appear in the food system stakeholder constellation, stakeholders' identities and relations (Kosior, 2019; Wolfert et al. 2017). First, new actors enter the food system that provide data-driven solutions and become data economy enablers in the food system. These are technology and IT companies, from start-ups to tech 'giants', that work in application software, data storage, data analytics and business intelligence, etc., as well as data economy enabling actors (regulators, scientists, investors and alike) whose field of operation now extends also to the data-related processes in the food system. Second, connected to data economy, 'traditional' food system actors take up new data functions, such as data source, data productions, collection, storage etc. and become also data value chain actors. Data management becomes an integral part of food system actors' operations. For

instance, food supply chain actors become also data sources; input providers such as machinery, fertilizer and seed manufacturers collect data and provide data-driven services; controlling institutions can operate as data suppliers and data end users as they collect, aggregate and use data in decision-making etc. Moreover, many stakeholders fulfil multiple roles in the data value chain and are not confined to one.

We distinguish four groups of food system actors in the context of data economy:

1. **Food value chain actors:** input providers, primary producers, processors, retailers, caterers, consumers, waste managers.
2. **Food systems support actors:** actors that provide a range of resources (rules, knowledge and advice, funding, publicity etc.) to food-value chain actors: policy-makers, researchers, advisors, food safety bodies, media etc.
3. **Data actors:** providers of data technologies and solutions in food systems.
4. **Actors from adjacent sectors:** actors from other sectors, such as health, environment, territorial development, energy etc. that are interlinked with food system.

Across and within these stakeholder groups we take into consideration marginalised or disadvantaged actors, or those who have little influence in food systems and / or over the data economy. They are marginalized or poorly included as their needs and/or digital capabilities are not well addressed in data economy. The marginalised actors do not make a uniform group. The marginalisation can happen due to the stakeholders' context: for instance, territorial digital divide with unequal access to digital infrastructure and services; typically, remote rural areas are less advantageous in digital development terms. Marginalisation can happen also on the base of stakeholders' socio-economic profiles, such as gender, socio-economic status, ethnic background etc. In the context of digitalisation of food systems, following actors have been identified as marginalised or less involved: small-scale farmers, farm workers, short food chains (Lioutas et al, 2021).

### 3. Analytical dimensions of data economy for food systems

To capture the whole environment and diverse factors that shape the data economy development and stakeholder perceptions and experiences of it, we deployed an adopted PEST approach (Parra-López et al., 2021; Martyniuk and Khodakivska, 2022). PEST stands for “political”, “economic”, “social”, “technological”, and this and similar models (for instance, PESTEL and STEEPLED complemented by environmental, legal, and ethical dimensions) identify and assess factors that influence a phenomenon in the focus. Three steps were followed:

- 1) Selection of key dimensions of data economy following PEST model. The initial set of six dimensions - social, legal, ethical, economic, technological and environmental - was transformed into five after pilot interviews which suggested to merge social and ethical dimensions. It should be noted that while the dimensions are helpful to highlight different aspects of DE, they are interlinked and overlapping.
- 2) Description of each dimension based on academic literature, research projects and reports with a focus on its relevance for FS and its stakeholders.
- 3) Operationalisation of each dimension with specific indicators (see Table 1) that are further used to formulate operational questions for qualitative interviews and focus groups, and to guide and structure data analysis. It should be noted that PEST dimensions and indicators were developed to capture trends in both FS and DE and, most importantly, their interlinkages.

#### 3.1. Technological dimension

Data economy is intrinsically linked to technologies: hard- and software that make data operations (collection, storage, access etc) possible. The food sector is undergoing data-driven transformations as the Internet of Things (IoT) artificial intelligence (AI), big data, blockchain, smart sensors, robotics, cloud computing, digital twins and other technologies are introduced. However, the capabilities of these technologies in terms of data gathering, understanding and use in agro-food systems are not fully realized and turned into advantages yet (Roussaki et al. 2022).

The availability of technologies for food system actors that allow them to manage and operate with data in meaningful (i.e. addressing their needs) and appropriate ("readable") ways is crucial. While general big data, AI and other DE technologies are well advanced, their adaptation and translation into meaningful applications in the food and agricultural sectors are still needed (Osinga et al. 2022; Hassoun et al. 2022). For instance, in the agricultural sector, farms that are not specialised in the production of commodity crops have to deal with smart precision technologies that are poorly adapted to their operations (Visser et al. 2021). Digital infrastructure and internet connection are not sufficient everywhere (EC 2021) which hampers the uptake of more advanced data technologies (van Hilten and Wolfert, 2022).

Another challenging key feature of DE is interoperability, i.e., combining different data sources and exchanging data between information systems. Together with the increasing diversity of available data sources, their compatibility comes forefront. However, data is collected and stored in different formats which makes their transfer between different systems and optimal use difficult or impossible. Standardization of data, data management and technologies are needed to enable interoperability across heterogenous systems (Bahlo et al. 2019).

Data technologies are typically associated with a range of benefits in food systems such as improved productivity, traceability, less environmental damage etc. There is a high reliance on the accuracy of digital technologies and data-driven solutions. However, they can contain considerable inaccuracies and inbuilt limitations which are overlooked due to the increased opacity of digital technologies and underlying algorithms, increased remoteness from the field and loss of experiential knowledge, and a move from real-time measurement and advice to forecasting (Visser et al. 2021).

## 3.2. Economic dimension

Data economy is about creating economic value out of data; hence the economic dimension is at its core. Data has become an essential resource for economic growth, competitiveness, innovation, job creation and societal progress in general (Sestino et al., 2023). Data availability give rise to new or improved products, services, and business models and contribute to enhancing productivity (Ibid.). Data has become an essential economic asset, but it is a specific type of asset. While data is at times viewed as any physical commodity that can be traded, there is a noticeable difference: data can be usually copied or destroyed at marginal costs and its value often does not lay in the exclusive rights of its usage (Wolfert et al., 2021). On the contrary, the unique economic aspect of DE lies in multiple uses and co-creation of data (Ibid.).

Data and technologies have considerable economic implications on FSS as they impact their operations, strategy, and market power. For businesses, participating in the DE brings such benefits as improved collaboration with partners and vendors, creating new business models, fostering innovations, customer acquisition and retention, and increased revenues (MIT Technology Review, 2021). With regards to economic revenues and benefits from the data, mapping all actors gaining economic benefit from the data flow is important. For example, from farmer perspective, so far there has been “little evidence available that data sharing will lead to knowledge that brings great business advantages” (Wolfert et al. 2021, p. 26). Due to the absence or the unavailability of such evidence, farmers often lack conviction that the benefits will outweigh the costs of the investment in digital technologies and the existing privacy, proofing, and digital surveillance concerns (Ibid.).

So, participation in DE involves also costs. These are related to different phases of data flow, such as costs of data production, storage, distribution, transmission, and use (for instance, fees for using a database, an app, or a service). Next to economic costs, the ethical, social, and environmental impact of the data technologies and associated costs should not be ignored (Wolfert et al., 2021).

## 3.3. Legal dimension

The legal dimension regards legal aspects of data management in food systems in the context of data economy, it addresses the questions of who and how has the right to manipulate data. Proper data stewardship matters to maximize the effectiveness of data use for all the involved parties as well as to limit the risks of data exposure and misuse (Cue et al. 2021). However, it is also argued that the current legal framework for data governance in food systems is incomplete and it does not fully address the needs of responsible smart, data-driven farming systems and food chains (Kosior, 2019; Wiseman, 2019).



#### Box 2 - Data-related definitions in the EU Data Act

Data is any digital representation of acts, facts or information and any compilation of such acts, facts or information, including in the form of sound, visual or audio-visual recording. In the context of food systems, some examples of data involve on-farm measurements by smart devices, records of the origins of food and its movement in the food-chain, consumer shopping patterns and seasonal purchasing data.

Database is a collection of independent works, data or other materials arranged in a systematic or methodical way and individually accessible by electronic or other means.

In EU legislation, data protection covers analogue and digital data in scope as well as personal data. Personal data is any information about an identified or identifiable natural person. Also, the protection of non-personal data, such as farm data, receives increasing attention.

Data protection is among the key legal issues and concerns when considering data economy. Data protection essentially means legal control over access to and use of data. On one hand, data exchange and sharing is a backbone of data economy; on the other hand, poorly regulated data processes can generate risks for privacy, economic, environmental and other harms (Kosior, 2019). Some food system stakeholders such as farmers and consumers are particularly concerned about their data privacy when they share their data with other food system stakeholders (van den Burg et al. 2021; Wiseman et al. 2019). For instance, farmers express worries that the data collected can facilitate price discrimination by input suppliers, with customized pricing based on farm attributes or that the data aggregators can create additional value beyond the farm without compensating the farmers for the data (Sykuta, 2016). Similarly, deficiency in data protection law leads to information asymmetry between consumers and data-driven companies and puts the first in a vulnerable position with risks to their data privacy (van de Waerd, 2020).

The discussion on data protection is linked to data ownership i.e. who owns what data and can exert control over them. The Data Act proposal distinguishes between three types of data stakeholders with different data ownership profiles: data subjects/users/producers, data holders, and data recipients. In general, the users can exercise ownership rights over their data (right to access, consult, delete, transfer). Processing, and compiling of data in an organised manner creates a database giving authorship rights to the creator of the database (i.e. protected by the copyright law). In the food sector, the property rights to different types of agricultural data are not clearly defined. There are examples of unclear property rights to data in other food system stages beyond agriculture as well, e.g., if there is a cargo trailer carrying temperature-sensitive food, equipped with a sensor constantly sending data through the internet, the questions are raised, who truly owns this data – is it the company that made the sensor, the logistics firm managing the shipment, or the parties involved in sending and receiving the food? (Astill, 2019). While in agriculture, in general, farmers are considered as the owners of raw agricultural data collected on their farms, and aggregated datasets are considered to be the ownership of companies and organizations engaged in collecting and aggregating data (Kosior, 2019). The current legal frameworks benefit data aggregators more than data producers, such as farmers and consumers (Kosior, 2019; van de Waerd, 2020).

The power of data aggregators, especially multi-nationals, in the data economy has raised the issue of data sovereignty. As a legal term it involves that data is subject to the laws of the nation, territory or union of countries where that data is collected or the ability. But it has been extended

to one's (individual, organisation, group, territory, nation etc.) ability to act independently in the digital world, to keep control and responsibility over one's data and avoid dependence from data aggregators (Mark, 2019; Foster et al. 2023). Big tech companies, like GAFA (Google, Apple, Facebook, Amazon), are shaping today's technological world, including in food systems. Governments, let alone less powerful data stakeholders, have little influence over their actions. This undermines a number of important data-related values promoted in the EU, such as data privacy, data protection, and non-discrimination.

Law enforcement and legal compliance are critical components of law efficiency and of building trust in the digital single market through legal certainty. Enforcement refers to the public authority's activities aiming to ensure the effective application of the law, such as promoting compliance, monitoring and assessing compliance, and responding to non-compliance (through, e.g., a legal notice or financial penalty). Compliance refers to an internal organisational effort to follow the regulations. A legal subject is compliant with the law when it follows all regulations that concern its activities.

### **3.4. Social dimension**

Data processes, such as data sharing, collecting, storing, and usage, build a relationship between the involved actors that consequently leads to a strong social dimension of DE to be taken into consideration. Inclusion is at the core of understanding the social dimension of DE for FS, as it is at the basis of the power relations between the involved people and organisations. Inclusion is about access to the data economy (McCampbell et al., 2021). Access means that the digital technologies, the generated data and therefore the wider data economy consider data availability and affordability, and agency and awareness, or ability (i.e., physical ability, but also digital literacy or other necessary skills) of the involved stakeholders, even if these stakeholders are unaware that they are part of the data economy.

Exclusion, i.e., lack of access, can be intentional or unintentional, and may lead to negative effects for the excluded stakeholder and to digital divides or uneven distribution of data technologies, processes and their benefits (McCampbell et al., 2021). Digital divides can be considered as the urban-rural digital divide, gender digital divide, age digital divide, or the data divide. The urban-rural digital divide refers to such technological disadvantages in rural areas as slower internet speed and less technological choices (Negreiro, 2015) both of which, accompanied by varying levels of digital literacy, can have a direct impact on farmers' and other rural stakeholders' participation in DE. Age digital divide is also a crucial social aspect as older people are in general more disadvantaged with regards to accessing data and possessing agency and awareness over the shared data. Meanwhile, the data divide can be described as asymmetries between the 'data haves' and 'have-nots' (Scholz et al., 2018). According to Cinnamon (2019, p. 228), data divides matter because "access to data production and analytics in some cases actually has the reverse effect, the instantiation of new harms and the widening of inequalities." For instance, if farmers are not equipped with the tools and context to analyse their data, their storage and usage, a big data digital divide' occurs which can exacerbate further inequality and power imbalance in the sector (Kritikos, 2017). In other words, the DE inherently has winners and losers, that go beyond the usual dichotomy of in- and exclusion (McCampbell et al., 2021).

In relational perspective another key social aspect is the role of trust. To have a clearer understanding of how trust impacts DE of FS, it is beneficial to observe this aspect in three separate but interlinked areas: (1) trust in the technology (i.e., reliability), (2) trust in the governance and process of, for example, data sharing, collecting, storage and use, (i.e., governance structures, accountability, responsibility) and (3) trust in the people or organisations that one shares data with (i.e., interpersonal and interorganisational trust) (Rijswijk et al., 2023). This aspect of the social dimension is closely related to the ethical dimension and especially its elements of transparency and fairness.

### 3.5. Ethical dimension

The ethical dimension of DE for FS is closely interlinked to other dimensions, especially the legal aspect. Meanwhile, the goal of exploring the ethical dimension is more closely related to the values guiding the actions of other dimensions and assisting in the decision-making of the involved actors. Four specific themes covering the ethical aspects of DE are particularly relevant for the study: transparency, fairness, responsibility, and trust.

Transparency is a core principle to mainstream sustainability in the food system. All actors need relevant information and data to make informed choices. Transparency facilitates data and information exchange on sustainability criteria between relevant actors; and vice versa, data and information exchange lead to more transparency. In the context of DE for FS transparency refers to openness about data collection, storage and usage hence making data easily accessible and understandable to all parties involved. Important elements of a transparency are data quality (including accuracy of data, harmonisation to improve reliability and compatibility of data, timeliness of data availability), clear rules for access to data, respect of confidentiality and of legitimate interest of public authorities. To ensure that transparency becomes an integral part of DE for FS and benefits all involved actors, a transparency system needs to be established, along with harmonised definitions, rules, methods and compatible tools. It also needs an infrastructure (centralised or networked), and different interfaces and levels of access tailored to the information needs of each actor. Transparency can promote such crucial aspects in FS as e.g., a potential food safety risk that due to data transparency can be detected early allowing quick actions to mitigate the risks (Astill, 2019).

Fairness is about all kinds of justice - social, environmental, legal, etc. Fairness results from moral judgement: the way in which people decide what is right and what is wrong. Fairness is about equal or reasonable (financial or social) transactions; it assesses whether people get what they deserve. A fair data economy has been defined by such characteristics as clarity in terms and conditions, users' control to user over data and data sharing, transparency, security, and reliability (Rantanen 2019). However, more clarification is needed on how fairness is understood and perceived by various actors in the context of a data economy for food systems.

Responsibility is about understanding and acting upon principles and values according to the standards within food systems in a growing data economy. Sustainable Development Goal 12 is "responsible consumption and production" (United Nations 2015). Responsibility here entails that resources are used well (e.g., not wasted), energy is used efficiently, the infrastructure works, people have jobs, can use services, and have quality of life. Regarding collective responsibility, one can think of Responsible Innovation (European Commission, 2013) as a systematic approach

of embedding moral principles in everyday practice. Besides that individuals and organisations should act in a responsible manner, there is also accountability: who needs to take action when some thing goes wrong.

Trust is at the core of data economy as it enables data sharing and usage among stakeholders. Lack of transparency in data collection, storage, use and distribution of benefits, in turn, generate mistrust and undermines data economy. People-centric and transparent approach to the data economy with clear and fair rules is needed to overcome the lack of trust and, more broadly, risks for ethical society (Koskinen et al. 2023). Governmental interventions are needed that help regulate, shape, and standardize data governance and data stewardship to establish trust and promote participation and an equitable relationship in the data economy (Cue et al., 2021).

### **3.6. Environmental dimension**

The environmental dimension of DE in food systems is addressed through the impacts of data and related digital tools on environmental management: how they improve or hamper sound environmental management across food systems and with what environmental effects, e.g., in terms of soil, water and air pollution/safety, biodiversity, carbon emissions and climate change. In addition, also the data environmental footprint – environmental impact of data technologies in terms of energy consumption, waste and carbon emissions – must be considered.

New data collection and processing tools and technologies can provide information that is helpful for monitoring environmental conditions and environmental performance of food-related practices, and making better-informed decisions that benefit environmental goals in agriculture and food systems (Lioutas et al., 2021; Lovarelli et al., 2020.) For instance, data from on-farm smart devices combined with agro-environmental data allows a more precise and efficient application of agricultural inputs, such as fertilizer, pesticide, herbicide, feed and nutrients; much data is used to map out the large contributions to global carbon emissions and models are being made to mitigate the effects of growing emissions: such documentation on carbon emissions is becoming a key decision-making tool of policy makers. Examples from other stages of food system shows that due to the gathered and shared data, more precise forecasting can be done on food demand and supply thus reducing food waste (Martin-Rios et al., 2021; Rodrigues et al., 2023).

In the meantime, there are critical voices that underline that the environmental benefits of DE are not straightforward, and it can even cause ecological threats. For instance, DE is more appropriate and beneficial for specific types of businesses and production modes such as large-scale, intensive, specialised farming which has more detrimental impact on the environment; there are less solutions appropriate for alternative or environmentally friendlier initiatives such as organic agriculture, crop rotation, permaculture, short food supply chains (Lioutas et al., 2021; Visser et al., 2021).

What is more, the DE itself - data infrastructure (data centres, devices etc) and data processes (collection, storage, transfer, processing etc.) – generates negative environmental impact. Information and communication technologies, data centres and cloud computing have a heavy environmental footprint due to high consumption of non-renewable energy, generation of waste and CO<sub>2</sub> emissions (Lucivero, 2020; Whitehead et al. 2014). Although there is growing awareness of these impacts, they are insufficiently recognised, monitored and addressed yet.

**Table 1 - Analytical dimensions and indicators for the data economy for food systems**

<b>Themes and indicators of data economy for food systems</b>			
<b>Theme</b>	<b>Indicator</b>	<b>Definition</b>	<b>Measurement</b> (applied in a qualitative study: interviews and focus groups)
<b>Technological</b>	Hardware (tools, devices) and software that make data operations (collection, storage, access etc) possible		
	Appropriateness	Suitability of data technology to local conditions and stakeholder's needs	Q.: How appropriate are available data technologies: do they address your needs, provide sound results, are easy to use?
	Interoperability	Compatibility of different data and data sources	Q.: Do you face some issues with data interoperability, ie, compatibility of data coming from different data sources, combining and exchanging data between information systems?
<b>Economic</b>	How data influence the economic performance of food system and its stakeholders, the ways of production, distribution and consumption of goods or services, income generation and distribution		
	Costs	Economic costs and expenditures related to the participation in data economy	Q.: Are there some costs for you linked to your data-related roles and activities, such as costs of data technologies and devices, data collection, storage, distribution, use etc? How important are those costs; are they a barrier for you to participate in the data economy?
	Benefits	Economic benefits and revenues related to the participation in data economy	Q.: What are economic gains for you (other stakeholders with or for whom you work) from operating with data, such as boosting competitiveness or innovation, increasing income, or other?
<b>Legal</b>	Data regulation, who and how has the right to access, manipulate, use data		
	Data ownership	Rights and control to use, possess and distribute data	Q.: Do you face with any data ownership or data protection issues, such as access to and use of some data, keeping control and responsibility over your data?
	Data regulation enforcement	Implementation of data regulation	Q.: Do you find that the data-related processes are sufficiently regulated? How effective, in your opinion, are public authorities' capacities to ensure stakeholders' compliance with legal requirements regarding data economy for food systems?
<b>Social Ethical</b> (+)	Social processes, relations, values that accompany data economy, as well as its societal impacts, including the distribution of its benefits		
	Inclusion	Awareness, availability, affordability of data solutions and capability to use them	Q.: How accessible or inclusive are data economy processes for the stakeholder group you represent, i.e., do you have the necessary skills and knowledge to work with data, access to infrastructure and technologies, support, etc? Are there any groups in the stakeholder group that you represent that are excluded from the data economy?
	Fairness	Equality of possibilities and opportunities, distribution of benefits	Q.: Do you feel that data collection, exchange and use among different people and organisations involved in food system is transparent and fair? Do you have sufficient information and knowledge on how data collected are used by other people and organisations in food system? Do you think all the stakeholders get their fair share or value in terms of resources, information, data, innovations, etc.?
	Transparency	How clear, monitorable and understandable are data flow processes	
<b>Environmental</b>	The impacts of data, digital tools and digitalisation on environmental management, i.e., how they improve or hamper sound environmental management across food systems and with what environmental effects		
	Environmental benefits	Positive environmental impacts of data solutions	Q.: Does data economy help to solve environmental challenges in food systems, improve your environmental performance (reduction of GHG emissions, maintenance biodiversity, soil, air and water quality, optimisation of inputs, etc)?
	Environmental costs	Negative environmental impacts of data solutions	Q.: Do you see any negative impacts of data economy on environment in the food system context?

## 4. Data collection and analysis methods

This section explains the main methods of data collection, sequence of data collection, criteria of respondent recruitment, logic of guiding questions, roles and responsibilities of WP4 partners in data collection, methods of data recording, storing and further processing.

### 4.1. Data collection

Data collection was carried out in two consecutive steps: qualitative interviews followed by national multi-stakeholder discussions (focus groups).

#### 4.1.1. Stakeholder interviews

Stakeholders for interviews were selected within the identified stakeholder groups as reported in Chapter 2. European and national level representatives were targeted who had a comprehensive stakeholder perspective and could represent the stakeholder group's situation and experience in the data economy, not only their personal one.

The main criteria for selecting interviewees were:

1. Representativeness of diverse stakeholder groups;
2. Individual and organisational competence and experience in DE4FS: interviewees hold sufficient competence and experience with data economy of food systems.;
3. Geographical coverage: different European regions (North, South, East, West) are covered;
4. Gender: equal representation of women and men was aimed for.

Interviews, following joint interview guidelines (Annex I), were conducted in English or in national languages. Interviews were organised online or face-to-face. They were carried out during January – February 2023. In total, 22 stakeholder group representatives were interviewed.

#### 4.1.2. Multi-stakeholder focus groups

Data collection in focus groups was built up on interview results. Topics and findings emerging from the interviews were further explored in national-level multi-stakeholder focus groups. After covering the European perspective on DE in the interviews, focus groups were conducted at the national level. The national focus allowed to gain in-depth insights in the variations of the DE in different national contexts; the national level also provided a more uniform context for a multi-stakeholder discussion. Focus group discussions were conducted in four project countries, i.e., Belgium, Latvia, the Netherlands and Poland. In each country, the partner organisation organised one multi-stakeholder focus group.

Participant's recruitment procedure and principles were similar to those of the interviews. Selection criteria of participants involved:

1. Representativeness of diverse stakeholder groups identified;
2. Individual and organisational competence and experience in DE4FS: participants hold sufficient competence and experience with data economy of food systems;
3. Gender: equal representation of women and men was aimed for.

Focus groups were organised in April / May 2023. In total, there were 38 participants in the four focus groups. The focus group discussions followed joint guidelines (Annex II). The discussions were recorded and reported in a structured template. The reports were used for further analysis.

## **4.2. Data analysis**

The gathered data - interview summaries or transcripts and focus group summaries - were analysed with the thematic content analysis method. Thematic analysis is a method of identifying, analysing and reporting themes within data (Jnanathapaswi, 2021).

The data were organised manually and with the support of Atlas software. The data were coded and structured according to the predefined and interlinked groups of conceptual themes:

1. Five dimensions of the DE: technological, economic, legal, social and environmental;
2. Opportunities and challenges in the DE;
3. Good practices and recommendations to improve the DE.

Deductive and inductive coding were further combined to explore each theme. Indicators of the five dimensions form the predefined subcodes, and additional subcodes arise from the data. Related codes were merged or grouped into broader categories or themes, and / or hierarchised; hence a network of associations was generated. The final list of themes was reviewed for completeness against the data and whether they covered all the codes.

## 5. Food system stakeholder perceptions and experiences in the data economy

Stakeholder observations, experiences, and issues evoked regarding the data economy were complex, complementary and multi-faceted: they reveal different perspectives, aspects, pros and cons of the data economy development. Hence, the results are organised in dialectic pairs that highlight this multi-faceted, sometimes contradictory character of the data economy. Despite the different perspectives, there were eight also overarching themes emerging from the stakeholders' discourses that reveal the shared values that the stakeholders associated with the data economy development: inclusiveness, enhancement, innovation, transparency, interoperability, balance, sustainability and governance. The results are depicted in infographic in Figure 3. This infographic is available also in an [interactive format](#) on the project's website.

### 5.1. Key values and associated perceptions and experiences

**Inclusiveness:** Winners – Losers

There was a shared understanding and expectation among the stakeholders that the data economy is or should be beneficial for the entire food system and all the stakeholders. However, depending on the stakeholders' access to data and the capability to make use of data, some stakeholders were perceived as benefitting more than others. This was conceptualised as those who benefit from the data economy for food systems, and those who encounter more disadvantageous circumstances. Some typical pairs perceived in a simpler dialectic framing of winners and losers:

Big companies and organisations	Small companies and organisations
Rich	Poor
Powerful	Vulnerable
Retailers, processors	Farmers, consumers
Data companies	Data owners, and data end users
Private Sector	Public Sector
Well educated, including researchers	Less educated
Young People	Older People
Men	Women

This reveals there are structural barriers in the societies and food systems that hamper equal participation in the data economy and fair distribution of its benefits, many of these are the same structural barriers we see with regards to included or excluded groups. When developing data initiatives and data solutions, it makes sense to consider and involve all the relevant stakeholders. A particular collective effort should be made to involve those stakeholders who are less visible and less powerful.



# Data4Food 2030

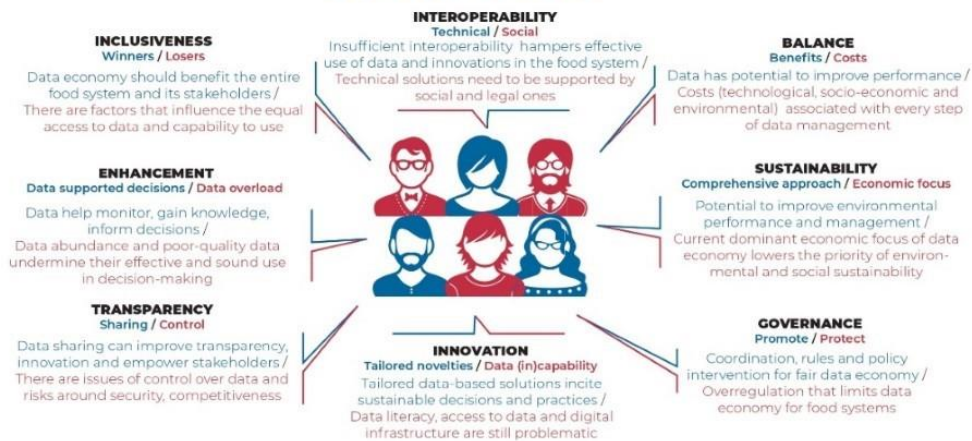
Data and data-driven solutions are already shaping food systems and the ways we produce, consume and govern food.

## What are the perceptions and experiences of food system participants' of the data economy?

### METHOD



### RESULTS



### RECOMMENDATIONS

Key stakeholder recommendations – preconditions to arrive at fair data economy



### CONCLUSIONS

While the term "data economy" is new for many food system stakeholders, they are aware of the role of data in their daily professional lives. Still, many stakeholders experience limited control and influence on data economy processes.



[data4food2030.eu](http://data4food2030.eu)

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Contributors: Sandra Šumane, Maja Ušca, Tõnis Tisenkops (BSC), Monika Čebska, Edward Majewski, Sławomir Jarka, Agnieszka Bernat Jarka (SGGW), Pia Groenewolt, Maciej Otrnianowski (VUB), Femke Moulman, Marc Jeroen Bogardt, Kelly Rijswijk (WR). Design: Foodscale Hub. Contact: sandra.sumane@bscresearch.nl

Figure 3 – Infographic: perceptions and experiences of food system participants' of the data economy

**Box 3 - Stakeholders about the data economy inclusiveness**

“Farmers are the weakest chain in the food systems. All actors need data from farmers, and they are not getting enough benefit from it.” (Researcher)

“Digital transformation and data economy are more accessible for bigger players in the food system. This is due to financial and other costs involved.” (Data actor)

“There is a risk that data reproduce existing unequal social structures and leave marginalised groups out as there are no data about them. Also, data that are the prototype of white men are less meaningful for women.” (Health actor)

**Enhancement:** Data supported decisions – Data overload

One of the key perceived benefits of data is that they help food system stakeholders to monitor and gain knowledge about food system, diverse food-products, food business and governance related processes and outcomes. These insights help food system stakeholders to take better-informed decisions. On the other hand, the stakeholders pointed out there are too many data, unused data, misused data, incorrect and poor-quality data that undermine their effective and sound use in decision-making. This evokes the importance of data transparency and data literacy.

**Box 4 - Stakeholders about the potential of data to enhance their performance**

“Data flow ensures that very fast reactions are possible at every chain element, starting from procurement to the situation in shelves. Data flow is used to make all the orders, to forecast procurement, to get information about customers.” (Retailer organisation)

“There is the problem of reliability and credibility of data. Different sources may provide different data on the same subject. Significant obstacle in proper use of data is that often data are not complete. The quality of dataset can be unknown – who and how verifies it?” (Polish discussion)

**Innovation:** Tailored novelties – Data (in)capability

The stakeholders associate data with innovation, as such there is an element of data being treated as a novelty. The transformative potential of data to change food system participants’ decisions, behaviours, practices towards more sustainable ones is related to the fact that data allow to develop tailored, customized, personalized solutions that can consider specific situation and address specific stakeholders’ needs. Such solutions incite and help food system stakeholders to adopt novel sustainable food-related decisions and practices. However, to use this data innovation potential and to become proficient and responsible users of data and data solutions, stakeholders need access to data and appropriate digital infrastructure, equipment, tools, skills and data intelligence, which is not always the case. Hence, investments in these are still a necessity.

**Box 5 - Stakeholders about the innovation potential of the data economy**

“Data can help to define more specific and better targeted aims to solve problems in food systems, e.g. data on waste structure can help to identify specific food waste groups and develop targeted solutions to reduce them.” (Latvian discussion)

“Data availability is one side, and the other side is how you analyse data and what you get out of data. Some advisors have these skills, while other still need to acquire them. Until you do not know how to turn data into conclusions and decisions, data remain just data.” (Advisor organisation)

“In the agrifood sector, you see that farmers do not always have access to the data that they create. They could simply not have access, but they can also not know how to get that access. .. Farmers, as data owners, often lack the capacity to use [data]. Among others, this is a result of minimal access to digital infrastructures.” (Dutch discussion)

**Transparency: Data sharing – Data control**

Data sharing is at the core of the DE. The stakeholders saw data sharing as improving transparency across the entire food system, contributing to innovations, improving their performance, and empowering stakeholders, in particular those in a more vulnerable situation. On the other hand, data sharing entails loss of control over one’s data – when data are given away, one does not always know and control what is done with this data. Data sharing is also associated with such risks as data insecurity, reduced competitiveness and economic advantage, overcontrol and possible repressions in case of non-compliance with some rules or requirements.

**Box 6 - Stakeholders about transparency in the data economy**

“Transparency and proper control are beneficial in food production. All food entities are exposed to multiple hazards (e.g., biological or chemical), resulting in a high likelihood of contamination. That is why instantaneous information about operations at all food production stages reduces companies' and consumers' risks.” (Farmer organisation)

“We need transparency to move towards sustainability transitions. We need to be aware of requirements from suppliers or for products. But if you become very transparent, you lose of your competitive advantage. If everyone has access to it, then what happens to your market position?” (Retailer organisation)

“Citizens often wonder if they can request data holders to delete their data. They feel that data is being collected about them, but they are unable to utilize the same data to empower themselves or support businesses and stakeholders aligned with their interests.” (Belgian discussion)

**Interoperability: Technical – Social**

Data sharing is closely linked to interoperability or compatibility of data coming from different data sources, the ability to combine and exchange data between information systems. According to the stakeholders, insufficient interoperability of data, devices, applications, data repositories, and services is a central issue that hampers effective use of data and innovations in the food system. Their experience suggests that technical solutions of interoperability are closely linked to social and legal ones, such as development of common understanding, common public and private standards, enhancing willingness and trust to share data.

**Box 7 - Stakeholders about interoperability**

“There is a big issue of interoperability. Suppose you have a tractor produced by one company gathering data. When you change this tractor to a tractor produced by another company, you will lose all data from the first tractor. This method keeps clients loyal, but consequently, data has only a limited use.” (Policy maker)

“Interoperability means that there is good understanding and an agreement among the stakeholders what kind of data are existing and how this data is flowing. Interoperability requires that there are restrictions and norms which regulate who can access this data and how it can be used.” (Equipment manufacturer)

"As intermediaries, advisors work with many databases of different organisations, and those databases need to be compiled. Data interoperability can be very complicated. .. It is very difficult to negotiate with other data holders about automated data." (Advisor organisation)

**Balance: Benefits – Costs**

As noted above, the stakeholders associate the data economy with improved performance, and this regards all the domains of food system. Data can help to optimize food production, food waste management, improve research efficiency, policy implementation, provide a more appropriate farm advice etc. In the meantime, adoption of data solutions is not always seen as beneficial, and every step of data management – starting from data collection, to storage, access and use – can involve considerable costs. Costs are associated both with technological (equipment, tools, devices, software etc.) and human (knowledge, skills) resources. Furthermore, there are also social and environmental costs involved.

**Box 8 - Stakeholders about the data economy costs and benefits**

“The economic benefit comes from the possible immediate reaction of a decision-maker. Companies can survive due to the innovative use of data concerning the market. Data are available more frequently, and shorter time window opportunities arise.” (Farmer organisation)

"IT (information technology) consumes energy, there is a carbon footprint; rare minerals are in everything that demands computation. We need to keep an eye on it and balance. High tech demands a lot of environmental resources. That'll be even more an issue in the future if data field is expanding in a rapid pace". (Data actor)

“Digital technologies (such as software based on algorithms, AI (artificial intelligence), IOT (Internet of Things), Blockchain) are not tangible and farmers do not see that they bring in direct benefits. The prior motivation of farmers is to provide good products and take care of their animals. This is where they receive direct compensation from. It is difficult to bring data into this. This differs from the bigger data companies who see a business model in data, for farmers this is an additional task.” (Dutch discussion)

**Sustainability: Comprehensive approach – Economic focus**

Altogether, the stakeholders agreed that the DE has a good potential to improve environmental performance of food systems through a more effective management of resources, supporting more sustainable and climate-friendly food-related behaviours and practices in the entire food-chain, including reduction of food waste. However, the current data economy has a strong economic focus: economic data, economic value of data, and data application for economic purposes dominate. This eventually leads to lower prioritising of environmental and social sustainability dimensions in food systems.

#### Box 9 - Stakeholders about the data economy sustainability

“Data economy is an essential for the realisation of the goals in agriculture that citizens expect and request - ensuring high food security, high-quality standards, welfare, sustainability and environmental protection.” (Farmer organisation)

“The current data flows are skewed towards economic indicators and the production side of a complex food system. The consumer perspective on data should be put more in foci emphasizing the nutritional, health, environmental and social functions of food. Such a reorientation of food system data ‘mentality’ could trigger changes in consumption models with a positive impact on the environment, health and community wellbeing.” (Latvian discussion)

“The topic of data economy for food systems is very current for three reasons. Firstly, sustainability: food has such a high impact on sustainability, biodiversity and climate change. Second, food safety and food security: the variety we have in food is phenomenal these days, but at the same time now we've seen through the Ukraine war and through COVID that it's a fragile system. Third, fairness: we see food prices increasing, and I am worried about people who cannot afford healthy nutrition. Also, for entrepreneurs, it is very difficult to get into the food space because it is highly regulated and there are big players there. All this calls for data-based approaches, but for ones that are not worsening the situation or the biases, but the opposite.” (Consumer organisation)

#### **Governance:** Promote – Protect

The DE needs governance – coordinated joint structures, mechanisms, norms that ensure accountability and rule of law. The stakeholders expect top-down measures – proportional policy interventions and guidelines that steer fair data economy and shared common rules regarding data rights and responsibility. However, they do not wish overregulation and overcontrol when norms and regulations become a burden.

#### Box 10 - Stakeholders about the data economy governance

“There should be regulations and public actors that balance the existing asymmetry, counteract power imbalances”. (Researcher)

“Sometimes there is a huge bureaucratic burden. But maybe it must be well regulated and transparent for the sake of a safe future. [Data] regulations can become problematic if they have a negative impact on progress and development, if we exaggerate and wish to protect everything.” (Food safety agency)

“The importance of data governance [increases] as trust emerges as a recurring challenge in the context of the data economy. Even with the implementation of blockchain technology, a stronger regulatory structure is necessary for effective governance. Drawing parallels to land regulation, the need for a robust framework to ensure responsible management and utilization of data becomes evident.” (Belgian discussion)

## 5.2. Conclusions

While the term “data economy” is new for many food system stakeholders, they are aware of the role of data in their professional and personal (as consumers) lives. Still, many stakeholders experience limited control and influence on the DE processes. There were eight overarching themes identified that reveal shared values that the food systems' stakeholders associated with the data economy development: inclusiveness, enhancement, innovation, transparency, interoperability, balance, sustainability and governance. As the identified themes represent the result of the choices and agreements of stakeholders, there are no simple and linear solutions possible, rather there is a discussion about a balanced and inclusive approach to data economy

development. Simultaneously food system stakeholders perceive they are mutually connected and interdependent in the data economy. Hence, collaboration and joint solutions are needed, but they are also complex and challenging to achieve.

To achieve a fair DE for sustainable food systems that is beneficial for all the food system participants and the environment, food system stakeholders expect proportional regulations, legal guidance and participatory governance.

### 5.3. Recommendations

The most common issues that according to the different stakeholders need to be addressed included ensuring data security and, more broadly, improving data economy governance. Regarding the latter, the stakeholders referred to the need to develop a food systems' data ecosystem or a system of well interconnected and coordinated stakeholders that would allow tackling a variety of challenges, such issues as data interoperability, inclusiveness, and ethics in the process of sharing data etc. With regards to data security, it was highlighted particularly by the representatives of retailers, consumers, and policy makers that a higher European body should be involved for ensuring a proper governance of data. Such intervention could also help tackle power imbalances created by data collection. Considering data interoperability, the policy makers pointed to the need for negotiations and mutual agreements between different parties on data sharing and correct use of data where again European bodies could be involved. Meanwhile, the researchers were more focused on the ethical and inclusive aspects of data sharing than other stakeholders. The idea of building trust among different actors by the use of blockchain was mentioned by different interviewees, including the policy makers and the researchers. Finally, looking from health perspective, the importance of using the data for the purpose of shifting consumers' dietary patterns in a healthier and more sustainable direction was highlighted. To accomplish this goal, improvement of data literacy and skills of food system stakeholders to support data-based sustainable food decisions and practices is necessary.

To summarise stakeholder recommendations or what they see as necessary preconditions to arrive at a fair data economy, there are following measures and support needed:

- Policy interventions to address the issues of power imbalances, data privacy and security, and interoperability.
- Collaboration and mutual agreements between food system stakeholders on data sharing and correct use of data.
- Improving data literacy and skills of food system stakeholders to support data-driven decisions and practices for a sustainable food system.

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# Annexes

## Annex I: Interview guidelines

### Task 4.1 Interview guidelines

24/02/2023

*The text in Italic are notes for the interviewee.*

*As for semi-structured interviews, these guidelines provide with the general structure of interviews and the topics that should be covered in them. The guidelines can be followed and used in a flexible manner (including, you may reword or rephrase questions keeping their sense, switch questions their places to follow a respondent's logic, skip some questions if a respondent has answered them spontaneously etc) as long as the necessary information is gathered.*

#### **Before the interview:**

*Print out the interview guidelines if it is more convenient for you.*

*Prepare a paper and a pen or open a text editor in case you need to take notes.*

*Get acquainted with / keep next to you the document [Data definitions](#).*

*Open the [file](#) with the figure of data chain roles to share them on the screen with the respondent if you find it helpful.*

#### **Interview**

Thank you for accepting to participate in Data4Food interview.

*Ethics: Check with the informant that s/he has received, signed and returned the informed consent form. You may remind that the participation in the study is voluntary, anonymous, the provided information will be used only for the project's scientific purposes, and that s/he can withdraw at any stage.*

*Introduce to the project and the purpose of the interview. Stay vague about data economy concept here to let the respondent to express their ideas first.*

This interview is a part of EU project "Data4Food2030: Pathways towards a fair, inclusive and innovative Data Economy for Sustainable Food Systems". The project aims to understand and improve the data economy for food systems. In a series of interviews, we wish to explore different food systems stakeholders' experience and attitudes regarding the data economy. The results of the interviews will also contribute to generate propositions how the data economy can contribute to the transition to sustainable food systems in fair and inclusive ways.

*Ask the permission to record the interview and press the button. In case the respondent refuses to be recorded, make notes as neatly as possible.*

### **Introduction to DE4FS, data flow activities and roles**

1. Can you please introduce yourself: which organisation are you from, what is your role/function in it? What is your experience with digital transformation processes?

2. What do you think of when we talk about the data economy for food systems?
3. *Explain the project's definition:* The data economy for food systems (DE4FS) creates value from increasingly available data as they are integrated in products, services, support to achieve better informed decision-making, social engagement, governance and innovation. This involves various activities around data, such as data production, collection, processing, storage, monetization, usage etc. while at the same time it can help developing food systems that provide healthy food and manage natural resources more efficiently. Do you have some comments about it?
4. A stakeholder, such as yourself, can play various roles within these data flow activities. Could you identify which roles you play among the ones that I shall list you now? (*See the document [Data definitions](#) for a more comprehensive overview of data flow and roles and you can share the picture with the respondent to ease.*)

Data owner (also data subject, data source or data originator) - people and organisations that serve as data sources, i.e., from whom data are gathered.

Data provider (also data holder, data supplier, data vendor) - people and organisations that create, collect, aggregate data from different sources (published (f.i. social media), requested (f.i. questionnaires), sensory (f.i. smart devices) etc).

Data consumer (also data buyer) - people and organisations that buy or get access to third-party data for their own use.

Data end-user - people and organisations that use data, data services, data-products for their advantage (for decision-making, development of goods, service-provision etc).

Data intermediaries: people and organisations that act as middlemen between data owners, providers and end-users by providing a range of data-related services, e.g. data market places, entrepreneurs, brokers, facilitators.

Data marketplace – people and organisations that host data and offer it to consumers/ end-users.

Data entrepreneur – people and organisations that develop innovative data-driven technologies, products and services.

Enabler – people and organisations that enable data economy through a range of resources and services, such as regulations, funding, knowledge, advice, technologies, publicity etc.

5. Could you describe in what way do you/your organisation undertake this role?
6. Is there another role that you implement regarding data, but which was not named? What is it?

## **Stakeholder needs, interests, concerns**

Next, we would like to better understand your needs, interest, and concerns regarding the data economy for food systems.

7. What are the key challenges, concerns that you face regarding the data economy for food systems?
8. What are the key opportunities that you see for you in the data economy for food systems?

We shall separately discuss now technological, legal, economic, environmental and social, aspects. When answering these questions, please, consider your experience in the different roles you have identified that you/ your organisation perform in food systems in the context of data economy.

9. What are the key **technological** aspects or issues of data economy and data-related processes in food systems that are of your interest or that raise your concern? With the technological aspect we understand hardware (tools, devices) and software that make data operations (collection, storage, access etc) possible.

*Ask the following questions 9.1.-9.2. if the respondent has not responded them spontaneously in the question 9.*

9.1. How appropriate are available data technologies: do they address your needs, provide sound results, are easy to use?

9.2. Do you face some issues with data interoperability, ie, compatibility of data coming from different data sources, combining and exchanging data between information systems?

10. What are the key **legal** aspects or issues of data economy and data-related processes in food systems that are of your interest or that raise your concern? With the legal aspect we understand data regulation, who and how has the right to access, manipulate, use data.

*Ask the following questions 10.1.- 10.2 if the respondent has not responded them spontaneously in the question 10.*

10.1. Do you face with any data ownership or data protection issues, such as access to and use of some data, keeping control and responsibility over your data?

10.2. Do you find that the data-related processes are sufficiently regulated? How effective, in your opinion, are public authorities' capacities to ensure stakeholders' compliance with legal requirements regarding data economy for food systems?

11. What are the key **economic** aspects or issues of data economy and data-related processes in food systems that are of your interest or that raise your concern? With the economic aspect we understand how data influence the economic performance of food system and its stakeholders, the ways of production, distribution and consumption of goods or services, income generation and distribution.

*Ask the following questions 11.1.-11.2 if the respondent has not responded them spontaneously in the question 11.*

11.1. Are there some costs for you linked to your data-related roles and activities, such as costs of data technologies and devices, data collection, storage, distribution, use etc? How important are those costs; are they a barrier for you to participate in the data economy?

11.2. What are economic gains for you (other stakeholders with or for whom you work) from operating with data, such as boosting competitiveness or innovation, increasing income, or other?

12. What are the key **environmental** aspects or issues of data economy and data-related processes in food systems that are of your interest or that raise your concern? With the environmental aspect we understand the impacts of data, digital tools and digitalisation on environmental management, ie, how they improve or hamper sound environmental management across food systems and with what environmental effects.

*Ask the following questions 12.1.-12.2 if the respondent has not responded them spontaneously in the question 12.*

12.1. Does data economy help to solve environmental challenges in food systems, improve your environmental performance (reduction of GHG emissions, maintenance biodiversity, soil, air and water quality, optimisation of inputs, etc)?

12.2. Do you see any negative impacts of data economy on environment in the food system context?

13. What are the key **social** aspects or issues of data economy and data-related processes in food systems that are of your interest or that raise your concern? With the social aspect we

understand social processes, relations, values that accompany data economy, as well as its societal impacts, including the distribution of its benefits.

*Ask the following questions 13.1.-13.2 if the respondent has not responded them spontaneously in the question 13.*

13.1. How accessible or inclusive are data economy processes for the stakeholder group you represent, ie, do you have the necessary skills and knowledge to work with data, access to infrastructure and technologies, support, etc? Are there any groups in the stakeholder group that you represent that are excluded from data economy?

13.2. Do you feel that data collection, exchange and use among different people and organisations involved in food system is transparent and fair? Do you have sufficient information and knowledge on how data collected are used by other people and organisations in food system? Do you think all the stakeholders get their fair share or value in terms of resources, information, data, innovations, etc.?

14. Are there any other concerns, interests and needs that you have when considering your role and activities in data economy for food systems?

## **Recommendations**

15. What do you think are one to three the most urgent issues to be solved in data economy for food systems?

16. Do you have any suggestions or recommendations how this can be done and by whom?

17. Any other final remarks?

18. Is there anyone else you think we should ask for an interview or involve in the focus groups?

Thank you for the interview!

## **Annex II: Focus group discussion guidelines**

### **WP4 T4.1. Stakeholder discussion**

#### **Guidelines**

10/03/2023

#### **Purpose**

In line with the overall goal of WP4 to support inclusive data economy for food systems, in T4.1 we map relevant stakeholder-types in the food system and collect their stories about their interests, values, power and influence regarding the developing data economy. The aim of multi-stakeholder focus groups is to gain a better understanding of stakeholder experiences, concerns and values as well as to enhance reflection between them. We will do this in a joint discussion on stakeholders' roles and relations in the data-chain, challenges and opportunities they face, and potential solutions and good practices to support inclusive data economy. The integrated results of T4.1 will inform the evaluative framework in WP1 and the co-development of future scenarios in T.4.2.

#### **Target groups**

The stakeholder discussion will involve representatives of food system stakeholder groups identified in T4.1 mapping exercise:

1. Farmers
2. Processors
3. Retailers
4. Catering
5. Consumers
6. Waste
7. Input suppliers
8. Policy makers
9. Advisors
10. Research
11. Food control and monitoring, incl. certification schemes
12. Media
13. Environment
14. Health
15. Rural / territorial
16. New data actors

Not all the 16 stakeholder groups must be present in the discussion. To manage a smooth discussion, we aim at 8-10 participants per discussion who represent different stakeholder groups. Each partner can decide which are the most relevant stakeholder groups in their country to be invited.

The participants should (1) have experience with data-related processes in food systems in whatever role in the data-chain (data subject, facilitator, user etc) and (2) ideally, be able to represent a stakeholder group's opinion and experience, not only individual.

## Place and time

To gain insights of stakeholders' experiences and stimulate their interactions, joint discussion and collaborative work in their real-life context, we will organise multi-stakeholder discussions at national level. Four stakeholder discussions will be organised in different countries - Belgium, Latvia, The Netherlands and Poland - by the respective partner in that country.

The workshops are to be held April 2023. The preparation of the workshops includes identifying, contacting and inviting the right persons. The effort and time required for that should not be underestimated.

## Methodology

To enhance exchanges and reflection between stakeholders (as proposed in the proposal), we will deviate from a classical focus group discussion towards a more participatory and collaborative format, ie, multi-stakeholder discussion. During the discussion, in four consecutive steps, the participants will (1) draw together a national map of DE4FS, (2) present their gains, (3) expose their concerns, challenges and they face, and (4) identify and co-develop potential solutions to address the identified challenges and to unfold opportunities.

Record the discussion or have a note-taker.

## Introduction

Present Data4Food2030 project, data economy, WP4 and Task4.1 discussion (See presentation).

### Step 1: Mapping the DE4FS in the country

Support material: a large sheet with the data-chain figure, post-its and pens

Present and explain the figure of data-chain with its different data roles to the participants. Afterwards the participants are asked to:

1) Use post-its (each participant writes his/her stakeholder group on her/his) to position where they see themselves in the data chain (can be several roles / post-its; one post-it for role) and comment on those roles. In turn, each participant posts his/her sticky notes on the figure and shortly explains.

*Questions: Stakeholders, such as each of you, can play various roles within these data flow activities. Could you think over and identify which roles you play among the ones that I have just presented you?*

2) After the accomplished round of participants, they (or with the help of the moderator) add to the figure post-its with other key system stakeholders (can be concrete organisations or stakeholder groups) that might not be present.

*Questions: Who else, which other organisations or stakeholder groups that are participating in the data economy for food systems are missing in the picture? What data roles do they play?*

*Are there some stakeholders who should be involved in DE4FS, but are poorly or no included?*

3) Draw data links between the different stakeholders in the map and shortly explain them. You may use arrows to mark the directions of data flows, and add explanatory names to the links/ arrows.

Questions: *What are your relations with other data stakeholders? How are you linked to other data stakeholders? Who are in the power positions in this map? Who are less integrated or are excluded?*

## **Step 2: Gains**

Support material: a large sheet, post-its and pens

1) With the collective map in view and mind (stick it on a wall or other support so that it remains visible), each participant thinks over and notes on post-its the key gains (one per post-it) that s/he as a stakeholder sees or experiences in the data economy context. (Remind to write their stakeholder group on post-its so that we can recognize them afterwards.) In turn, participants post their sticky notes on the sheet and shortly explain. The moderator follows that the participants explain also why gains are gains.

Questions: *What are the key gains that you see or experience in the context of DE4FS? Why these are important for you?*

2) Grouping of gains. Similar gains are grouped – during the process and at the end when all the sticky notes are posted.

3) Introduce the participants with the key findings on gains from the interviews and ask for their feedback on these.

## **Step 3: Concerns**

Support material: one large sheet, post-its and pens

1) Each participant thinks over and notes on post-its the key concerns (one per post-it) that s/he as a stakeholder experiences in the data economy context. (Remind to write their stakeholder group on post-its so that we can recognize them afterwards.) In turn, participants post their sticky notes on the sheet and shortly explain. The moderator follows that the participants explain also why gains are gains.

Questions: *What are the key concerns that you have in the context of DE4FS? Why these are important for you?*

2) Grouping of concerns. Similar concerns are grouped – during the process and at the end when all the sticky notes are posted.

3) Introduce the participants with the key findings on concerns from the interviews and ask for their feedback on these.

## **Step 4: Solutions**

Support material: the sheets from Step 2 and Step 3, blank sheets, post-its and pens.

On the base of concerns and gains identified in Steps 2 and 3, the participants agree on 3-4 the most urgent issues to be solved and develop recommendations and identify good practices.

1) Agreement on the most urgent issues can be reached in an open discussion or by vote: for instant, each participant has 3-5 (depending on the number of challenges) small voting stickers that s/he sticks on the groups of challenges s/he finds the most urgent. The participants rank the issues (from the most important (1) to the less important). In a vote, the number of stickers is counted. When agreed, issues are written on a sheet.



Questions: *Considering the concerns and the gains that you have identified, what are the most urgent issues to be solved in DE4FS?*

2) Starting from the most urgent issue (rank 1) the participants propose 2.1) recommendations or identify existing good practices / solutions with "How might we...?".  
Questions: *How might we address this issue? What are potential or existing solutions?*

[Optional: 2.2) Identify the role of different stakeholders in the implementation of the recommendation / solution.

Questions: *Who and what actions should take to implement this solution? ]*

This is a collective discussion. Participants or with the help of the moderator add and present post-its with the solutions (one post-it per solution) next to the respective challenge; and actions to be taken (one post-it per action) next to the respective solution.

## Workshop Plan

<i>Time</i>	<i>What</i>	<i>Additional info</i>
- 00.15	Registration	Welcome and register participants – in a collective consent form or distribute and collect if filled-in individual consent forms
00.00	Introduction	Introduction to Data4Food2030, WP4 and the workshop Remind about the consent forms Round table introductions of participants Explain shortly the four steps of the discussion Ask the permission to record, in case you record the discussion
00.15	Discussion Step 1: Mapping the DE4FS in the country	5 min: Present the data-chain with data roles 5 min: Participants' individual reflection 15 min: Post and explain participants' roles 5 min: Add missing stakeholders 5 min: Draw links between stakeholders
00.50	Discussion Step 2: Gains	5 min: Individual reflection of gains 20 min: Post and present gains 5 min: Present gains from the interviews and receive feedback
01.20	Discussion Step 3: Concerns	5 min: Individual reflection of concerns 20 min: Post and present concerns 5 min: Present concerns from the interviews and receive feedback
01.50	Discussion Step 4: Solutions	10 min: Agree on the key issues 20 min: Joint discussion of solutions and actions to be taken
02.20	Summary and finish	Round-up of the discussion Ask for participants' questions and/ or feedback Thank and good-bye

The Work Plan is developed for a discussion of app. 2h30. The indicated time for each item is approximative, you can organise your discussion flexibly. Think of introducing a break (for instance, after Step 1 or Step 2), and refreshments.

## To do list

<i>When</i>	<i>What</i>	<i>Additional info</i>
March / early April	Send invite to potential participants (the goal is 8-10 participants at the discussion; you may need send invites to more)	Translate and adapt provided invitation to the local context (e.g. date, time, location)
March/ early April	Book a venue	Think about size and set-up of the room (e.g. number of participants, availability of screen, laptop, etc.) Arrange drinks and snacks, if appropriate
March/ April = a week after the initial invite	Send reminder to potential participants	Only to those who have not responded yet
April	Prepare the event's content	Adapt provided/prepare PPTs and the data-chain figure. Make sure there are designated persons as welcomer/receptionist, presenter, facilitator and note-taker. Arrange name tags, pens, tape, sticky notes, etc. (see 7. Workshop necessities).
April = one week before the event	Send a reminder & consent sheet to participants	
April	Event	Arrive at venue at least 1 hour before to set up the room and make sure everything works. Have someone takes notes during the workshop and/or record audio of the discussion
May	Write a detailed report	Outline of report provided by BSC In English

### **Workshop Necessities**

- Registration sheet with an integrated collective consent form or separate individual consent forms
- Large screen & projector, if needed to introduce with the project and the discussion (incl. the figure of data-chain)
- Name tags for participants (add also the respective stakeholder group) and organizers
- Large sheets, one of which with the figure of data-chain
- Sticky notes of different colours
- Small stickers for voting
- Pens
- Tape
- Tape-recorder

### **Annex 1. Example Invitation**

Mail subject: Invitation to a discussion for EU project Data4Food2030

Dear [title and name of the resopondent],

On behalf of EU Horizon project [Data4Food2030](#) I invite you to participate in our study on data economy for food systems.

The overall goal of the project Data4Food2030 (Pathways towards a fair, inclusive and innovative Data Economy for Sustainable Food Systems) is to understand and improve the data economy for food systems. Data and data-driven innovations are already shaping food systems and the ways we produce, consume and govern food, and the project aims also at reducing the existing knowledge gap about these data processes and their impacts, including on different food system elements and stakeholders.

As a part of the project, we organise a discussion with food systems stakeholders in *[the country name]*. The discussion's aim is to explore the current state of the data economy for food systems in the country with a focus on stakeholders' experience and attitudes, including the barriers and opportunities they face, and potential solutions for a more effective and inclusive data economy for food systems. The results will contribute to generate propositions how the data economy can contribute to the transition to sustainable food systems in fair and inclusive ways.

We consider *[name of the organisation]* as a valuable food system stakeholder and would highly appreciate if you accept to take part in the discussion.

The stakeholder discussion will take place on *[date, time from to, and place]*.

Please, respond about your availability for the discussion until *[date]*. Once you provide your agreement, we will send you the consent form. If for any reason you cannot participate in the discussion yourself, we appreciate if you can suggest other appropriate colleague of yours. Please, find attached a project brochure.

I am happy to answer your any further questions about the study and the stakeholder discussion.

*[Closing phrase,  
Signature]*

*Attach the project's [brochure](#) to the mail*

## **Annex 2. Information sheet and individual consent form for participants**

### **Data4Food2030 Information letter**

*Please take some time to read this information and ask questions if anything is unclear. Contact details can be found at the end of this document.*

#### **Project background and purpose**

The aim of the [Data4Food2030](#) project is to define and map the development, performance and impact of the data economy for food systems (DE4FS) in order to create new insights and opportunities related to the digital transformation of food systems. Data and data-driven innovations are already shaping food systems and the ways we produce, consume and govern food, and the project aims also at reducing the existing knowledge gap about these data processes and their impacts, including on different food system elements and stakeholders.

Together with (the input from) various stakeholders the researchers want to identify drivers and barriers related to the development of a data economy for food systems, and turn these into opportunities, recommendations and solutions for the development of a data economy.

## **Organisation**

Wageningen Economic Research is coordinating the Data4Food2030 project and the research for this study is being undertaken by the [consortium partners](#). This discussion is part of the activity stakeholder mapping, undertaken by the Baltic Studies Centre (BSC), the Free University of Brussels (VUB), Warsaw University of Life Sciences (SGGW) and Wageningen Research (WR). This project is funded through the EU commission through the Horizon Europe funding program (grant agreement No.101059473). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

## **Participation in the discussion**

Participation in this discussion is voluntary and you may ask any questions before agreeing to participate. If you agree to participate, you will be asked to sign this consent form. However, at any time, you are free to withdraw consent during the discussion or to withdraw consent regarding (parts of) the information gathered during the discussion by contacting the researcher that conducted the discussion.

If you agree to take part in this discussion, you will be asked questions about your experiences with and attitudes to the data economy for food systems.

Your experience and expertise with the food system and/or data related activities (e.g. data production, aggregation, storage, etc.) as a key stakeholder in a food system will be of valuable input providing an overview of drivers and barriers related to the development of a data economy for food systems.

## **How will my information provided in the discussion be used?**

The information from the discussion will be used by the researchers in the Data4Food2030 project for a report to the European Commission, to develop infographics that will be publicly available through the website of the Data4Food2030 project (<https://data4food2030.eu>) and for open access scientific article(s).

Personal data (name, organisation, e-mail, phone number) is collected for the purpose of contact, follow-up and invitation to this discussion only and will be anonymised in any reports, infographics or publications.

The information will be processed in accordance with the provisions of the GDPR and will be deleted no later than 10 years after the project ends. Your personal data will not be shared with other parties other than the consortium partners involved in this project.

The information will be retained by project coordinator (WR) and will only be used for the purpose of research. The security of personal data and by the processors takes place on the basis of generally accepted standards and best practices. Please refer to the [WUR information security policy](#) and the [WUR data policy](#) for more details.

By supplying this information you give consent to storing your information for the purposes and uses outlined above. Any use of the information beyond the scope or duration of this project will require the researchers to contact you for (re-newed) consent.

There are no risks in taking part in this study.

## **Research results**

You may request a summary of the research findings by contacting the task leader, Talis Tisenkopf of the Baltic Studies Centre: [talis.tisenkopfs@bscresearch.lv](mailto:talis.tisenkopfs@bscresearch.lv).

## **Concerns or complaints**

If you have any concerns about the project, your involvement in it or this consent form, please discuss this with the researcher conducting the discussion in order to find out how your concern will be addressed.

## **Data4Food2030 – Consent Form**

Issue	Initials
I have read the information presented in this information letter.	
I have had the opportunity to ask any questions related to this research and received satisfactory answers to my questions.	
I am aware that excerpts from the discussion may be included in publications to come from this research. Quotations will be kept anonymous.	
I understand that relevant sections of the data collected during the research may be looked at by individuals from the Data4Food2030 project. I give permission for these individuals to have access to my responses.	

With full knowledge of all the foregoing, I agree to participate in this discussion and the processing of my answers.

Yes \_\_\_ No \_\_\_

I agree to be contacted again by the researchers for clarification or elaboration from the discussion.

Yes \_\_\_ No \_\_\_

If yes, my preferred method of being contacted is:

- Telephone:
- Email:
- Other: .....

Participant's Name		Researcher	
Signature		Signature	
Date		Date	

## Annex 3. Report structure

Please write your report in English

See the [reporting template](#) in WP1 Focus groups folder.

### 1. Introduction

Information about the event: place, date and time

Information about participants: number of participants, stakeholder groups and organisations represented, gender.

Selection of participants: shortly describe which stakeholder groups were invited, how the potential participants were identified and addressed, any reflection on the selection procedure and the final composition of the group discussion.

### 2. Method

Explain only any deviation from the common methodology. Otherwise keep this empty.

### 3. Results

#### 3.1 Map of DE4FS

Describe

- your observations about the participants' understanding of DE4FS;
- the generated national map of data economy for food systems with a special attention to stakeholders' roles, relations, and power positions in it, always specify the stakeholder group;
- other relevant observations about the functioning of DE4FS.

A concluding summary paragraph with a couple of points that you wish to highlight about the overall state of DE4FS and/or stakeholders' roles, relations or positions in it.

### **3.2 Gains**

Describe

- gains and opportunities in DE4FS as identified by the stakeholder groups, always specify the stakeholder group;
- the participants feedback on the gains and opportunities identified in the T4.1 interviews;
- any other relevant observations.

A summary concluding paragraph with a couple of points that you wish to highlight about gains and opportunities.

### **3.3 Concerns**

Describe

- concerns and challenges identified by the stakeholder groups, always specify the stakeholder group;
- the participants feedback on the concerns and challenges identified in the T4.1 interviews;
- any other relevant observations.

A summary concluding paragraph with a couple of points that you wish to highlight about concerns and challenges.

### **3.4 Solutions**

Describe

- the identified most urgent issues to be solved and the respective solutions, recommendations and good practices, always specify the stakeholder group;
- any other relevant observations.

A summary concluding paragraph with a couple of points that you wish to highlight about the most urgent issues selected and proposed solutions.

#### **4. Participants' feedback**

Present any relevant participants' feedback (for instance, about the organisation, the topic etc) if there was some.

#### **5. Conclusions**

4-6 key highlights from the discussion

### **Annex**

Add any other information that you find relevant