The Contribution of Benchmarking Tools to Increasing Transparency in Agricultural Data Sharing in Value Chains and Farmer's Trust

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Abstract— **The digitalization of agriculture through the proliferation of Information Technology (IT) capabilities has generated exponential growth in data. In this context, agriculture generates a large amount of data, but its potential often remains unexplored. The reasons are identified in technical interoperability, commercial relationships between stakeholders and social acceptability issues related to data ownership and market transparency. However, a lack of experience in managing data or adopting data-driven services can limit the opportunities arising from digital transformation. This study shows how the development of benchmarking tools serves as a support to promote greater trust in sharing data by farmers who should be informed about the purpose of the survey they are invited to participate in, and to ensure the success of the surveys.**

Keywords-agricultural data sharing; interoperability; farmer's trust.

I. INTRODUCTION

This study investigates the use of benchmarking tools to help increase farmers' confidence in sharing agricultural data. The digitalization of agriculture has generated exponential growth in agricultural data. Although data sources in agriculture and software for their analysis and valorization are growing, there still seems to be a lack of true interoperability between systems that allows for adequate exploration. In the institutional context, the European Commission has stressed in several documents the need to facilitate and strengthen the agricultural data sharing and optimise their use for better policies design [1][2][3]. The increase in connected devices during daily operations has led farmers to become more digitalized and more aware of the potential benefits of digital technologies for their business and related data sharing scenarios.

Although datasets are useful for analysis at individual stages of the supply chain, they also have significant potential for widespread use if they are made interoperable.

The valorisation and use of agricultural data implies that the owners of the data also agree with their sharing. However, the willingness to share by data owners is low and it is precisely this lack of sharing and its acceptance that is the biggest obstacle. Therefore, despite a rigorous set of rules, cultural barriers and security concerns remain, which slow down the exploitation and sharing of data. This reduces the actual value that data can play for the for the European Union (EU)'s agricultural competitiveness. The nature of agricultural data is highly specific, but very diverse, and the economic value it generates both for farmers and the entire value chain requires that the necessary safeguards be established. Due to these features, it is difficult to monitor who is authorized to share data and which data is shared. Furthermore, it is known that transparency is necessary to consolidate farmers' trust regarding data sharing. The lack of transparency and clarity on issues such as data ownership, portability, privacy, trust and accountability in the business relationships that govern smart agriculture are contributing to farmers' reluctance to engage in widespread sharing of agricultural data. At the heart of the concerns is a lack of trust among farmers as data providers and third parties, regarding unauthorized access, collection and sharing of their data with third parties by agricultural technology providers. Additionally, ambiguity in agreements and legal frameworks on data collection, processing and sharing can lead to practical uncertainties regarding data privacy. A major concern is transparency and distributional concerns about who in the value chain will benefit from accessing and using "*farmer data*." These concerns create skepticism about their potential use among stakeholders and particularly farmers [4]. This paper is structured as follows. The first Section shows the introduction; in Section II, we present the methodology of our approach. Section III discusses our results and we conclude the discussion in Section IV.

II. METHODOLOGY

Our study presents a benchmarking model implemented with data provided by farmers. We intend to contribute to increasing farmers' trust by demonstrating that sharing agricultural data can provide them with valid support for farm management. The tool was developed within the DIVINE project (DemonstratIng Value of agri data sharIng for boostiNg data Economy in agriculture) [6] that aims at building an Agricultural Data Space Ecosystem or sharing and analyzing agricultural data, funded by the European Union through the Horizone Europe program. To proceed with the construction of a benchmarking system, we identified the useful indicators, based on several studies available in the literature about the topic of Key Performace Indicators (KPIs). According to Bodini et al. [5], important sources of data which are currently of potential use for benchmarking in agriculture include: i) accountancy data (e.g. Farm Accountancy Data Network (FADN) or other accountancy data); ii) official statistics data (e.g. Farm Structure Surveys, Economic accounts for agriculture); iii) specific administrative registers (e.g. animal traceability databases, land use and ownership databases, producer and subsidies registers, animal veterinary drug use registers); iv) industry supply/processor databases; v) technical data inputted by primary producers directly or collected by specialist bodies; vi) machine/sensor-derived data.

Following this approach, our benchmarking tool has been developed by the implementation of a set of DIVINE compliant components that can be demonstrated in the pilot activities, based on available data.

III. RESULTS

As a result of the analysis of pilot requirements, three types of benchmarking were selected to be applied to the specific components:

− Generic Farm Comparison: a generic tool usable by all farms with a minimum set of requested inputs, that allows each farm to know its performance over the years. The component will provide, to each farm, a set of basic indicators to be used to get a general benchmark of the farm activities. The system should be connected to the FADN or other farm-level data sources and will be able to provide each farm with an estimated reference of the farm performance indicators. From the farm's general structure, a set of general indicators (European regions, dimension, surface by crops, composition of livestock) will be defined.

− Farm Group Benchmarking: a tool usable by a single farm to compare its results with those of a group of similar farms in terms of type of farming, location area, economic size, etc.

− Top Farms Benchmarking: a tool helping farmers evaluate their performance in comparison with a group of farms that realized the best performance in the considered. The benchmarking tool use the Agricultural Interoperability Spaces (AIS) [7] to access the farm data in a standard format. When a user accesses the benchmarking tool, the general interface of the benchmarking system will clearly explain the required data and each farmer will have control of their data. It will be possible to define which data to send to the benchmarking component and if the user agrees that the resulting indicators will be available. The indicator can be used anonymously, to calculate a set of reference values to be used for benchmarking. Our results, i.e. the development of our benchmarking tool, aim to fill the lack of concrete examples of how data sharing in the agri-food sector can be useful for the analysis of economic performances. Although some attempts have been made to encourage interoperability, there are still important challenges to address. The sharing of this data between supply chain actors and interested parties therefore requires greater depth if we want to introduce greater efficiencies and further added value to the agricultural data economy.

IV. CONCLUSIONS

Our research study intends to offer a contribute to show the cost and benefit and added value of sharing agri-data to support policy makers, technology providers, farm representatives and other agri-data stakeholder.

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