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Understanding the farmer's technology needs and requirements from DEMETER: The Farmer & Software Provider Viewpoint

MAY 2021

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1 INTRODUCTION

DEMETER is a Horizon 2020 project which aims to build an interoperable, data-driven, innovative, and sustainable European agri-food sector. The project's objective is to lead the digital transformation of the sector through the rapid adoption of advanced Internet of Things (IoT) technologies, data science and smart farming, ensuring its resilience and sustainability.

Twenty real-world pilot projects, grouped into five pilot clusters, are running within DEMETER to demonstrate and evaluate how agricultural innovations and extended capabilities benefit farmers, technology providers, and society. The topics, scope and size of the pilots are diverse, from saving resources, such as water and energy, to a more environmentally compatible crop management with reduced application of fertilisers and pesticides, to improved animal welfare and the tracing of complete supply chains.

DEMETER uses a multi actor approach (MAA) focusing on real problems or opportunities that farmers, and other end-users who need a solution are facing. Listening to farmers' needs, interests and concerns is an essential process to ensure that DEMETER's final solutions address real challenges. To understand these needs and concerns, a survey was conducted in February 2021 with farmers participating in DEMETER. A full report on the results is available [here](#). While quantitative data is useful in providing consensus regarding the most pressing problems and issues, farmers' decisions are a complex process influenced by several social, cultural, demographic, and financial factors. Therefore, a qualitative approach is also needed to better understand how the farmer is feeling and their subsequent behaviour. Consequently, a series of interviews was conducted with farmers participating in DEMETER with the aim of learning more about their on-farm experiences, their technological needs and concerns and how DEMETER can help to overcome these issues. In addition, interviews were also carried out with software providers involved in DEMETER who work closely with farmers to understand their viewpoint. This white paper aims to provide an overview of the findings from the series of interviews conducted.

2   Methodology

Seven interviews were conducted over Zoom with farmers and software providers from Spain, Germany, UK, Greece, Norway and Serbia to ensure that a diverse range of stakeholders views were collected. Farmers represented the dairy sector and fruit and vegetable production, while the software providers involved had technological solutions available for such farming sectors. An interview guide was created that outlined a list of topics to be discussed. However, the interviews were unstructured allowing the respondents to talk freely about their own experiences and thoughts.

3   Findings

Following analysis of each interview, several themes arose regarding the reasons why farmers adopt technology and the issues they face during the adoption process. Each of these themes is explored in further detail below.

3.1   Why adopt technology on farm?

Regarding the trigger to adopt technology, this was unique to the farmer and farming sector. The main reasons uncovered were increasing productivity, reducing resources, improving sustainability, and addressing workforce issues. Both farmers and software providers agreed that farmers are always looking to improve productivity to achieve a reasonable profit margin but not at the detriment of the land. Indeed, one software provider stated, ' *Farmers are a special bunch, they will tell you that profit is the most important thing, but most of them just want to get by'*.

Farmers are also looking to save costs by reducing their inputs particularly water, nitrogen, and pesticide application. They want to use technology to allow them to continuously measure irrigation and pesticide usage and therefore optimise their inputs and activities. This led onto the topic of sustainability and how as one participant stated, *'We all need to reduce the impact of farming'*. Farmers and software providers also agreed that in many instances there is an over usage of resources and adopting technology can help reduce the use of resources and result in increased sustainability.

Next farmers are often interested in adopting technology to account for changes in the labour workforce. Many farmers who want to increase production consider increasing herd size and increasing yield per cow but try to keep labour force costs consistent. Furthermore, if a key staff member is retiring or moving on, it can be catalyst to consider adopting technology.

3.2   What benefits are there to using smart technologies on farm?

Most of the benefits of adopting technology related to the reason for adoption in terms of increased productivity and cost savings with regard to inputs and labour resources. In addition, farmers and software providers discussed the benefits in terms of helping decision-making. For example, the technology can help to determine the optimal harvest date or sensor technology can help to forecast sickness in cows enabling intervention at an early stage.

3.3   What issues do you face when using smart farming technologies?

Interoperability

Interoperability was cited as a key concern. Both software providers and farmers highlighted that there are different systems in operation that are not interoperable. Farmers discussed the 'lock-in effect' where it is difficult to change provider once they have invested in a solution. This is particularly difficult if there is a problem with the solution, or a change is needed. Even in some cases, the company may exit the market, leaving the farmer with a solution that is no longer supported, cannot be upgraded or integrated with other solutions.

Data Integration & Interpretation

Data integration was a considerable hurdle for farmers, as one participant stated, "*I have to look at six different screens and add up all the information in my head to make sense of the information*". Data is decentralised and the farmer needs to bring it all together when often they lack the time or indeed the data mining skills to do so. Very often, farmers are looking at multiple applications which provide large amounts of data and help is needed to interpret the data. "*Farmers are not technicians*", as raised by one of the participants.

Software providers also highlighted the issue that information does not get integrated with data from other farms. Benchmarking systems can be very helpful to help the farmer determine how their farm compares to others in terms of operations, revenue and costs accrued. Furthermore, the farmer needs to make sure they take the time to ensure that any data that is inputted is of good quality, otherwise any production model created will not be as precise.

Technical Skills

Unsurprisingly, both farmers and software providers outlined how technical skills can be a barrier to technology adoption. Younger farmers are more open to technology and can see the benefits of adopting smart technologies. One farmer declared, "*I had a hard time entering all this by hand*" and therefore recognised that

technology can help to cut out some menial tasks. However, older farmers are not as comfortable using the technology. Training from experts and advisors is needed to encourage adoption across both age cohorts. Software providers also highlighted that farmers often need to see a successful real live example of the technology in operation to encourage them to consider adopting something similar on their farm.

Trust
Trust in the technology was also considered a significant barrier to adoption. First, the software providers highlighted that farmers do not always believe what the technology is telling them. For example, with regard to irrigation, it may tell them to use less water, but the farmer often feels that the amount recommended is far less than what they would consider sufficient. Second, farmers are unsure regarding data privacy and data sharing issues which can deter them from adopting the technology.

Infrastructural developments
Lastly, the lack of infrastructure to facilitate technology adoption was cited as a considerable barrier to adoption.

4   DEMETER addressing the issues

DEMETER understands the importance of the multi actor approach and ensuring that solutions developed are optimal to farmers' needs. Farmers in these interviews have highlighted the importance of co-creation, education and training and improved communication with end-users. DEMETER is addressing this through farmer workshops, interviews and surveys. Farmer-focused content is being created specifically addressing how DEMETER will benefit farmers using a non-technical language. Video testimonials from the farmers in DEMETER also explain how the technology works and the benefits they are seeing following adoption.

DEMETER is also addressing many of the issues which farmers are facing when using smart technologies and ensuring software providers create solutions that account for these challenges. With regard to interoperability and data integration, DEMETER is analysing, adopting, and enhancing existing (and if necessary, introducing new) Information Models in the agri-food sector easing data sharing and interoperability across multiple Internet of Things (IOT) and Farming Management Information Systems (FMIS) and associated technologies. An information model is a "representation of concepts and the relationships,

constraints, rules, and operations to specify data semantics[1] for a chosen domain of discourse". This work is being carried out across the various pilot projects. DEMETER will then use these information models to create a basis for trusted sharing / exposure of data between farmers.

Next, DEMETER is building knowledge exchange mechanisms, delivering an 'Interoperability Space' for the agri-food domain. This involves presenting technologies and data from different vendors, ensuring interoperability, and using a core set of open standards (adopted across all agri-food deployments thereby) coupled with carefully planned security and privacy protection mechanisms (also addressing business confidentiality). Offering solutions based on open standards allows farmers not only to save resources such as water and energy but to choose and combine hardware and software from different providers. This adds a level of long-term investment security.

DEMETER seeks to empower the farmer, as a prosumer, to gain control in the data-food-chain by identifying and demonstrating a series of new IoT-based, data-driven, business models for profit, collaboration, and co-production for farmers and across the value chain, leading to disruptive new value creation models.

Finally, DEMETER will establish a benchmarking mechanism for agriculture solutions and businesses, targeting end-goals in terms of productivity and sustainability performance of farms, services, technologies, and practices based on a set of key performance indicators that are relevant to the farming community.

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[1] Data semantics is the study of the meaning and use of specific pieces of data in computer programming and other areas that employ data

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