A thematic partnership for "Traceability and Big Data" for the EU agri-food value chain: SMARTFOOD

"Scoping Note"

Authors:

Andalusia Region (Spain):

Vice-regional Minister of Agriculture, Fisheries and Rural Development: Ricardo Domínquez García-Baquero

Regional Contact: Judit Anda Ugarte. Technical Counselor Vice-Ministry team (judit.anda@juntadeandalucia.es)

Commission Expert: Alasdair Reid

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1.- Introduction

The importance of and the opportunities and challenges facing the agri-food sector at regional and national level across the European Union (EU), calls for a specific effort to create a prospective vision and coordinated actions that reinforce a sustainable and competitive food chain.

The elaboration of smart specialisation strategies (RIS3) in the EU regions and countries has fostered an 'entrepreneurial discovery process' with business, research and societal stakeholders identifying priority actions to help transform and modernise socio-economic systems. The European Commission's S3 Platform has supported this process and has recognised the potential for inter-regional cooperation based on similar RIS3 priorities. In response, the S3 Platform proposed the creation of thematic platforms including a S3 Platform for Agri-Food.

These initiatives are designed to foster interregional cooperation based on matching smart specialisation priorities

The aim is to create an investment pipeline of mature projects in new growth areas across the EU. The thematic platforms aim to foster the co-creation of solutions through interregional public-private cooperation, including via the integration of Key Enabling Technologies (KET), by analysing complementarities and synergies between regions, sharing knowledge, enhancing mutual learning, etc. In summary, the platform will help to build an ecosystem and foster inter-regional engagement that supports digital innovation and entrepreneurship within European food chains.

It is evident that one of the most important challenges, that could benefit from more co-creation and interregional cooperation, is the incorporation of Big Data and cognitive techniques to improve traceability, from a broad-based perspective that involves all actors at every stage of the food chain. Given the complexity of the food chain, even restricted to the improvement of traceability and the role of "Big Data", requires from an operational viewpoint, to limit the scope and goals, to identify where interregional cooperation can create most value and to focus on them to boost sustainability and efficiency of the agri-food value chain in the EU.

For these reasons, in response to the S3 Platform call to promote interregional cooperation and the creation of thematic partnerships, the Autonomous Region of Andalusia proposed to lead the development of a thematic network oriented towards the "traceability and Big Data". This scoping paper serves as a basis for inviting other European regions to join the platform and actively participate in identifying specific goals and developing collaborative projects. To this end, we propose a number of focus areas that seem important to accompany innovation processes along the food chain and where the possible contribution of inter-regional co-operation is clear.

2.- The application of big data and relevant technologies to the agri-food sector

2.1 The agri-food sector and the shift to a data-driven economy

The agri-food sector is a strategically relevant economic sector for the EU and the European Single Market has been beneficial for the European agri-food sector as well as for consumers. However, the sector faces new challenges and these include the potential that information and communication technologies (ICTs) offer but also the disruptive effects they can have on the current practices and habits of agri-food value chain actors (farmers, food manufacturers, transport, retail and of course consumers). Internet and digital technologies are radically changing the life of European citizens, leading the European Commission to make the creation of a Single digital market a priority. The agri-food sector must take as much advantage as possible of the growth potential of the digital economy.

The European Council conclusions of October 2013, describe the growth potential of the digital economy, and related innovation and services that are rapidly changing. The Council recognised that it is urgent to create a single integrated market in digital and telecommunication matters, bringing benefits to consumers and businesses. Actions required include the creation of a EU framework for

strategic technologies such as big data and cloud computing. As a response, the Commission published a Communication (COM, 2014 442) "Towards a thriving data-driven economy" and the Cloud Initiative Communication (COM, 2016 178). Furthermore, concrete actions are foreseen to advance in secure information systems, interoperability of data, in high performance electronic infrastructures, etc.

In addition, there is a need to take into consideration the Internet of Things (IoT), which represents a step towards the digitalisation of our society and the economy, where objects and things are interconnected through communication networks and give information about their state and their environment. According to a recent study from the European Commission, the market value of the IOT in the EU is expected to exceed a billion Euros in 2020.

The agri-food value chain has characteristics that make it different from value chains in other industries and there is a need for specific types of information and data management systems. The large volume and diverse nature of the data, including both structured and non-structured data, calls for specific integration and management procedures to make the most of the new economic opportunities based on information, data and cognitive technologies.

THE UNIQUENESS OF THE AGRI-FOOD VALUE CHAIN

- Products are perishable and they are directly linked to varied and controlled processes of transformation and accordingly derived data has an additional complexity.
- It is based on natural resources and their sustainability.
- It is made up of "non-accurate" systems affected by multiple factors (market volatility, weather conditions at origin or destination, markets structure, consumption patterns, etc.)
- The capacity to collect and handle data by the actors varies along the value chain and even within a single step there is a low level of coordinated information. This calls for a systemic approach to data along the value chain to foster synergies and share data.
- Consumers are increasingly informed and more demanding and their choices and experience need to be fed-back along the chain.

In the primary production phase, the system is highly dispersed geographically and based on and dependent on natural resources. The monitoring of processes is complex and decisions need to be made based on new digital models using networks of sensors, predictive models based on big data, open data, cloud computing, etc. Data based decisions should support farming from a broad socio-economic perspective including, aspects such as environmental and social sustainability, consumer preferences and experiences as well as international market trendss, etc.

At European level, there are 10.8 million farms (244,500 are located in Andalusia)

In the industrial transformation phase, value added is incorporated into the basic agricultural product which, in some cases, means just the preparation and conditioning for sale, and in others, the transformation into more complex products. The extent to which the industrial process incorporates digital, automation, sensor, etc. technologies is variable and this has to be taken into account in data management systems. The shift towards 'factories of the future' in the food processing stage of the value chain is a key element for the evolution towards a new digital agro-food economy.

At European level there are 290,000 agri-food firms (5,300 are located in Andalusia)

In the phase, transport and distribution are important. The existence of good marketing infrastructures in Europe favours this process from the production regions to the consumer ones. The progresses made regarding enabling technologies, a consumer approach and a production model

more balanced and transparent with the producing sector could be challenges of the new economic model.

At European level there are 500 million consumers and EU agri-food exports to the rest of the world in 2015 amounted to € 11.5 trillion

The EU is a key player on the world food market and EU exports grew by nearly 6.3% per year from 2000-2013, yet the share of world food exports fell from 18% to 16%, as world trade grew faster. With combined imports and exports of €242 billion in 2015, the EU is the world's foremost trader in agri-food products, benefiting producers and consumers within and outside the EU. The increase in international trade and the resulting positive balance for the EU reflect the huge market opportunities that exist for European farmers and the food industry.
Concentration in the food processing industry and retail sectors is higher than in the agricultural sector and endows downstream actors with higher bargaining power. The relative bargaining power leads to trading practices in the food chain that place undue pressure on farmers. This is a reality confirmed by the stakeholders of the High Level Forum for a Better Functioning Food Supply Chain, who acknowledged the existence of unfair practices. Representatives from the entire food chain agreed on a list of principles of good practice in contractual relations, and part of the food chain (the food processing industry and food distributors) has engaged in a voluntary scheme for the implementation of these principles.
In this context, one of the most important challenges for the agri-food chain, that calls for more co-creation and interregional cooperation, is the incorporation of "Big data" and cognitive techniques to improve traceability, broadly defined, considering the different operators and their interactions as well as the different related dimensions.

2.2 Emerging technology areas for Traceability and Big Data in the agri-food value chain

Innovation in the agri-food industry is key for sustaining productivity growth and meet the growing demands for food at global level, while preserving environmental resources and adapting to and mitigating climate change (OECD, 2016). Scientific, technological and farm practice innovation can improve productivity and sustainability of the agri-food sector.

ICTs have multiple applications in the agri-food industry. Data integration improves traceability in the supply chain and reduces information costs. Big data, Cognitive Techonologies and Open Data are increasingly used in the sector, and have the potential to improve farmers' information base and for other players in the chain, allowing them to make better informed decisions assisted or not with cognitive technologies such as machine learning, intelligent connectivity, etc.

There are important distinctions between both concepts. Big Data refers to

> "*large amounts of data produced very quickly by a high number of diverse sources. Data can either be created by people or generated by machines, such as sensors gathering climate information, satellite imagery, digital pictures and videos, purchase transaction records, GPS signals, etc. It covers many sectors, from healthcare to transport and energy*"[1].

In contrast, Open Data can be freely used, modified and shared by anyone. Open refers to cases where

1 See: https://ec.europa.eu/digital-single-market/en/big-data

> "*anyone is free to access, use, modify and share it (*the data*) – subject, at most, to measures that preserve provenance and openness*" (Open Knowledge, 2015)[2].

Open Data covers two different aspects of openness: the data is legally open, which in practice generally means that the data is published under an open licence and that the conditions for re-use are limited to attribution (1); and the data is technically open, meaning that the file is machine readable and non-proprietary where possible (i.e. the data is free to access for everybody, and the file format and its content are not restricted to a particular non-open source software tool).

Two critical impacts have been identified from the use of Big Data in agri-food value chains: improvements in supply chain linkages to enhance efficiency and effectiveness of the food production and distribution industry (1); and improvements in on-farm production practices (2) (Boehlje, 2016). In contrast, the availability of open data can catalyse agri-food value chains by providing all the players with valuable information, resulting in greater overall impact, and strengthening the food and nutrition security of smallholder farmers in particular. Open data is commonly linked to data democratisation, and it often leads to better governance as an indirect benefit of its use (Jellema et al., 2015).

A recent seminar organised by the agricultural European Innovation Partnership (EIP-AGRI) on "*Emerging new data-driven business models in the agri-food sector*"[3], highlighted five type of business models for the sector, inspired from Van't Spijker's (2014) framework for data-driven business models. These are presented in the table below.

Table 1 Data-driven business models for the agri-food sector

Business Model	Description	Examples
Basic data sales	Software is created to help farmers or others to collect data (by manual registration or a relatively simple sensor). Data is in some cases linked to other open data and then information for the decision maker is generated. Usually, the buyer pays for the software or data, either by subscription or by paying up front for the software package or data set. In many cases, the software is sponsored by the government or a research/advisory organisation, and it could be given away for free. The farmer is usually the client of the data-driven business	MILK MONEY online internet-based system to benchmark milk production costs in Italy American Farmers Business Network (FBN) FARMOBILE: data collection tool that centralises growers' agronomic data from multiple systems in one electronic farm record.
Product Innovation	Existing products (often machinery) become much more data-intensive. The hardware or product usually turns into a service. The development of Internet of Things stimulates this type of innovation.	Lely Industries. Dutch company manufacturing milking robots and collecting data on the performance of the individual cows
Commodity swap: data-for-data	Data is exchanged between (for instance) farmers and food manufacturers to increase the service component of the transaction.	UniTip software of the Dutch sugar cooperative Cosum. Farmers can register their field data in the software of the cooperative. They then receive management tips and benchmarking data. The cooperative uses this data to organise its logistics, production planning and its marketing.
Value chain integration	The activities in an existing chain are organised by ICTs in an alternative way, as the availability of	Prescriptive farming. Some of the decision making moves from the

2 This definition has been also adopted by the European Data Portal. See: https://www.europeandataportal.eu/en/providing-data/goldbook/open-data-nutshell

3 See: https://ec.europa.eu/eip/agriculture/en/Seminar_Data_Revolution

Business Model	Description	Examples
	data makes decision making at another point in the chain more efficient.	farm (based on local knowledge or 'green fingers') to software at another level in the value chain.
Value net creation	Platforms that link different groups of clients and support their interaction. Often, there is an element of co-creation: the data of one group triggers activities by the other group and vice versa. In some cases, such platforms have strong network effects (i.e. for users it is attractive to join a platform that other customers have already subscribed to). A market of specialised apps can be created (e.g. like in Facebook), creating an ecosystem of apps.	365Farmnet Akkerweb[4] (by the international cooperative Agrifirm). EU project FISpace (Future Internet Business Collaboration Network) REKO. Direct selling system from producers to consumers. It is based on the use of social media as a market channel. It is embedded in Facebook, where volunteer administrators run closed Facebook groups with producers and consumers. EDI-Circle. Large data hub used for exchanging invoices and several other messages from feed suppliers, dairy companies and the government, to accounting firms and farm management software.

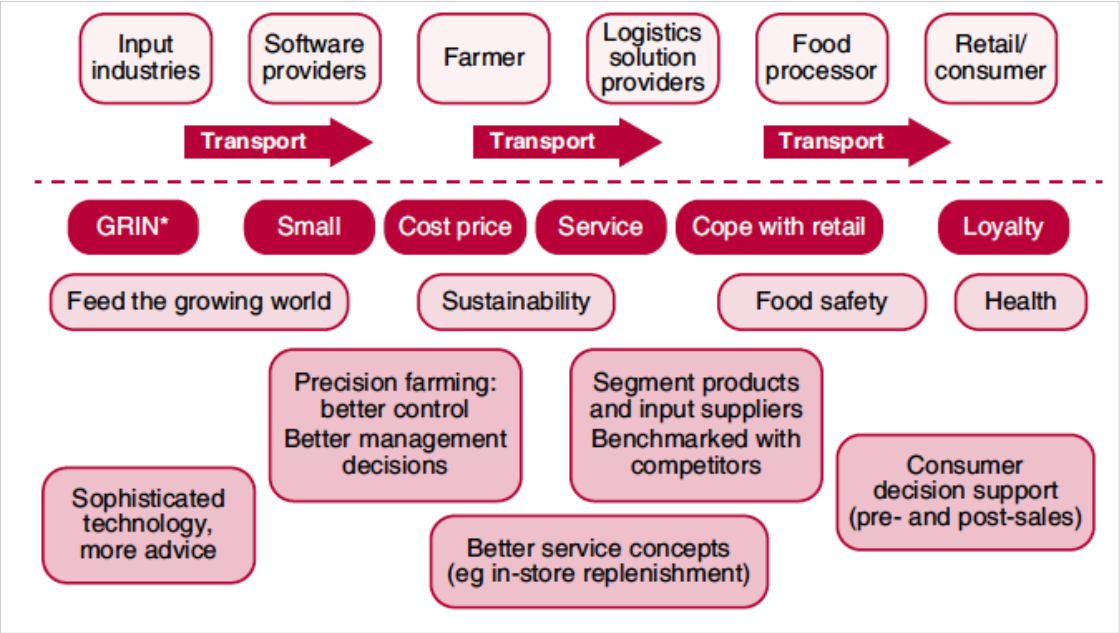
Source: EIP-AGRI, 2016

Data is not information, and as such it does not lead automatically to better decision making by men or machines, especially if it comes from different sensors and other Internet of Things sources. Even if large organisations are mostly digital, between organisations, and specifically between SMEs, data exchange and interoperability is still very poor. More data exchange for collaboration and business process control in the chain is needed (Poppe, 2016). Moreover, agri-food supply chain networks are multi-dimensional, with markets allocating products to different destinations, and supply chains being supported by many service providers.

Figure 1 below summarises the extent that data contributes to the development of new business models and the policy challenges that this addresses along the agri-food chain. Below the dotted line, business challenges are first presented (dark red), followed by societal challenges (light red) along the chain. At the very bottom, an indicative list of data solutions is presented.

4 See (in Dutch): https://akkerweb.nl/

Figure 1 Business and societal challenges and their data solutions in the agri-food chain



Source: Poppe et al., 2013 (EU FP7 Project Smart AgriFood)
**GRIN: Genetic, Robotic, Information and Nanotechnologies*

The use of ICTs and data are changing the agri-food sector. On the side of input industries and farmers, robots and sensor technology are used to automatise agricultural activities, and satellite based positioning systems are used for precision agriculture. At the other side of the agri-food chain, retailers provide product data to consumers on smart phones. Data exchange contributes to alleviating major societal problems like food waste, sustainability and health.

The different actors in the value chain face different challenges and problems. Retailers focus on market share and brand loyalty, and their main worry is to get consumers back into the stores. Loyalty cards provide with more data to the retailer, while smart phones and web shops help the stressed consumer dealing with limited time for shopping. Food processors focus in coping with the power of large retailers. Data from input suppliers, including data on sustainability play an important role in product differentiation. Logistic solution providers that organise transport services along the chain develop new service concepts so that their business partners can concentrate on the core process. Farmers and other agents of the supply chain try to increase the quality and traceability of its products and decrease their cost price, by using more technology, by increasing their size, or both. They are increasingly data intensive and some of them make this data available to food processors for tracing and tracking, while others focus on value added strategies by developing new special products, often for local markets. Finally, Input industries often work worldwide, are R&D intensive and deal with new technologies including Genetics, Robotics, Informatics and Nanotechnology (GRIN).

Societal challenges in the agri-food chain also interact with the above business challenges. Besides the challenge to feed the world, there is the sustainability issue, which is mainly an issue of farming and transport. Food safety is another issue together with the relation between food and health (e.g. obesity concerns) directly impacting food processors, retailers, and consumers.

This conceptual framework was first developed in the context of the EU FP7 project Smart AgriFood, and provides a good initial framework for placing specific technologies and technology areas to prioritise within the S3 platform for traceability and big data.

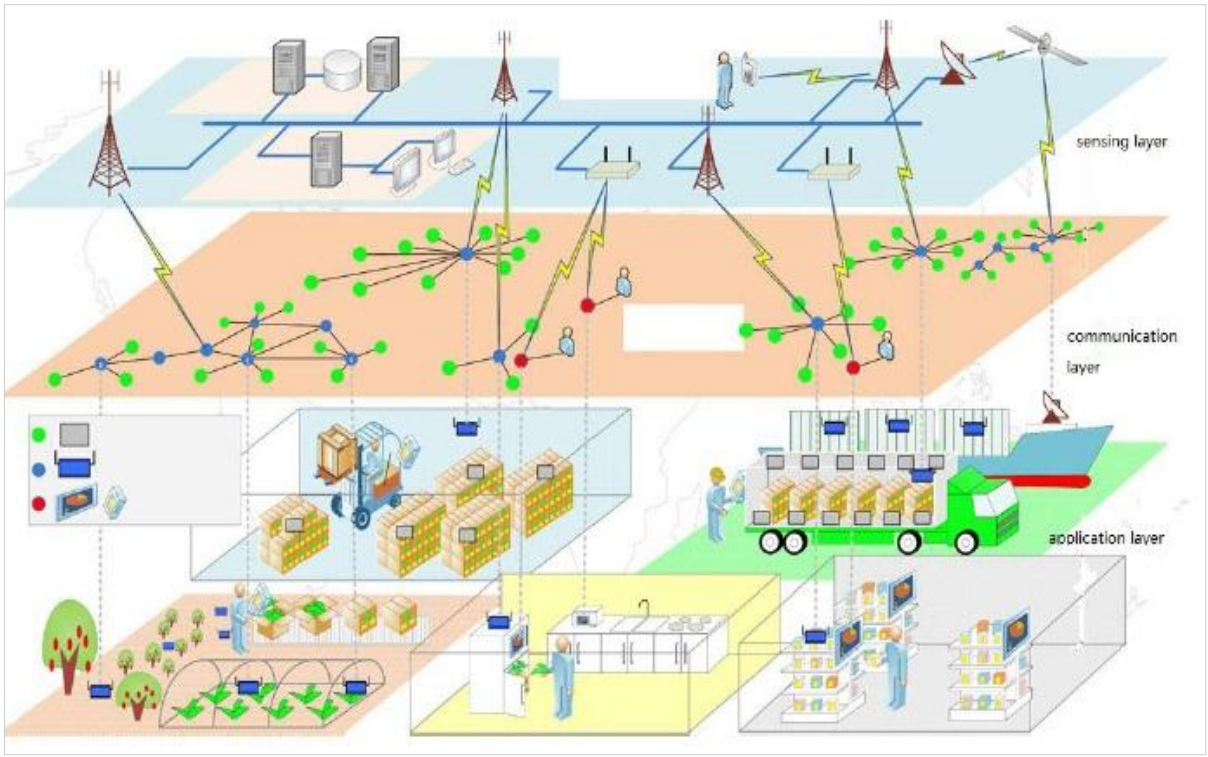
2.3 Technologies supporting traceability and Big Data in the agrifood sector.

The use of Big Data techniques and cognitive technologies are deeply related to the development of different technologies allowing the collection of data from very valuable information sources. Table 2 describes those technologies that used partly or completely, contribute with important amount of data, which represent new opportunities for the agri-food sector.

The rapid development of the Internet of Things (IoT) has given new perspectives for the improvement of food logistics with the emergence of technology applications and food logistics management systems. This applies, in particular, along the cold chain for the manufacture, distribution and sale of perishable and condition-sensitive products. Achieving the objectives of for instance food quality partly relies on physical traceability throughout the chain. Track and trace agriculture applications from the field through the supply chain and in food processing environments can lead to effective identification and traceability in the food supply chain. In March 2015, the European Commission launched the creation of the Alliance for the Internet of Things, where a working group about agriculture and smart food security is participating. Furthermore, the EC has approved an H2020 big scale project in the agri-food sector with 73 partners and 30M Euros budget.

The IoT makes possible cooperation between food producers, logistics and transportation services providers and hospitality and retail companies that can work together to ensure efficient delivery of (safe-r) food. These interactions are visible in the diagram below that illustrates the complexity of food supply chains in the IOT era. Five scenarios can be imagined within this distributed system with large geographical and temporal scale, complex operation processes and diverse technical requirements: Produce, Store, Transport, Sell and Consume.

Figure 2 Food supply chains in the era of the Internet-of-Things



Source: Xiaorong et al., 2015

As an example, this framework, food companies connected to testing equipment can confirm food quality as it leaves the factory or warehouse. Fleet managers can make sure that temperature sensitive, perishable goods do not go bad in transit through sensor enabled refrigeration systems.

Any temperature fluctuations can trigger alerts that auto-correct automatically the truck's refrigeration system and send an alert to the food supplier to replace the bad goods before they reach the customer's dock. Trucking managers can also optimise routing and ensure the on-time delivery of goods. The sensor enabled refrigeration system can also alert the manufacturer, identifying the exact part that broke down and facilitating faster replacement and fixes.

A typical IoT solution comprises a series of field devices (WSN nodes, RFID readers/tags, user interface terminals, etc.) (1); a backbone system (databases, servers, and terminals connected by distributed computer networks, etc.) (2); and a series of heterogeneous wired and wireless communication infrastructures (Wifi, cellular, satellite, power line, Ethernet, etc.) (3). Finally, raw data is extracted and fused into high level and directly usable information for decision support systems (DSS) (4) (Xiaorong et al., 2015).

In general, traceability platforms are comprised of three layers:

- Sensing. Designed to monitor the condition of crops and livestock on farms and in the supply chain with different automatic identification and data capture technologies, based on cost-effectiveness.
- Communication. Allows various stakeholders access supply chain information.
- Applications. Provides functionalities that support applications and services that could be used by farmers, retailers, government, analysts and consumers.

The following table includes a list (non-exhaustive) of technology fields used in traceability and Big Data for the agri-food industry in the era of the IoTs.

Table 2 Illustrative technology fields of Traceability and Big Data for the agri-food industry

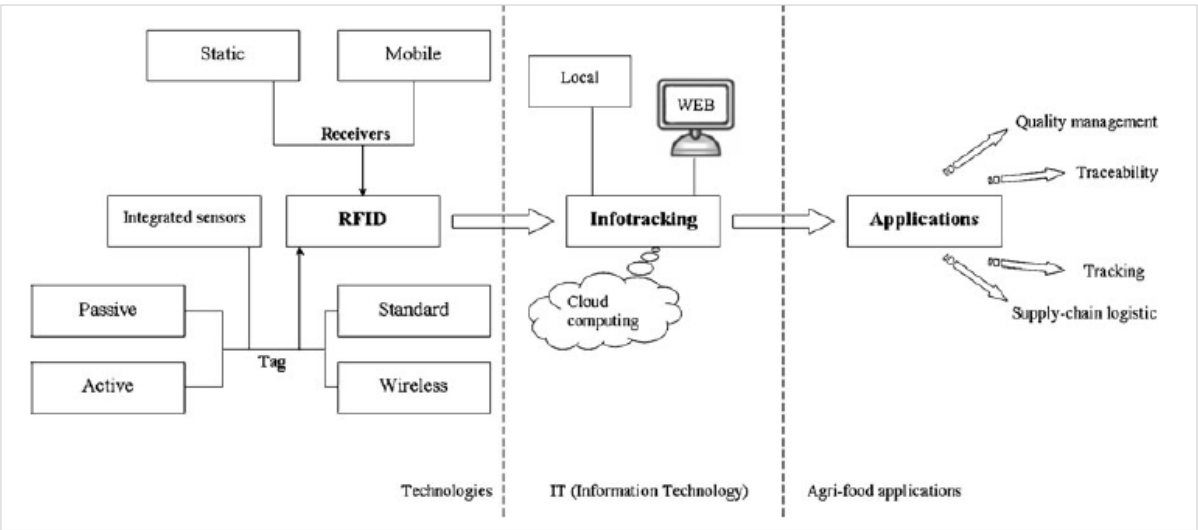
Technology/application area	Specific focus/application	Traceability level of application
Radio Frequency Identification (RFID)	Current applications in the agri-food value chain include automatic toll collection, library management, counterfeit or theft prevention systems, animal traceability and access control systems. Advancements in sensor technology, communication networks and their integration with RFID technology, are expanding the application domain including real time monitoring, quality control, food safety, traceability systems, intelligent transportation and online information systems for end-users.	Sensing Communication
Wireless Sensor Networks (WSN)	Monitoring of perishable goods: temperature monitoring, humidity, carbon dioxide, heavy metals and other environmental conditions in fields, greenhouses and housing for swine and cattle, including perishable during transport.	Sensing
Satellite and remote sensing technologies and devices	Collection, analysis and presentation of data to better understand pre-planting to post-harvest conditions including production through research cycle.	Sensing
Geotraceability, Geo Information and satellite imageries	Combination of geographical information with conventional traceability data. Geographical information related to the environment of the production plots, exploitation of spatial analysis tools existing in geographical information systems (GIS) and development of specific tools such as geoidentifiers and geoindicators. Applications of geotraceability systems in supply chains including consumer warnings in cases of food crises and assistance for certification of differentiated quality agricultural products.	Sensing Communication
Smart tags, quality sensors, sensor enabled Refrigeration	Monitoring of freshness of products through the entire value chain. Production of indicators of	Sensing Communication

Technology/application area	Specific focus/application	Traceability level of application
Systems	product status for both sellers and consumers.	Applications
Drones	Digitisation of agriculture, measurement of plant's biome in real-time, combination of drone information/data with sophisticated data analytics for decision-making on-farm.	Sensing Communication
Genetic, Robotic, Information and Nano technologies (GRIN)	Disruptive technologies applied to the agri-food value chain, such as self-driving tractors, development of medicines based on nano-technologies, monitoring of animals with sensors, weather modification, biorefineries based on synthetic biology, food printing, artificial food	
Block-chain Technology	Systems that record the whole supply chain by utilising the power of a shared secure ledger, smart farming applications for broadcasting tamper-resistant weather data, SMS alerts, machinery protocols, GPS positioning and tethering precision agriculture-related platforms.	Sensing Communication Applications

Source: Authors, based on Kumari et al., 2015 and Poppe, 2016

As an example, igure 3 presents the case of RFID technologies and how these are linked to agri-food applications, which could be further linked to business and societal challenges. Specific product chains for prioritised technologies and technology areas could be developed for the S3 platform focusing on specific agri-food products (e.g. olive oil, fish, milk, etc.).

Figure 3 RFID technological devices, information technology systems and agri-food applications



Source: Costa et al., 2012

2.4 Main pre-identified thematic areas

Andalusia region has developed a regional partnership (see list in Annex 2. Members of the Andalusian partnership "Traceability and Big Data") for "Traceability and Big Data" involving the Regional Administration, businesses, technology and knowledge institutions. The Andalusian partnership has identified specific areas where Traceability and Big Data are particularly interesting for the agri-food sector (table 3). These topics are based on the conclusions from a meeting held in Cordoba on 20th October with the agri-food sector and supporting technological businesses as well as technology and research.

The table below links a long list of possible thematic areas for the SMARTFOOD S3 platform to business and societal challenges and data-driven business models in the agri-food value chain.

Table 3 Linking business models, business and societal challenges and possible thematic areas of the S3 Platform

S3 Platform proposed thematic areas (Córdoba meeting outputs)	Business and Societal Challenges	Business Model
1. Life cycle and production and distribution systems Better measurement of the environmental footprint in the agri-food value chain	Sustainability	Value Chain Integration
2. Market Observatories Predictive models, analysis of market prices at the different stages of the value chain	Cost price Cope with retail	Basic Data Sales
3.1. Integration of sensors and systems for decision support Sensor systems services and its use for improving traceability, new physical and biological sensors, development of software for control and signal processing, dashboards (DSS and BSC)	Cost price Service Cope with retail Sustainability Food Safety Health	Value Chain Integration
3.2. Logistics Improving the efficiency, sustainability and security of the agri-food value chain, and implementing appropriate contingency plans in the event of changes	Cost price Service Cope with retail Sustainability Food Safety Health	Value Chain Integration
3.3. "Smart Food" and agri-business 4.0 Smart agribusinesses that allow producing healthier and safer food with less environmental footprint	Service Cope with retail Loyalty Sustainability Food safety Health	Product innovation Value Chain Integration Value Net Creation
3.4. KETs New materials, nanotechnology, optics, biotechnology, cognitive technologies, robotics, etc. that enable the development of new traceability strategies	GRIN	Product innovation Value Chain Integration Value Net Creation
3.5. Smart Phones and Internet of Things Development of apps and partnership protocols to improve the efficiency of the Internet of Things	Service Loyalty Sustainability Food Safety Health	Basic Data Sales Product Innovation Commodity swap: data-to-data Value Net creation
4. Open Data, interoperability and data governance Metadata and interoperability, standards, clauses of data anonymity, user profiles, protection of sensitive data, updating commitments, etc.	Sustainability Food Safety Health	Basic Data Sales Product innovation Value Chain Integration
5. Consumer Experience Big Data and cognitive techniques, use of high performance computing and supercomputers to incorporate the user experience into decision-making processes along the agri-food chain	Cope with retail Loyalty Food Safety Health	Value Chain Integration Value Net Creation
6. Circular Economy and Food Recycling Increased efficiency and reduction of food waste along the agri-food chain	Sustainability	Value Chain Integration

Source: Authors based on Junta de Andalucía Working Paper from the meeting held at FIMART in Córdoba, 20 October 2016

2.5 Identified regions with RIS3 priorities in Agri-food, Traceability and Big Data

With the objective of identifying other EU regions placing food traceability and big data in the core of their Smart Specialisation Strategies, we have scanned the *Eye@RIS3 tool* of the JRC-IPTS. The table below presents the results of this scanning. A total of 20 EU regions were identified in 10 different Member States. Many of the regions mention explicitly the importance of traceability in the agri-food sector in their regions (e.g. País Vasco, Andalucía, Satakunta, Pays de la Loire, Poitou-Charantes, Slovenia); while all others remain more general on the importance of innovation and the use of new technologies in the agri-food sector, with some cases mentioning smart packaging (Oberösterreich), smart farming (Picardie) and smart agri-food (Veneto) as RIS3 priority areas.

Table 4 EU regions and RIS3 priorities in agri-food, Traceability and Big Data

Region	Description of RIS3 priority area
Oberösterreich (AT31)	Ingredients and modification of food, materials, smart packaging, food quality, quality assurance, food production technologies
Flemish Region (BE2)	High-quality agro-food
País Vasco (ES21)	New Food Production Systems that aim to support and development new technologies and systems for efficient, high quality, sustainable food processing. Integration of ICT technologies in the production, logistics and commercialisation processes in production through automation, food traceability, logistic systems.
Comunidad de Madrid (ES30)	Advanced technologies for the production and characterisation of functional foods, improving food quality and safety
Andalucía (ES61)	Innovation in Agro-Food industry and healthy diet habits - functional and customised food habits. Food quality, traceability of its origin and food safety systems.
Región de Murcia (ES62)	KETs in the agro-food cluster industry
Etelä-Pohjanmaa (FI194)	Food technology and agricultural innovations
Satakunta [FI196]	Food quality, traceability of its origin and food safety systems. New technologies applied to achieve sustainable but efficient Food Systems. Efficient technologies designed for energy efficiency, traceability, quality management, transparency, and risk management in Food Systems.
Picardie (FR22)	Smart farming and agricultural engineering
Alsace (FR42)	Agriculture innovation and environmental impact reduction.
Pays de la Loire (FR51)	Agri-food, bio resources, agriculture, health - nutrition, agro-food of the future, precision agriculture, sustainable agriculture, products traceability
Poitou-Charentes (FR53)	Improving food quality and production process and traceability
Aquitaine (FR61)	Development of available new technologies such as drones, tele-detection, bio-captors for the improvement of a sustainable agricultural production as much as the improvement of the food production chains.
Veneto (ITH3)	Smart Agri-food
Lithuania (LT)	Agricultural innovations and food technologies: sustainable agri-biological resources and safer food; functional food
Swietokrzyskie (PL33)	Modern agriculture and food processing
Wielkopolskie [PL41]	Biomaterials and food for sophisticated consumers: functional food, food safety, modern food processing technologies
Kujawsko-Pomorskie (PL61)	Top quality and safe food
Slovenia (SI)	Sustainable food production; establish an innovative and short supply chains for locally and organically produced foods with a guaranteed and recognised traceability from the field to the table
Northern Ireland (UKN0)	Agri-Food Technology

Source: Eye@RIS3 Tool (http://s3platform.jrc.ec.europa.eu/eye-ris3)

Not surprisingly, several French regions emerged from this mapping exercise as many are populated by a dense network of farmers and agri-businesses. For instance, the region of Alsace has as one of its priorities in the green economy field to "*innovate in agriculture and reduce its environmental impact*". Their focus is on switching to new farming practices, and combining competitive exports with sustainable performance.

The region of Wielkopolskie (PL) focuses on the food industry and agriculture given the importance the sector has in terms of economic activity and employment. This is an area of traditional economic specialisation for the region. Their S3 priority area is on "*food for informed consumers*", including the following themes: safe bioproducts and healthy food (functional food, food safety) (1); modern food production technologies (ICT traceability systems in food production safety, production management, decision support and automation; e-agriculture) (2); innovative methods of sale and

distribution of high-quality food (marketing, innovative food production and distribution chains, food packaging and food design) (3); organic food production and waste management (4); and professionalisation of human resources in the area (5). Among the specific directions for the development of the specialisation area until 2020 are the integration of innovative value chains in food production and distribution; the development of new technologies leading to the development of high-quality food products; the creation, development and implementation of new technologies of production and control of comfortable and organic food products with projected health-promoting functions.

Slovenia is focusing on the market area of functional foods where the market potential is deemed the strongest during the entrepreneurial discovery process and where stakeholders work towards establishing a value chain by taking into account available natural resources. A market analysis referenced for their specialisation process show that 56% of Europeans are trying to improve their health by using proper food and drinks, and that 19% of Europeans use functional foods few times a week, with demand not being strongly related to the already-established brands.

Central Denmark, with its Central Denmark Growth Forum, has made big efforts to develop strong environments and boost the innovation competencies of food companies since 2007. Public and private stakeholders are heavily engaged in supporting the food industry, and the establishment of the *Agro Food Park* and *Future Food Innovation* has played an important role in highlighting the innovation power of the food industry in Central Denmark. A specialisation analysis of the sector supporting the RIS3 process, identified as strongest specialisation areas food analysis and consultancy, processing of dairy products and ingredients, processing of meat, and production of ingredients (Napier and Bjerregaard, 2013). However, the region has given increasing importance to 'hybrid areas' that are at the interface between food and climate, environment and health. Entrepreneurial companies in these areas have emerged, working in the development of IT tools for documenting consumption in fields (LetFarm); development of alternatives to meat products (Soy4you); identification of DNA in animals and plants (GenoScan); development of IT equipment for stables (Bovisoft); development of IT for pig production (Agrosoft); and the development of equipment for measuring the temperature of grains (Webstech). The region is also supported by an ecosystem developing new knowledge and research in the food sector, including Aarhus University (specialised in primary production research, raw material quality and consumer behaviour); the University of Copenhagen (product characteristics and human health); and the Technical University of Denmark (food safety, bioprocesses and aquatic products).

Although none of the Dutch regions emerged from this S3 priority scanning, the Netherlands has a leading position at the world level in agricultural sciences, and has been at the forefront of the smart farming development. The country has focused in the last years in the dual relationship between agriculture and climate change. There are two complementary approaches for agriculture in the Netherlands: including national efforts on climate change targeting the Dutch agro sectors (1); and the need to promote food security and climate smart agriculture (2). In 2014, at the occasion of the UN Climate Summit, the Netherlands launched a global alliance for greater food security through climate-smart agriculture. The Dutch approach is based on intensive cooperation between the private sector, scientific institutes and the government. Through this cooperation method, and in partnership with local farmers, the Netherlands proposed developing innovative and sustainable production methods that are also more resilient to climate change, while reducing CO2 emissions at the same time. The objective of the alliance is to expand and intensify projects carried out by small farmers, horticultural growers (and fishermen), and to continue to guarantee food safety through targeted public-private partnerships. The Wageningen University and Research Centre (WUR) plays a central role in the development of new technologies and innovation for the agri-food sector (see Table 1).

The list of regions presented in Table 4 is an illustration of the prioritisation process and it remains important to dig further not only into their priorities, but also in the capabilities in terms of skills,

technologies and infrastructures that these regions have in the field, with the view of concretising and engaging them in the SMARTFOOD S3 platform.

2.6 Relevant stakeholders: existing networks, R&D centres, research facilities and cluster organisations

A scan has been undertaken of existing networks of stakeholders relevant to the agri-food value chain, with which cooperation links could be built with the view of supporting the work of the SMARTFOOD platform. These are presented in the table below.

Table 5 Global and European networks working in Traceability and Big-open Data for the agro-food industry

Name and Type	Description of expertise/applications developed
ICT-Agri ERANET ERA-NET funded under FP7	ICT-AGRI is funded by the EC's ERA-NET scheme under FP7. The overall goal of ICT-AGRI is to strengthen the European research within the diverse area of precision farming and develop a common European research agenda concerning ICT and robotics in agriculture, and to follow up with calls based on funds from the participating countries' national research programmes. The purpose is to pool fragmented human and financial resources, in order to improve both the efficiency and the effectiveness of Europe's research efforts. ICT-AGRI helps coordinating European research in ICT and robotics and develop a common research agenda based on share priorities. It supports the development and implementation of new technologies for a competitive, sustainable and environmentally friendly agriculture. ICT-AGRI 1 began in May 2009 and ran 65 months until September 2014. The follow-up project ICT-AGRI-2 started in January 2014 and is scheduled to run for 4 years until the end of 2017.
Agricultural European Innovation Partnership (EIP-AGRI) EU-wide Network	Pools expertise and resources by bringing together public and private sectors at EU, national and regional levels, combining supply and demand side measures. Supports cooperation between research and innovation partners so that they are able to achieve better and faster results compared to existing approaches. It works to foster competitive and sustainable farming and forestry that 'achieves more and better from less'. It contributes to ensuring a steady supply of food, feed and biomaterials.
EIP-Agri Focus Groups Groups of experts	The EIP-AGRI Focus Groups are temporary groups of selected experts focusing on a specific subject, sharing knowledge and experience. Each group explores practical innovative solutions to problems or opportunities in the field, and draws on experience derived from related useful projects. Each EIP-AGRI Focus Group meets twice and produces a recommendations and outcomes report. The EIP-AGRI Focus Groups also discuss and document research results, best practices and identify the implications for further research activities that will help to solve practical problems in the sector. These may be related to production, processing, consumption, transport or other issues. There have been 26 EIP-Agri Focus Groups so far[5].
EU's Standing Committee on Agricultural Research (SCAR) EU-wide research committee	SCAR was established in 1974. Since it's re-launched in 2005, SCAR grew to become a respected source of advice on European agricultural and wider bioeconomy research, along with being a major catalyst for the coordination of national research programmes. The Committee plays an important role in coupling research and innovation and in removing barriers to innovation, and aims to make it easier for public-public and public-private sectors to work together in delivering innovation that tackles the challenges faced in the bio-economy area. SCAR currently represents 37 different countries, the members being ministries (or other organisations such as research councils) from all EU Member States, with Candidate and Associated Countries as observers. The Committee was given a revised mandate in 2005, reflecting the significant changes to the agricultural research agenda over the years, and requested to advise the Commission and the Member States on the coordination of agricultural research in Europe.

5 See: https://ec.europa.eu/eip/agriculture/en/content/focus-groups

Name and Type	Description of expertise/applications developed
European Regions for Innovation in Agriculture, Food and Forestry (ERIAFF) network	The ERIAFF network focuses on moving EU regions towards a better coordinated multi-actor co-operation between its regions within the agriculture, food and forestry sectors. The network's main task is to create innovative actions for the growth and sustainability of the sector. There are around 30 EU member regions, and 19 observing regions participating in the actions of the network.
Smart AgriFood FP7-funded research project (smartagrifood.eu)	FP7 funded project in the scope of the Future Internet Public Private Partnership Programme (FI-PPP). The key objective was to elaborate requirements that shall be fulfilled by a "Future Internet" to drastically improve the production and delivery of safe and healthy food. The project focused on three main areas: - Smart Agri-logistics. Data exchange between growers of pot plants, service providers and retail stores (forth and back) leading to intelligent dynamic planning that decreases costs and waste and improves product quality. - Smart Food Awareness. Delivery of data from the food chain to the consumer and matched with the consumer's own shopping profile based on health and sustainability considerations. - Smart Farming. Development of a service oriented architecture that allows the integration and support of a plethora of services that can be developed by any stakeholders. It intends to be a new market place (e.g. like Apple's App store market).
Global Alliance for Climate-Smart Agriculture International network	Launched on 23 September 2014 at the UN Climate Summit by the President of Niger and the Prime Minister of the Netherlands, to improve people's food security and nutrition in the face of climate change.
SmartAgriFood Business Accelerator (smartagrifood.com)	SmartAgriFood is a FIWARE accelerator providing direct funding and support to SMEs, web entrepreneurs and individuals working in Smart Agrimatics to transform innovative ideas into new applications and services. It funds web entrepreneurs and SMEs with new or innovative ideas for applications and services to address the lack of smart ICT tools suited for farm and wider agricultural use. New existing applications should use FIWARE technologies (an innovative, open cloud-based infrastructure for cost-effective creation and delivery of future internet applications and services) and ideally be delivered through the FIspace platform (an integrated collaboration system). €4 million in funding is available for SMEs and web entrepreneurs. Grants of up to €100K are available which are distributed over 3 stages: • Stage 1. Prototype development (Up to €40,000 in EU funding, 100% funded, no matched funding required) • Stage 2. End user trials (Up to €40,000 in EU funding funded at 75%; 25% matched funding required) • Stage 3. Business Development (Up to €20,000 in EU funding funded at 50%; 50% matched funding required).
Global Open Data for Agriculture and Nutrition (GODAN) International initiative/group	GODAN supports the proactive sharing of open data to make information about agriculture and nutrition available, accessible and usable to deal with the urgent challenge of ensuring world food security. It is a rapidly growing group, involving partners from national governments, non-governmental, international and private sector organisations. The initiative focuses on building high-level support among governments, policymakers, international organizations and businesses. It promotes collaboration to harness the growing volume of data generated by new technologies to solve long-standing problems and to benefit farmers and the health of consumers. It encourages collaboration and cooperation between stakeholders in the sector. The initiative was announced at the Open Government Partnership Conference in 2013. Participants made commitments to Open Data for Agriculture at the International Conference on Open Data for Agriculture in Washington D.C.

Annex 3. Examples of national centres of expertise in big and open data for agri-food industry, presents examples of national centres of expertise in the agri-food sector. This list is non-exhaustive and illustrative. Generally, countries and regions that have a strong agricultural sector

have a knowledge ecosystem around them, focusing on their key priority areas. The list of relevant centres can be completed by examining the database of projects held by the ICT-Agri ERANET[6] within ICT and robotics for agriculture. A keyword search using the term 'big data' gave a total of 53 hits for projects in the field. This database could be mined for specific expertise available in the regions.
Finally, a scan of cluster organisations using the European Cluster Collaboration Platform[7] identified 44 cluster organisations in the food sector. Among them, activities related to traceability are mentioned for the ASINCAR cluster in Asturias, the EcoPlus Cluster in Niederösterreich, the FEDACOVA Cluster of the Comunidad Valenciana, and the Food Processing Initiative in Detmold (DE). A full list of the cluster organisations identified can be found in Annex 4. Cluster organisations in the Food Processing and Manufacturing Sectoral Industries of the European Cluster Collaboration Platform.

3.- Proposed objectives and topics for the S3 thematic partnership traceability and big data for the agri-food chain

3.1.- Proposed objectives

The thematic partnership aims at encouraging, motivating and facilitating the incorporation of necessary digital technologies and data application in agri-food sector value chains[8]. The specific objectives of the application of Traceability in the value chain are:

- Improving the competitiveness, resilience and sustainability of the agrifood sector.
- Achieving a transparent, collaborative and balanced agrifood value chain and promoting an economy of shared value.
- Accelerating adoption of ICT, improved data management and interoperability in the agrifood sector
- Fostering exponential innovation in all stages of the agrifood value chain
- Developing new business models and market opportunities, including but not limited to quality job creation.
- Establishing creative designs for decision-making based on data management and the creation of decision support systems and ecosystems
- Ensuring the inclusive governance of data and knowledge flows
- Improving the synergies between public institutions, knowledge agents, civil society entities, farmers and companies.
- Sharing best practices and developing standards and benchmarking in relation to agrifood value chain developments based on the digital economy.
- Promoting cooperation between different disciplines and areas, as well as between regions taking advantage of common interests and market opportunity niches.
- Promoting the incorporation of the agrifood secto into ICTs and the digital economy.
- Facilitating the development of the economy linked to "open data" and learning and support for the same.
- Improving coherence and strategic alliance with the objectives of the Commission on the strategy for smart, sustainable and inclusive growth.

6 See: http://www.ict-agri.eu/node/36495

7 See: http://www.clustercollaboration.eu/cluster-list?combine=&sector_id=18

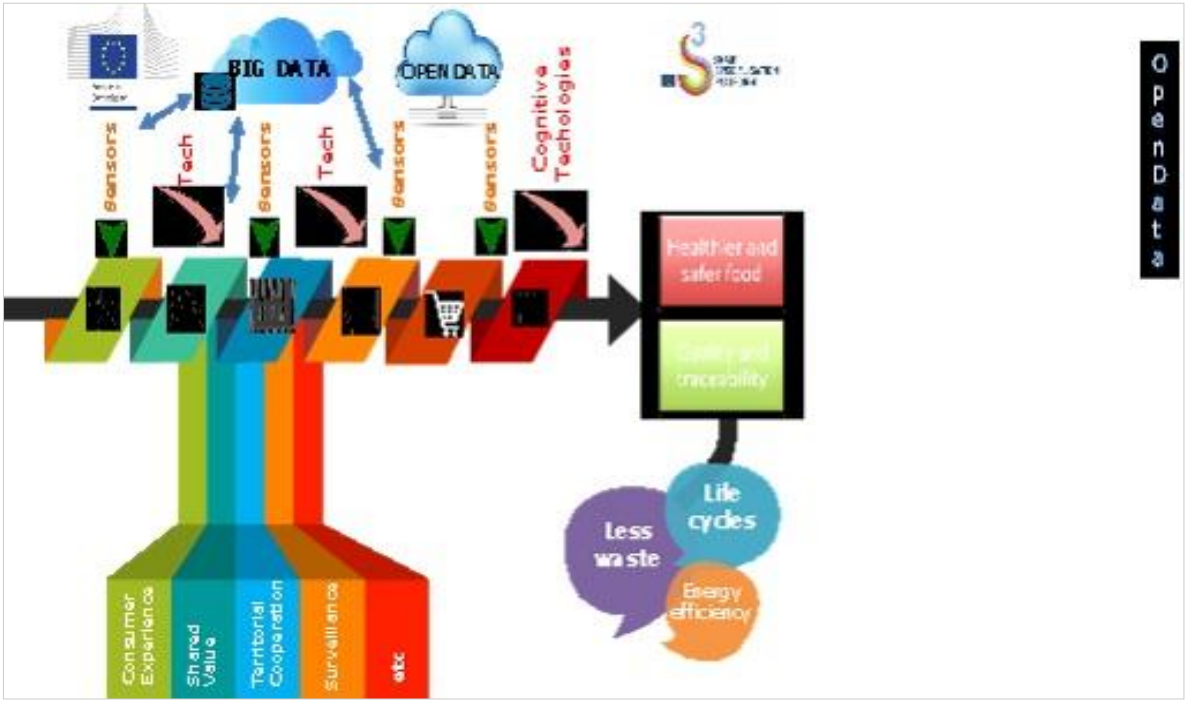
8 The information economy has been also called the "fourth industrial revolution" based on digital data, computing and automation as the key engines of the economy.

3.2.- Proposed thematic topics

To focus and to foster a rich debate in which the proposals of the interested regions can be integrated in the project a work programme will be built around a number of specific topics. To develop each topic, it is suggested to start from a common foundation based on the overall opportunities for the agri-food sector:

- More complete and trusted information available to consumers.
- Smart information systems for companies and the public administration.
- Territorial cooperation as basis for the transfer of technology and research outcomes, experiences, research staff and between companies, in those regions that are interested in this topic.
- The shared value that will generate added value in all stages of the chain that will have an impact on the rest of phases and in society and the territories at large.
- Improvement of business competitiveness, resilience and sustainability and creation of new businesses.

Figure 4 Conceptual scheme of the Traceability and Big Data proposal of Andalusia



It is suggested that the activities focus on key innovation processes of the food chain where inter-regional cooperation can be most beneficial. Three specific and one cross-cutting topics are proposed:

a) Specific topic 1. Traceability and Big Data in the "Lifecycles of the value chain"
b) Specific topic 2. Traceability and Big Data in the "Smart monitoring of the value chain (agricultural production, agri-food industry, logistics, distribution and consumers) to improve the overall competitiveness of the agri-food sector"
c) Specific topic 3. Traceability and Big Data to "incorporate consumer experience and the different operators in the food chain in decision-making processes"
d) Cross-cutting topic 1. Open data, interoperability, data governance and information security, cyber security.

<u>Topic 1. Traceability and Big Data in the "Lifecycles of the value chain"</u>

The environmental dimension of production, distribution and food recycling is becoming increasingly important and the lifecycles concept is a mandatory reference that is being adopted by many production and distribution systems. Improved knowledge of carbon, water and environmental footprints is essential to assess the efficiency, sustainability and competitiveness of a value chain. Moreover, these criteria represent a very important aspect of traceability and such information is increasingly requested by consumers.

A sufficient and comprehensive quantification of the environmental footprint of a value chain requires a major effort and the use of tools which enable the mass treatment of structured and non-structured information, such as big data and cognitive techniques.

To this end, it is important to make the most of the opportunity offered by the application of big data and cognitive techniques to continue making progresses in line with the European Commission communication (COM (2013), 196) "creation of a single market for organic products - Improving information on the environmental behaviour of the products and organisations."

Topic 2. Traceability and Big Data in the "Smart monitoring of the value chain (production, agri-food industry, logistics, distribution and consumers) to improve agri-food sector competitiveness

Big data and cognitive technologies provide a basis for the development of smart monitoring systems that can enhance the traceability of products and processes. They also provide a basis for new predictive models that improve business intelligence and the capacity of respond and decision making Smart monitoring applications improve the **traceability, transparency in the value chain and fighting food fraud and unfair competition.** However, there is a need to analyse the state of the art and establish guidelines to accompany the innovation processes in the food chain that foster progress in smart monitoring systems. These areas include:

- The incorporation of intelligent tools into the agro-industrial sector (smart food, industries 4.0.) that make use big data is an opportunity to produce in a healthier, safer and more traceable way.
- The use of sensor technologies that enable the use of safer, robust, more versatile, sensitive, effective and especially cheaper systems, the development of software for control and the treatment of the signal and its incorporation into decision-making support systems and dashboards (DSS and BSC). Moreover, other technologies based on new materials, nanotechnologies, optics, biotechnology, robotics, etc., among others, are key to boost the economy of data from the traceability point of view.
- The development of logistics is a fundamental aspect in the agri-food value chain. There are numerous factors which influence the "perfect delivery" and, information technologies are key to a professional, timely and documented delivery of products in perfect conditions.

Topic 3. Traceability and Big Data in "Incorporating the experiences of the consumers and of the different operators of the food chain in decision-making processes"

One of the most important drivers of innovation processes is the integration of the consumer experience in different decision and operation centres in a systematic way and in "real time"[9]. It is a very relevant aspect for the food chain but it is necessary to consider the magnitude of the challenge and, particularly, the huge amount and variety of data necessary, both structured and non-structured, and the procedures to generate useful information and identify relevant patterns that are not evident. The use of "big data" and cognitive techniques, even with the predictable advances in supercomputers and high-performance computing, is a commitment for the future and can be of great help. However, to make the challenge come true, it will require a major change of culture towards the shared digital economy and an important effort of interregional cooperation.

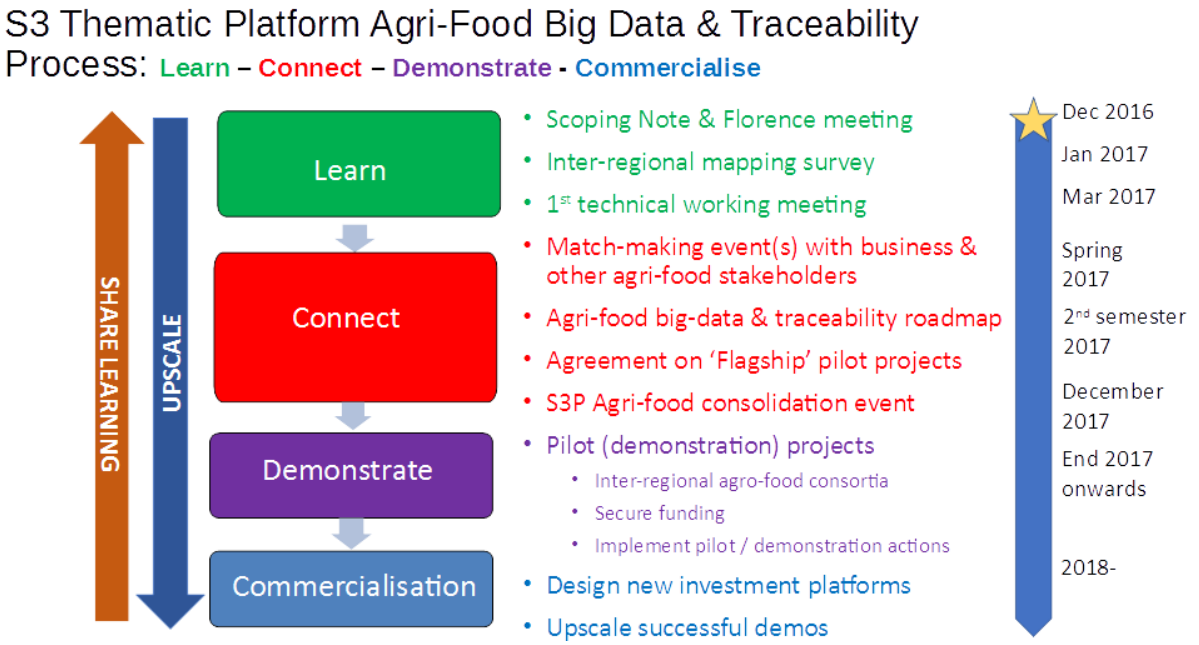
9 http://ec.europa.eu/growth/industry/innovation/business-innovation-observatory_es

Cross-cutting Topic 1. Open data, interoperability, data governance and information security, cyber security.

The application of big data in the agri-food sector involves adapting the pattern of communications of information security. Without appropriate security, interoperability and open data development frameworks, the fourth industrial revolution will not be applicable to the sector.
The features of the data available, quantity, quality, update, formats, metadata, restrictions of use, property, etc., are key aspects for improving traceability and the agri-food value chain. An efficient use usually requires that different features, different origins and property of data are treated in a different way. In the agri-food chain, public and private data, with very different features, coexist. However, metadata attributes (information of information) and interoperability are mandatory. In the case of the EU and of public data, the EU Directive 2003/98CE (Open Data) underlines the need to create conditions that favour the development of digital services that cover the whole EU and a wide possibility of re-use of public data. This will substantially improve the performance of public institutions and private companies, will ensure that the conditions for re-use of public sector documents are clear and are available to the public, as a precondition for the development of a market of information which will cover the whole European Community. Despite the importance and usefulness of this initiative, the application of the directive in the Member States has been limited and uneven. However, It is likely that trend towards "open data" (http://opendatabarometer.org) will become an increasing reality acosss the EU, although it is important to develop, at the same time, associated methods. In the case of private data, there is also a growing trend to improve metadata, interoperability and share and use open data and therefore, open innovation and, in general, the "sharing economy" are key drivers.
To support and accompany innovation by public institutions and private stakeholders in the framework of inter-regional cooperation, there is a need for data governance strategies, particularly concerning traceability in the agri-food supply chain, by establishing relationships and agreements, standards, data anonymity clauses, user profiles, processing of sensitive data, commitment, property, etc. In a nutshell, designing and implementing data governance is necessary.
These topics was discussed and agreed in a plenary session during the S3P Agrifood kick off meeting in Florence (Italy) the last December 2016 (see Annex 5. Summary of the workshop proceedings 7 December 2016, Florence, to know more about conclusions of the Traceability and Big Data workshop).
Also, next steps for the thematic partnership were exposed and agreed as follow.

4.- Next steps

In line with previous thematic smart specialisation platforms, it is proposed to follow a four step process in designing and developing the thematic platforms for agri-food traceability and big data.
The pilot process is summarised in the diagram below.



Based on the scoping note, the aim of the discussions during the Florence meeting was to establish the interest of between 8-12 regions to work together on the broad theme of traceability and big data. To further develop the partnership, a first mapping survey has been designed (see Annex 6. SMARTFOOD Regional questionnaire), which we have proposed to ask each interested region to complete by end February 2017. The survey should ideally be completed by at least one policy expert and one 'technical' agrI-food/big data/traceability expert per region. Another option is to organise a regional workshop, similar to what was organised by the Andalusia partnership and complete the survey questionnaire based on the discussions with relevant stakeholders.

The survey results will be used to further map the potential complementarities and priorities of the interested regions and will be integrated in a second version of the scoping note that we propose to discuss during a first technical workshop to be held in Andalusia by 28th and 29th March 2017 to which all interested regions will be invited. This workshop will agree on a final definition of the priority topics to be addressed by the inter-regional partnership. A final report of the "Learning" phase will then be circulated including a detailed work-plan for the period 2017-2018.

During the connect phase, it is proposed to organise several match-making events during which the partnership can further develop the analysis of needs and opportunities for cooperation in each topic area. The match-making events can be organised in and by the partner regions and will ideally bring together the 'quadruple helix' of actors involved at different stages in the food value chain. The aim is to develop an agrI-food chain roadmap of actions required to enhance the use of data for traceability applications that will identify between 4-6 flagship pilot or demonstration actions to be implemented at inter-regional level by end 2017 at the latest.

This phase will also include a task to explore the possibilities to build strategic alliances with others projects and initiatives for traceability and big data.

At the end of this phase (December 2017), it is proposed to organise a consolidation event of the S3 Agrifood Platform in Seville.

During the demonstrate phase, these 'flagship' actions will then be further defined including the composition of the consortia partners, identifying funding sources (public-private, national/regional/EU) and then implemented. The results of the demonstration and pilot actions will feed back into the road-mapping process and will also serve to inform the possible development of a

joint 'investment platform' or other novel forms of financing for upscaling and full application of the solutions tested in regional, national and European agri-food value chains.

5.- Annexes

Annex 1. Entities/Regions interested in the thematic partnership to date

COUNTRY	REGION	ENTITY	KIND OF ENTITY
FRANCE	PAYS DE LA LOIRE	Región	PUBLIC BODY
GREECE	EPIRO	Logotech	PRIVATE COMPANY
HUNGARY	HAJDU-BIHAR	University of debrecen	UNIVERSITY
HUNGARY	HAJDU-BIHAR	Región Hajdu-Bihar	PUBLIC BODY
HUNGARY	HAJDU-BIHAR	Pharmapolis Innovative Food Cluster	CLUSTER P-P
ITALIA	FRIULI VENEZIA GIULLIA	Amministazione Regionale Friuli Venezia Giulia, Parco Agroalimentare di Sandaniele	CLUSTER P-P
ITALY	BASILICATA	TAB srl.	PRIVATE COMPANY
ITALY	BASILICATA	AgriGO	CLUSTER P-P
ITALY	EMILIA-ROMAGNA	ASTER	CLUSTER P-P
ITALY	EMILIA-ROMAGNA	Emilia-Romagna Region	PUBLIC BODY
ITALY	SARDINIA	*Oficina de la Autoridad de Gestión de la Región de Cerdeña. Centro regionale di programmazione*	PUBLIC BODY
NETHERLANDS	LIMBURG	Provincie Limburg	PUBLIC BODY/DECISSION MAKER
NETHERLANDS	WAGENINGEM	University LEI Wageningen	UNIVERSITY
PORTUGAL	RIBATEJO	ANIMAFORUM-AGROCLUSTER RIBATEJO PORTUGAL	PRIVATE ASSOCIATION
SPAIN	INTERNATIONAL REPRESENTATIVE IN SPAIN	GLOBAL GAP	PRIVATE ASSOCIATION
SPAIN	EXTREMADURA	CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECNOLÓGICAS DE EXTREMADURA (CICYTEX)	PUBLIC BODY

SPAIN	EXTREMADURA	PARQUE CIENTÍFICO Y TECNOLÓGICO DE EXTREMADURA FUNDECYTPOTEX	TECHNOLOGICAL CENTRE
SPAIN	GALICIA	Gradiant	TECHNOLOGICAL CENTRE
SPAIN	GALICIA	Axencia Galega de innovacion	PUBLIC BODY/DECISSION MAKER
SPAIN	MADRID	FIAB (Federación Española de Industrias de Alimentación y Bebidas)	PRIVATE ASSOCIATION
SPAIN	BASQUE COUNTRY	AZTI Centro Tecnológico especializado en innovación marina y alimentaria	PRIVATE COMPANY
SPAIN	BASQUE COUNTRY	Govierno Vasco (Viceconsejería y Dirección de Industrias y Política Alimentaria)	PUBLIC BODY
TURKEY	MIDDLE BLACK SEA	Middle Black Sea Development Agency	PUBLIC BODY/DECISSION MAKER
UK	NORTHERN IRELAND	Agrifood Quest (Queen's University of Belfast)	University
UK	NORTHERN IRELAND	Agrifood and Biosciences Institute (AFBI)	PUBLIC BODY
SPAIN	NAVARRE	Regional Government of navarra	PUBLIC BODY
SPAIN	NAVARRE	INTIA	TECHNOLOGICAL CENTRE
FINLAND	SOUTH SAVO	REGIONAL COUNCIL	PUBLIC BODY
FINLAND	SOUTH SAVO	South-Eastern Finland University of Applied Sciences	UNIVERSITY
FINLAND	SOUTH OSTROBOTHNIA	Regional Council of South Ostrobothnia	PUBLIC BODY
FINLAND	SOUTH OSTROBOTHNIA	Seinäjoki University of Applied Sciences	UNIVERSITY

Annex 2. Members of the Andalusian partnership "Traceability and Big Data" to date

REGION	ENTITY NAME	KIND OF ENTITY
ANDALUCIA	Consejería de Agricultura, Pesca y Desarrollo Rural	PUBLIC BODY

ANDALUCIA	CeiA3	UNIVERSITY
ANDALUCIA	Universidad de Almería (Catedra Coexphal)	UNIVERSITY
ANDALUCIA	IFAPA	RESEARCH PUBLIC BOBY
ANDALUCIA	IDEA	PUBLIC BODY
ANDALUCIA	IFAPA	PUBLIC BODY
ANDALUCIA	Consejería de Empleo, Empresa y Mercado	PUBLIC BODY
ANDALUCIA	Consejería de Economía y Co nocimiento	PUBLIC BODY
ANDALUCIA	Consejería de Salud	PUBLIC BODY
ANDALUCIA	COEXPHAL	PRIVATE ASSOCIATION
ANDALUCIA	CO2 Consulting	PRIVATE COMPANY / agrifood consulting sector
ANDALUCIA	Wellness Telecom	PRIVATE COMPANY
ANDALUCIA	HISPATEC	PRIVATE COMPANY
ANDALUCIA	WENDU WEARABLE SL	PRIVATE COMPANY
ANDALUCIA	ec2ce	PRIVATE COMPANY
ANDALUCIA	Global Olive	PRIVATE COMPANY
ANDALUCIA	Anserlog	PRIVATE COMPANY
ANDALUCIA	TIER 1	PRIVATE COMPANY
ANDALUCIA	FAICO	PRIVATE COMPANY
ANDALUCIA	COVAP	PRIVATE COMPANY
ANDALUCIA	Internet of Things	PRIVATE COMPANY
ANDALUCIA	IBM España	PRIVATE COMPANY
ANDALUCIA	MGS SOFT	PRIVATE COMPANY
ANDALUCIA	UTW	PRIVATE COMPANY
ANDALUCIA	Inventia Agrarica SL	PRIVATE COMPANY
ANDALUCIA	DCOOP	PRIVATE COMPANY
ANDALUCIA	Subafresh	PRIVATE COMPANY
ANDALUCIA	HISPATEC	PRIVATE COMPANY
ANDALUCIA	Wellness Telecom	PRIVATE COMPANY
ANDALUCIA	Bioazul	PRIVATE COMPANY
ANDALUCIA	Aemetic (Grupo de Trabajo Smart Agro)	PRIVATE COMPANIES WORKING GROUP
ANDALUCIA	Asociación de Organizaciones de Productores de Andalucía (APROA)	PRIVATE ASSOCIATION
ANDALUCIA	CTA	PPP (public-private partnership)
ANDALUCIA	CITOLIVA	TECHNOLOGICAL CENTRE
ANDALUCIA	CTAQUA	TECHNOLOGICAL CENTRE
ANDALUCIA	TECNOVA	TECHNOLOGICAL CENTRE
ANDALUCIA	GEOLIT	TECHNOLOGICAL CENTRE
ANDALUCIA	GLOBAL GAP	PRIVATE ASSOCIATION
ANDALUCIA	SERMICRO	PRIVATE COMPANY
ANDALUCIA	MUEVO	PRIVATE COMPANY
ANDALUCIA	BYNSE	PRIVATE COMPANY

Annex 3. Examples of national centres of expertise in big and open data for agri-food industry

Name, type, country	Description of expertise/applications developed
AgriMetrics Centre of Excellence	Independent, not-for-profit centre that is the world's first focusing on Big Data for the whole Agri-food industry. It is one of the four new Centres for Agricultural Innovation established by the UK Government following the 2013 Strategy for Agricultural Technologies. It is the result of a partnership between Rothamsted Research, the University of Reading, the National Institute of Agricultural Botany (NIAB) and Scotland's Rural College (SRUC). It has expertise and capabilities in data science, smart analytics, bioinformatics, translational research and knowledge exchange in crops, livestock and food, and sustainability.
CEIA3 (Andalusia)	The Agrifood Campus of International Excellence ceiA3 is a joint initiative between the universities of Almeria, Cadiz, Huelva and Jaen, headed by the University of Cordoba. These institutions have a long scientific career path, and they put all this knowledge about the agrifood industry at the disposal of society with the main objective of contributing to the development of this sector. Their aim is also to find answers to the agricultural challenges of 21st century. These institutions have a long scientific career path, and they put all this knowledge about the agrifood industry at the disposal of society with the main objective of contributing to the development of this sector, aiming to develop university-centred knowledge clusters, acting as hub of international excellence and contributing to the regional economic development, social cohesion and employment. In order to achieve these objectives, ceiA3 puts at the disposal of society the results of the scientific work of more than 300 research groups, whose works deal with fields of special interest to the food production, international agrifood industry and food chain.
Natural Resources Institute of Finand (LUKE)	The Natural Resources Institute of Finland carries out research on Innovative Food Chains. This theme supports a sustainable, profitable and innovative food chain at every stage. The objective is to produce healthy and sustainably produced food, support a circular economy in the food system and use digital and smart technologies at different stages of the chain. The aim is to achieve an internationally competitive and responsible food chain and wellbeing of consumers.
Lithuanian Institute of Agrarian Economics R&D Centre	The institute has created a platform for farmers and consumers with the aim to provide services reflecting farmers and consumers demand on farmers' product selling/purchase. It serves as a tool that can be used by farmers to have direct contact with communities of consumers that need fresh locally produced food without intermediaries. Communities of consumers use this platform for various purchases of local fresh food directly from farmers creating food baskets according to their needs and frequency.
Smart Systems Unit (University College Dublin)	The Smart Systems Unit (SSU) is based within the UCD School of Biosystems Engineering, and specialises in the application of "smart farming" systems to the agri-food and bioresource industries. Smart Farming encompasses the use of the latest technologies and systems associated with realising the potential of the Internet of Things, coupled with the widespread adoption of smartfones, and the suite of capabilities delivered by them.

Name, type, country	Description of expertise/applications developed
	The SSU has a suite of research programmes addressing the use of sensors, data management and communication systems to optimise the performance and sustainability of agri-food and biomass-to-energy systems. Its portfolio of research projects is broad, including, inter alia, animal biometrics (face and other feature recognition) for animal identification, RFID and data analyses/communication for product chain traceability, hyper-spectral imaging for biological material characterisation, GIS and satellite-based tracking technologies, and smartfone Apps for delivery of real-time information to end-users.
Wageningen University and Research Centre (WUR) and Wageningen Economic Research University and R&D Centre	Wageningen UR dominates the research system in agricultural sciences in the Netherlands ensuring a good integration between fundamental and applied research and between research and education. It consists of a research university with chair groups for academic education and basic research and in total nine specialised research institutes for applied research (DLOs). Institutes like "Plant Research International", "Livestock research", "Imares" (marine ecology and fisheries research), "Rikilt" (food safety) and "LEI" (agricultural economic research) all contribute to the body of knowledge of the Dutch agricultural innovation system. Wageningen Economic Research is an independent and internationally leading socio-economic research institute that offers governments and companies (socio)economic insights and integral advice for sound policies and better decision-making in an innovative way. Within WUR and together with the Centre for Development Innovation (CDI) and the university's Department of Social Sciences (DMW), Wageningen Economic Research is part of the Social Sciences Group. DMW, Wageningen Economic Research and CDI comprise the entire knowledge chain of fundamental scientific research (DMW), applied scientific research (Wageningen Economic Research) and consultancy and capacity building (CDI).

Annex 4. Cluster organisations in the Food Processing and Manufacturing Sectoral Industries of the European Cluster Collaboration Platform

Name	Country	Region	Sector(s)
Agri Sud-Ouest Innovation	France	Midi-Pyrénées	Agricultural Inputs and Services, Food Processing and Manufacturing, Livestock Processing Advanced Packaging, Creative Industries, Logistical Services Agriculture Machinery / Technology, Micro- and Nanotechnology related to agriculture, Food Processing Crop & animal production, hunting &related service activities, Food, beverage & tobacco products, Sustainable agriculture

Name	Country	Region	Sector(s)
AGROFOOD - The Regional Cluster of Food Industry and Products	Romania	Centru	Agricultural Inputs and Services, Education and Knowledge Creation, Food Processing and Manufacturing Advanced Packaging, Digital Industries, Experience Industries Agriculture Machinery / Technology, Micro- and Nanotechnology related to agrofood, Health information management Food, beverage & tobacco products, Public health and well-being, Waste management
AgroTransilvania Cluster	Romania	Nord-Vest	Agricultural Inputs and Services, Education and Knowledge Creation, Food Processing and Manufacturing Advanced Packaging, Environmental Industries, Logistical Services Animal Production / Husbandry, Crop Production, Food Technology Crop & animal production, hunting &related service activities, Sustainable agriculture, Sustainable production & consumption
AINS cluster Nutrition and Health- Asociación empresarial Innvoadora Nutrición y Salud	Spain	Cataluña	Biopharmaceuticals, Food Processing and Manufacturing Bio-pharmaceuticals, Digital Industries, Medical Devices Food Additives/Ingredients/Functional Food, Gene Expression, Proteome Research Food, beverage & tobacco products, Food security & safety, New products or services that meet social needs
AMEC - Association of the Internationalized industrial companies	Spain	Cataluña	Electric Power Generation and Transmission, Food Processing and Manufacturing, Production Technology and Heavy Machinery Advanced Packaging, Digital Industries, Mobility Technologies Food Packaging / Handling, Food Processing, Food Technology Power generation / renewable sources, Machinery & equipment n.e.c., Food security & safety
ANEA	France	Basse-Normandie	Agricultural Inputs and Services, Food Processing and Manufacturing Food Additives/Ingredients/Functional Food, Food Packaging / Handling, Food Processing Crop & animal production, hunting &related service activities, Fishing & aquaculture, Forestry & logging

Name	Country	Region	Sector(s)
Animaforum - Associação para o Desenvolvimento da Agro-Industria	Portugal	Alentejo	Agricultural Inputs and Services, Food Processing and Manufacturing Advanced Packaging, Blue Growth Industries Agriculture Machinery / Technology, Horticulture, Food Technology Food, beverage & tobacco products, New or improved service processes, Scientific research & development
AQUIMER	France	Nord - Pas-de-Calais	Fishing and Fishing Products, Food Processing and Manufacturing Blue Growth Industries Aquaculture, Fish / Fisheries / Fishing Technology, Food Processing Fishing & aquaculture, Food, beverage & tobacco products, Food security & safety
Arctic Smart Rural Community	Finland		Agricultural Inputs and Services, Electric Power Generation and Transmission, Food Processing and Manufacturing Bio-pharmaceuticals, Blue Growth Industries, Experience Industries Animal Production / Husbandry, Food Additives/Ingredients/Functional Food, Food Processing New or improved service processes, Sustainable agriculture, Sustainable energy & renewables
Asociación Clúster Alimentario de Galicia	Spain	Galicia	Food Processing and Manufacturing Advanced Packaging, Blue Growth Industries, Logistical Services Food Additives/Ingredients/Functional Food, Food Processing, Food Technology Food, beverage & tobacco products, Sustainable production & consumption
Asociación de Investigación de Industrias Cárnicas del Principado de Asturias (ASINCAR)	Spain	Principado de Asturias	Education and Knowledge Creation, Food Processing and Manufacturing Advanced Packaging, Bio-pharmaceuticals Food Microbiology / Toxicology / Quality Control, Traceability of food, Food Processing Industrial biotechnology, Food, beverage & tobacco products, Food security & safety
Biobased Delta	Netherlands	Noord-Brabant	Agricultural Inputs and Services, Food Processing and Manufacturing, Upstream Chemical Products Environmental Industries Food Processing, Biobased Materials, Biobased high-performance materials Bio fuels & energy efficiency, Industrial biotechnology, Sustainable agriculture

Name	Country	Region	Sector(s)
Bioeconomy Cluster	Slovakia	Západné Slovensko	Agricultural Inputs and Services, Food Processing and Manufacturing Agriculture Machinery / Technology, Precision agriculture Resource efficiency, Sustainable agriculture, Sustainable land & water use
biomastec	Germany	Stuttgart	Agricultural Inputs and Services, Electric Power Generation and Transmission, Food Processing and Manufacturing Environmental Industries Biogas and anaerobic digestion (AD), Bio-refineries for energy, Biobased materials Power generation / renewable sources, Biotechnology, Waste collection, treatment&disposal activities, materials recovery & remediation activities
BioVale limited	United Kingdom	North Yorkshire	Agricultural Inputs and Services, Food Processing and Manufacturing, Upstream Chemical Products Advanced Packaging, Environmental Industries Precision agriculture, Biobased Materials, Waste to Energy /Resource Bio fuels & energy efficiency, Industrial biotechnology, Sustainable agriculture
C.H.I.CO. Cluster of Health, Innovation and Community	Italy	Lazio	Biopharmaceuticals, Food Processing and Manufacturing, Information Technology and Analytical Instruments Bio-pharmaceuticals, Environmental Industries, Medical Devices Food Additives/Ingredients/Functional Food, Clinical Research, Trials, Applications for Health e-Health (e.g. healthy ageing), Human health activities (medical services), Biotechnology
CAT.AL, High Technology Agrifood Lombardy Cluster (Parco Tecnologico Padano)	Italy	Lombardia	Agricultural Inputs and Services, Biopharmaceuticals, Food Processing and Manufacturing Biotechnology, Food security & safety, Sustainable agriculture
CL.USTER A.GRIFOOD N.AZIONALE - CL.A.N.	Italy	Lazio	Agricultural Inputs and Services, Food Processing and Manufacturing Advanced Packaging, Bio-pharmaceuticals, Environmental Industries Crop & animal production, hunting &related service activities, Food, beverage & tobacco products, Food security & safety

Name	Country	Region	Sector(s)
ecoplus. The Business Agency of Lower Austria, Food Cluster	Austria	Niederösterreich	Agricultural Inputs and Services, Food Processing and Manufacturing Traceability of food, Food Processing, Waste to Energy /Resource Food, beverage & tobacco products, Food security & safety, Resource efficiency
FEDACOVA	Spain	Comunidad Valenciana	Fishing and Fishing Products, Food Processing and Manufacturing Environmental Industries Detection and Analysis methods, Safe production methods, Traceability of food Fishing & aquaculture, Food, beverage & tobacco products, Food security & safety
Flanders' FOOD	Belgium	Flanders	Education and Knowledge Creation, Food Processing and Manufacturing, Information Technology and Analytical Instruments Advanced Packaging, Blue Growth Industries, Digital Industries Food Microbiology / Toxicology / Quality Control, Food Additives/Ingredients/Functional Food, Food Processing e-Health (e.g. healthy ageing), Food security & safety, Sustainable production & consumption
Food Products Quality Cluster	Latvia	Latvija	Fishing and Fishing Products, Food Processing and Manufacturing Blue Growth Industries, Logistical Services Fish / Fisheries / Fishing Technology, Food Processing, Food Technology Fishing & aquaculture, Food, beverage & tobacco products
Food-Processing Initiative e.V.	Germany	Detmold	Food Processing and Manufacturing Traceability of food, Food Processing, Process optimisation, waste heat utilisation Food, beverage & tobacco products, Food security & safety, Resource efficiency
foodRegio	Germany	Schleswig-Holstein	Fishing and Fishing Products, Food Processing and Manufacturing, Paper and Packaging Food Additives/Ingredients/Functional Food, Food Processing, Food Technology Food, beverage & tobacco products
FoodValleyNL	Netherlands	Gelderland	Food Processing and Manufacturing Creative Industries, Digital Industries Food Additives/Ingredients/Functional Food, Food Processing, Food Technology Crop & animal production, hunting &related service activities, Food, beverage & tobacco products, Food security & safety

Name	Country	Region	Sector(s)
Fórum Oceano - Associação da Economia do Mar (Association of Maritime Economy)	Portugal	Norte	Fishing and Fishing Products, Food Processing and Manufacturing, Transportation and Logistics Bio-pharmaceuticals, Blue Growth Industries, Logistical Services Aquaculture, Marine Science, Micro- and Nanotechnology related to marine resources Coastal & maritime tourism, Fisheries, Shipbuilding & ship repair
GlobalGap (Flavio Alzueta, Worldwide Director of Marketing and Communication)			
IAR - The French Bioeconomy Cluster	France	Picardie	Agricultural Inputs and Services, Food Processing and Manufacturing, Upstream Chemical Products Advanced Packaging, Environmental Industries Food Additives/Ingredients/Functional Food, Biobased Materials, Biobased chemical building blocks Bio fuels & energy efficiency, Industrial biotechnology, Food, beverage & tobacco products
IND-AGRO-POL	Romania	Bucureşti - Ilfov	Agricultural Inputs and Services, Education and Knowledge Creation, Food Processing and Manufacturing Advanced Packaging, Environmental Industries, Experience Industries Agriculture Machinery / Technology, Food Processing, Solid biomass Crop & animal production, hunting &related service activities, Food, beverage & tobacco products, Sustainable agriculture
Industrial Transformation Cluster ain	Spain	Comunidad Foral de Navarra	Automotive, Construction Products and Services, Food Processing and Manufacturing Digital Industries, Environmental Industries Food Technology, Construction engineering (design, simulation), Surface treatment (painting, galvano, polishing, CVD, ..) Advanced manufacturing systems, Basic metals & of fabricated metals products, Food, beverage & tobacco products
INNOVACC Associació Catalana d'Innovació del sector carni porcí	Spain	Cataluña	Food Processing and Manufacturing Digital Industries, Environmental Industries Detection and Analysis methods, Food Microbiology / Toxicology / Quality Control, Safe production methods Food, beverage & tobacco products, Machinery & equipment n.e.c.

Name	Country	Region	Sector(s)
Innovative Food Cluster FOOD4GOOD	Poland	Mazowieckie	Business Services, Education and Knowledge Creation, Food Processing and Manufacturing Advanced Packaging, Digital Industries, Experience Industries Food Additives/Ingredients/Functional Food, Food Processing, Food Technology Food, beverage & tobacco products, New products or services that meet social needs, Resource efficiency
LATVIAN HIGH ADDED VALUE AND HEALTHY FOOD CLUSTER	Latvia	Latvija	Food Processing and Manufacturing Advanced Packaging, Environmental Industries, Experience Industries Drink Technology, Food Processing, Food Technology Food, beverage & tobacco products, Food security & safety, Eco-innovations
Nova CHILD	France	Pays de la Loire	Food Processing and Manufacturing, Footwear, Textile Manufacturing Creative Industries, Digital Industries, Experience Industries Safe production methods, Creative products, Creative services New or improved organisational models, New or improved service processes, New products or services that meet social needs
NUTRIBIOMED Klaster	Poland	Dolnośląskie	Biopharmaceuticals, Business Services, Food Processing and Manufacturing Advanced Packaging, Bio-pharmaceuticals, Medical Devices Food Additives/Ingredients/Functional Food, Food Technology, Pharmaceutical Products / Drugs Basic pharmaceutical products & pharmaceutical preparations, Food, beverage & tobacco products, Other professional, scientific & technical activities
Packbridge	Sweden	Sydsverige	Food Processing and Manufacturing, Paper and Packaging, Transportation and Logistics Advanced Packaging, Logistical Services Laminate, Packaging for machines, Packaging for materials Advanced materials, Machinery & equipment n.e.c., Employment activities

Name	Country	Region	Sector(s)
PharmAgora Quality of Life Cluster	Hungary	Közép-Dunántúl	Appliances, Business Services, Food Processing and Manufacturing Medical Devices Food Additives/Ingredients/Functional Food, Health information management, Diagnostics, Diagnosis Food, beverage & tobacco products, Public health and well-being, Scientific research & development
Photonics cluster OPTITEC	France	Provence-Alpes-Côte d'Azur	Aerospace Vehicles and Defense, Food Processing and Manufacturing, Information Technology and Analytical Instruments Advanced Packaging, Bio-pharmaceuticals, Medical Devices Micro- and Nanotechnology related to agrofood, Food Packaging / Handling, Automation, Robotics Control Systems Photonics
SMART food cluster	Lithuania	Lietuva	Food Processing and Manufacturing Advanced Packaging Food Additives/Ingredients/Functional Food, Food Packaging / Handling, Food Processing Food, beverage & tobacco products, Food security & safety
Transylvania Lands Cluster	Romania	Centru	Education and Knowledge Creation, Food Processing and Manufacturing, Hospitality and Tourism Creative Industries, Digital Industries, Environmental Industries Food Packaging / Handling, Cultural Heritage, Sports and Leisure Creative, arts & entertainment activities, Support to link cultural & creative industries to traditional industries, E-Commerce & SMEs online
Upper Austrian Food Cluster	Austria	Oberösterreich	Food Processing and Manufacturing Creative Industries, Environmental Industries, Mobility Technologies Food Packaging / Handling, Food Processing, Food Technology Food, beverage & tobacco products, Food security & safety, Social innovation with regard to health, well-being and elder care

Name	Country	Region	Sector(s)
VALORIAL	France	Bretagne	Food Processing and Manufacturing Advanced Packaging, Creative Industries, Digital Industries Food Microbiology / Toxicology / Quality Control, Food Additives/Ingredients/Functional Food, Food Technology Crop & animal production, hunting &related service activities, Food, beverage & tobacco products, Machinery & equipment n.e.c.
Vitagora	France	Bourgogne	Agricultural Inputs and Services, Biopharmaceuticals, Food Processing and Manufacturing Advanced Packaging, Bio-pharmaceuticals, Digital Industries Precision agriculture, Food Additives/Ingredients/Functional Food, Food Technology e-Health (e.g. healthy ageing), Food, beverage & tobacco products, Sustainable agriculture
Wagralim	Belgium	Wallonia	Agricultural Inputs and Services, Food Processing and Manufacturing Advanced Packaging, Bio-pharmaceuticals, Digital Industries Advanced Packaging, Bio-pharmaceuticals, Digital Industries Food Additives/Ingredients/Functional Food, Food Processing, Food Technology
Water Alliance	Netherlands	Friesland	Environmental Services, Food Processing and Manufacturing, Water Transportation Blue Growth Industries, Digital Industries, Environmental Industries Industrial Water Treatment, Municipal Water Treatment, Wastewater Recycling Biotechnology, Waste collection, treatment&disposal activities, materials recovery & remediation activities, Water collection, treatment & supply

Annex 5. Summary of the workshop proceedings 7 December 2016, Florence

Smart specialisation thematic platform on Agri-Food
Sub-platform on Traceability and Big Data
Lead Region: Andalucía (Spain)

Summary of the workshop proceedings 7 December 2016, Florence (Italy)

Introduction

Scoping Note "Traceability and Big data" **January 25, 2017**

As part the European Commission's S3 Platform's Kick-off event for the thematic platform on Agri-Food10, the Regional Government of Andalucía hosted a parallel session to discuss a scoping paper on the sub-platform for the topic of traceability and big-data in the agri-food chain. The list of participants at the parallel session is appended to this note.

The scoping paper reviewed the state of the art and rational for the platform and proposed four topics on which the platform's future activities could be based. The scoping paper underlined that:

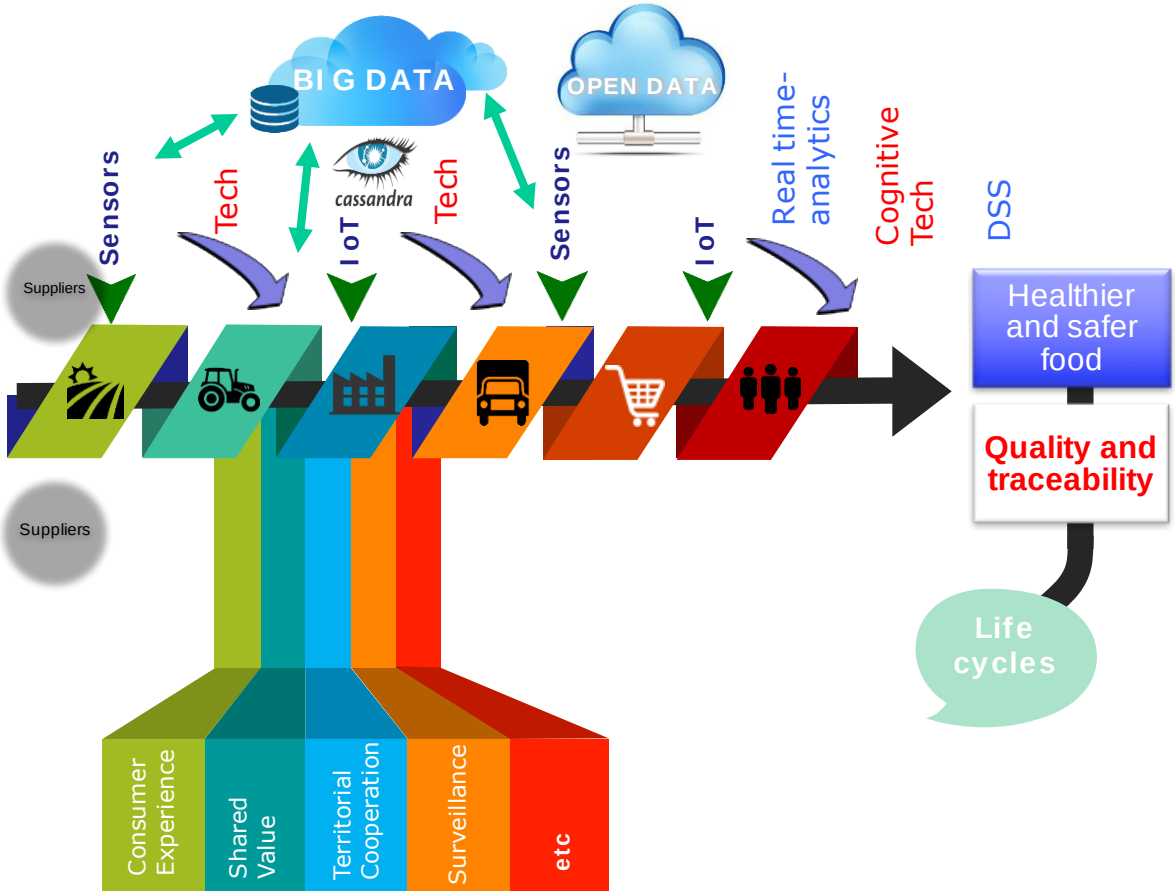
- Agri-food is a key sector for employment and future growth in many regions
- Boosting quality and productivity (value) along the whole food chain is a smart specialisaiton priority for regions across the EU:
- Agri-food innovation should help resolve societal challenges: health and ageing, resource efficiency and climate change mitigation;
- Enhancing food traceability is an identified challenge and 'opportunity' that can be supported applying ICT based systems in food production, safety, processing, decision-making, automation and distribution.

The initial mapping of initiatives in the field of traceability and big data in the agri-food chain underlines that there is a good basis for inter-regional co-operation:

- There are about 50 food related clusters in Europe with a number working specifically in agri-food ICT and data fields. There is therefore, significant scope to link up know-how and expertise in traceability, digital technologies and data-driven business models
- At European level, there are various complementary initiatives working 'upstream' on research and prototyping on key technologies for agri-sector, etc.. These include ERA-NET ICT AGRI 2, European Innovation Partnership (EIP-AGRI), IOT Food, etc.
- The newly approved EIT-KIC on Food will develop a business-research-education platform at pan-European level and is driven by major industry players. A number of the regions interested in joining the platform are involved in the KIC Food and this will help foster synergies.

Compared to these existing initiates, the S3 sub-platform's value proposition or 'unique selling point' (USP) will be: **to develop inter-regional co-operation on the application of data-driven business models to boost the competitiveness of regional agri-food chains.** The intervention logic of the sub-platform is illustrated in the diagram below

[10] http://s3platform.jrc.ec.europa.eu/-/kick-off-event-of-the-smart-specialisation-platform-on-agri-food?inheritRedirect=true



Building on the analysis in the scoping note and the sub-platform model, the four topics proposed for the sub-platform are:

- TOPIC 1. Traceability and Big Data in the lifecycles of the value chain.
- TOPIC 2. Traceability and big Data in the "Smart monitoring of the value chain (production, agri-food industry, logistics, distribution and consumers) aiming to improve the competitiveness in the agri-food sector"
- TOPIC 3. Traceability and Big Data to incorporate the experience of consumers and of different operators in the value chain in decision-making processes
- Cross-cutting Topic: Open data, interoperability, data governance and information security, cyber security.

The objectives of the parallel session were

- To assess the suitability of the proposed topics and/or propose alternative topics, where appropriate.
- To deepen understanding of each thematic area and define concrete work themes to be developed in the sub-platform.
- Identification of and / or proposals for pilot and demonstration actions.
- Detect regional / sectoral barriers to sub-platform development
- Detect regional / sectoral opportunities for sub-platform development
- Next steps to be taken and agreement on proposed work schedule

The session was structured in two parts. The morning session focused on reaching agreement on the thematic topics and was opened by a short presentation (see appendix) by Alasdair Reid (expert appointed by the European Commission) who also moderated the session. The discussion was structured around three key questions and participants were invited to contribute their ideas both during the discussion and by noting their ideas on post-its. The three key questions were:

- What are the key challenges for the adoption of data-driven business models in agri-food value chains?
- In which agri-food sector and/or value chain segment is there the most need or opportunity for inter-regional co-operation on traceability and big data?
- How can inter-regional co-operation build on and complement regional (RIS3) priorities related to agri-food and data-driven innovation ?

During the morning, the participants raised a number of points for consideration in the design and development of the sub-platform, these included:

- The sub-platform's activities should extend across the various food chains including not only agriculturally based foods but also seafoods.
- The relevant technologies supporting traceability extend beyond ICT applications and include 'molecular' traceability (genetics, etc.) and the platform should examine the relevance of data from multiple sources and how this can be used to enhance traceability and add value in the food chain.
- One objective should be to simplify and harmonise data collection processes for all food chain actors but especially producers (farmers, etc.) and small and medium sized food processing firms. Currently these actors are obliged to provide a lot of data to multiple 'registers' and one challenge is to combine existing proprietary and open data to reduce the burden of data provision (e.g. to food safety or environmental agencies, etc.).
- A related point raised was the need to distinguish between mandatory versus voluntary data collection to avoid the cost of collecting data with 'less value'. Data for data's sake should not be an aim and this implies a pre-identification of the types of existing data that can be used and how it adds value to traceability, quality and safety, etc. in the food chain.
- Enhancing consumer confidence in food traceability and food safety (e.g. temperature control during transport of foodstuffs) was raised as a critical element in securing the future competitive position of regional food chains on European and international markets.

The importance of the cross-cutting topic was underlined by many of the points raised during the morning discussion which related to data ownership and a balanced 'playing field' for all actors in the food chain (e.g. the risk that multinational companies like 'John Deere' end up controlling data relating to agricultural production or that supermarkets monopolise data on consumer preferences and trends to increase their 'influence' over the chain).
The afternoon session began with a summary, by Alasdair Reid, of the results of the 'post-its' session. The responses to the first question on the key challenges were largely in line with the morning session discussions and included:

- Improving understanding and developing a framework for data ownership / protection / security as a foundation for new applications;
- Ensuring that all actors in the value chain have access to data and avoid that 'downstream' players accumulate even more power over data.
- Help to overcome cultural and capability barriers to the adoption of data driven models in the agri-food sector, such as traditional thinking, language, consumer psychology, etc.
- Developing data standardisation and inter-operability to encourage and facilitate the exchange and analysis of data along the value chain
- Creating incentives and business models that foster data-sharing.

On the issue of whether the sub-platform should focus on specific food chains or segments of the 'generic' food chain, the participants underlined the need to cover the entire food chain but an emphasis on the two ends of the food chain:

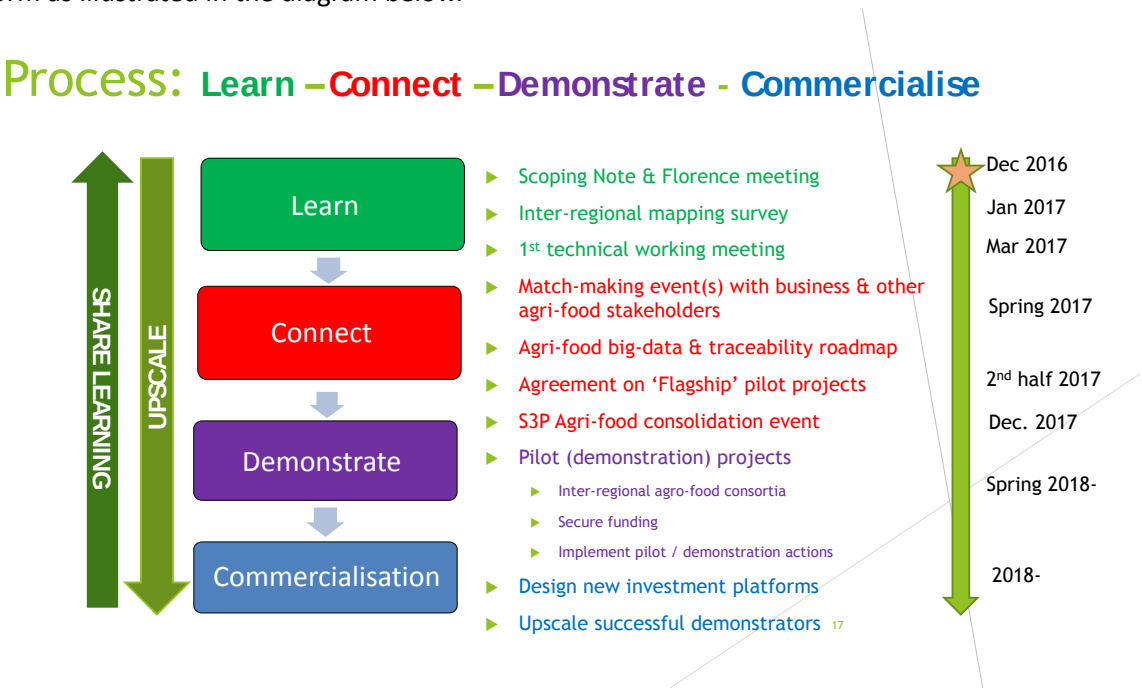
- Farmers to enhance use of data in decision making related to markets, resource use, etc.. Suggestions made included enhancing traceability back to individual farms and ensuring protection of designated origin

- Consumers: incorporating consumer experience data as key part of food chain traceability, improving information on packaging for consumers to respond to consumers' needs and improve awareness on food origin, etc.

It was also suggested to focus on traceability in transport/logistic chains and to help develop synergies between IT companies and food clusters.
The participants identified a number of specific food chains which could be of interest when developing pilot applications, these included: livestock (meat and dairy), fruit and vegetables (perishable products) olive oil and seafoods. The majority view was that the platform should not pre-select specific food chains at this stage and that the applications or pilot projects developed should seek to address the use of data for traceability relevant for all food chains.
On the four proposed topics, broadly speaking these were viewed as providing a good framework for the development of the platform. The feedback from the participants stressed the importance of:

- Creating common standards for sharing data and systems
- Joint testing of new data applications and creating 'demonstration hubs' (e.g. via Internet of things applications).
- Enhancing the quality of information provided to consumers based on improved food traceability.

José Luis Molina (HISPATEC, Spain) then presented a business view of how data-driven business models can be applied to the agri-food chain (see presentation in annex). This sparked a lively discussion on how to further refine the agreed four topics of the sub-platform and develop pilot projects at inter-regional level.
In closing, the discussion turned to the next steps to take with a presentation of the proposed timeline of activities for 2017 as well as identification of regions that could be invited to join the sub-platform as illustrated in the diagram below.



The participants agreed to the proposed timetable of activities and asked for an early confirmation of the data of the next meeting scheduled for March 2017 which will be hosted by the Regional Government of Andalucía. Based on requests from the participants, it was agreed that a guidance note for the mapping survey will be provided including hints on how to organise a consultation with relevant 'food cluster' actors in each region.

Annex 6. SMARTFOOD Regional questionnaire

A Smart Specialisation Platform on Traceability and big data for the EU agri-food value chain: SMART FOOD

This questionnaire will help to further develop the scoping paper for a 'Smart Specialisation Platform on Traceability and big data for the EU agri-food value chain: SMART FOOD. It uses the concepts and definitions of the draft scoping paper and it is recommended to read the paper before completing the survey.

Firstly, to build an evidence base for the development of the SSP Smart Food, the interested regions are invited to contribute to a prioritisation of the priorities and challenges faced in improving traceability through data applications at different steps in the agri-food value chain. It is expected that the you will draw on smart specialisation strategy priorities (&/or those from other relevant strategies such as digital agendas or rural development plans) when providing information.

Secondly, the survey aims to develop an initial mapping of the existing know-how, capabilities, organisations and initiatives in the field in each region. The aim is to ensure that the SSP Smart Food builds on rather than duplicates existing know-how and activities.

Contact for further information:

internacional.viceconsejeria.capder@juntadeandalucia.es

isabel.ruiz.garcia@juntadeandalucia.es

Vice Ministry of Agriculture, Fisheries and Rural Development of the Government of Andalusia's Advisory Team

Judit Anda Ugarte (judit.anda@juntadeandalucia.es)

Esperanza Perea Acosta (esperanza.perea.acosta@juntadeandalucia.es)

Carmen Capote Martín (mcarmen.capote@juntadeandalucia.es)

Section A: Contact information for Region

A1. What is your Region:

A2. What is your Country:

A3. Person(s) responsible

The person who has completed the questionnaire and/or the designated official of the regional authority

A4. Organisation

A5. Type of Organisation

- Government department ☐
- Public agency ☐
- Private Enterprise ☐
- Research organisation ☐
- Other ☐

Other

A6. Email

Section B: Challenges

Please rank the main challenges facing the agro-food sector in your region in relation to traceability and 'big data'?

B1. Challenges

	1 - Not important	2	3	4	5 - Critical
Capacity of farmers, processors, etc. to manage and use data collected via installation of new automations, sensors, etc.	☐	☐	☐	☐	☐
Cost of investment for farmers, food processors or transportation firms in equipment and technologies (sensors, robots, drones, etc.) including data management tools	☐	☐	☐	☐	☐
Improved measurement and control of environmental impact (water usage, soil quality, etc.) both for agro-food organisations and public authorities, etc.	☐	☐	☐	☐	☐
Improve effectiveness of traceability and control (temperature, 'tampering', etc.) of foodstuffs along logistic chains	☐	☐	☐	☐	☐
Capacity for farmers and/or food processors to anticipate or predict market trends including price changes	☐	☐	☐	☐	☐
Methods and tools enabling the analysis or visualisation of existing data from multiple sources (devices in fields, factories, trucks, etc.) and types (proprietary, open data, etc.).	☐	☐	☐	☐	☐
Legislative or regulatory frameworks governing the collection and use of data (data standards, security, interoperability, rights of access, updating, etc.)	☐	☐	☐	☐	☐

	1 - Not important	2	3	4	5 - Critical
Availability of know-how on new materials, optics, biotech, etc. (GRIN) that enable the application of new traceability strategies	☐	☐	☐	☐	☐
Development of platforms to improve swapping/exchange of data along the food value chain, notably improving the access of farmers and food processors to consumer feedback on products.	☐	☐	☐	☐	☐
Improved labelling and content of information provided to consumers (source, health, environmental data, etc.)	☐	☐	☐	☐	☐

B2. Other challenges, please specify:

Section C: Needs and current use of data technologies for traceability

C1. Please rank the level of knowledge and actual application (use) of data technologies of different actors of the agro-food chain in your region?

Level of knowledge – capacity to collect, process and analyse data:

Public authorities and agencies (agricultural, environmental, health and safety, etc.)	
Agricultural suppliers (feedstuffs, fertilisers, plant & animal health, etc.)	
Agro-food equipment and service providers	
Farmers	
Food and drink manufacturers/processors	
Logistic and transport companies	
Information technology companies (mobile phone operators, software developers, etc.)	
Retailers	
Consumers	

Actual application of available technologies:

Public authorities and agencies (agricultural, environmental, health and safety, etc.)	
Agricultural suppliers (feedstuffs, fertilisers, plant & animal health, etc.)	
Agro-food equipment and service providers	
Farmers	
Food and drink manufacturers/processors	
Logistic and transport companies	
Information technology companies (mobile phone operators, software developers, etc.)	

Retailers

Consumers

C2. For which regional agro-food chains (dairy, cereals, meat, oils, beverages, etc.) is it most urgent or important to improve the capacity to collect and manage data? Please list them and briefly explain why.

Section D: Strategies and policies relevant to smart food theme

In your region, which of the following strategies if any address the topic of traceability and data in the agri-food chain?

D1. Strategy document (*Please indicate title of document and year published*)

Smart specialisation strategy

Digital or information society strategy (big, open data, internet of things, etc.)

Rural Development or agricultural/agro-food strategies

D2. Other strategy documents (*Please indicate title of document and year published*)

D3. Please summarise (briefly) the main relevant policy priorities of the current policy documents/strategies for your region/country.

Section E: Policy measures in support of traceability for the agro-food chain

E1. Please list up to five regional or national programmes/initiatives that support the development or deployment of innovative methods and technologies in support of traceability and data for the agro-food chain? These can either be (co-)funded by public funds or supported through public-private partnerships.

Name of initiative:

1
2
3
4
5

Annual funding (if known):

1
2
3
4
5

Website (if available):

1
2
3
4
5

Section F: Regional expertise and know-how in technologies and applications for traceability and big data

Existing expertise in relevant technologies

In which of the relevant technologies for traceability and data management for the agro-food chain is your region most advanced/specialised?

Rank the top three fields in which the region is most specialised.

Current application of technologies

F1. Technology/Application Field 1

- Radio Frequency Identification (RFID) ☐
- Wireless Sensor Networks (WSN) ☐
- Satellite and remote sensing technologies and devices ☐
- Geotraceability, Geo Information and satellite imageries ☐
- Smart tags, quality sensors, sensor enabled Refrigeration Systems ☐
- Drones ☐
- Genetic, Robotic, Information and Nano technologies (GRIN) ☐
- Block-chain Technology ☐

F2. Technology/Application Field 2

- Radio Frequency Identification (RFID) ☐
- Wireless Sensor Networks (WSN) ☐
- Satellite and remote sensing technologies and devices ☐
- Geotraceability, Geo Information and satellite imageries ☐
- Smart tags, quality sensors, sensor enabled Refrigeration Systems ☐
- Drones ☐
- Genetic, Robotic, Information and Nano technologies (GRIN) ☐
- Block-chain Technology ☐

F3. Technology/Application Field 3

- Radio Frequency Identification (RFID) ☐
- Wireless Sensor Networks (WSN) ☐
- Satellite and remote sensing technologies and devices ☐
- Geotraceability, Geo Information and satellite imageries ☐
- Smart tags, quality sensors, sensor enabled Refrigeration Systems ☐
- Drones ☐
- Genetic, Robotic, Information and Nano technologies (GRIN) ☐
- Block-chain Technology ☐

F4. Please comment your ranking or suggest other relevant key technologies for which your region is specialised – you may also provide a web link to a study or analysis of regional specialisation in these fields.

F5. To what extent are the key technologies applied in your region at different stages of the agri-food chain? Rank from 1 (not yet used) to 5 (widely used), you may also indicate 'don't know'.

Input industries:

Radio Frequency Identification (RFID)	
Wireless Sensor Networks (WSN)	
Satellite and remote sensing technologies and devices	
Geotraceability, Geo Information and satellite imageries	
Smart tags, quality sensors, sensor enabled Refrigeration Systems	
Drones	
Genetic, Robotic, Information and Nano technologies (GRIN)	
Block-chain Technology	

Farmers:

Radio Frequency Identification (RFID)	
Wireless Sensor Networks (WSN)	

Satellite and remote sensing technologies and devices

Geotraceability, Geo Information and satellite imageries

Smart tags, quality sensors, sensor enabled Refrigeration Systems

Drones

Genetic, Robotic, Information and Nano technologies (GRIN)

Block-chain Technology

Logistic/ transport providers:

Radio Frequency Identification (RFID)

Wireless Sensor Networks (WSN)

Satellite and remote sensing technologies and devices

Geotraceability, Geo Information and satellite imageries

Smart tags, quality sensors, sensor enabled Refrigeration Systems

Drones

Genetic, Robotic, Information and Nano technologies (GRIN)

Block-chain Technology

Food manufacturers:

Radio Frequency Identification (RFID)

Wireless Sensor Networks (WSN)

Satellite and remote sensing technologies and devices

Geotraceability, Geo Information and satellite imageries

Smart tags, quality sensors, sensor enabled Refrigeration Systems

Drones

Genetic, Robotic, Information and Nano technologies (GRIN)

Block-chain Technology

Retail sector:

Radio Frequency Identification (RFID)

Wireless Sensor Networks (WSN)

Satellite and remote sensing technologies and devices

Geotraceability, Geo Information and satellite imageries

Smart tags, quality sensors, sensor enabled Refrigeration Systems

Drones

Genetic, Robotic, Information and Nano technologies (GRIN)

Block-chain Technology

F6. Other key technologies applied in your region (please specify)

F7. If you wish you may comment your ranking or provide examples of specific issues in applying the technologies.

Section G: Centres of expertise (academic/industrial research, technology or training centres, etc.)

G1. Please list up to 10 specialised organisations in your region involved in traceability and data innovations and applications for the agro-food value chain.

Name:

1

2

3

4

5

6

7

8

9

Section H: Partnerships

Existing regional involvement in European or inter-regional partnerships in the field of agro-food chains, traceability or big data applications

H1. Please list existing involvement of regional organisations (public, private, research, clusters, etc.) in European (ERA-NETs, Horizon 2020, agricultural, open or big data, networks, etc.) as well as inter-regional programmes such as INTERREG.

Name of initiative or project:

1
2
3
4
5
6
7
8
9
10

Organisations involved:

1
2
3
4
5
6
7
8
9
10

Specific focus or topic:

1

2
3
4
5
6
7
8
9
10

Section I: Priority topics

Regional priorities for the proposed Smart Specialisation Platform for agro-food SSP for Advanced Manufacturing

I1. Given the perceived challenges for your region and the priorities, which specific topics are of most interest for your region?

- Traceability and Big Data in the "Lifecycles of the value chain" ☐
- Traceability and Big Data in the "Smart monitoring of the value chain (production, agrifood industry, logistics, distribution and consumer) aiming to improve the competitiveness in the agri-food sector" ☐
- Traceability and Big Data to "Incorporate the experiences of the consumers and of the different operators of the food chain in decision-making processes" ☐
- Cross-cutting issues such as "Open data, interoperability, data governance and information security, cybersecurity" ☐

I2. If you wish to propose a specific additional topic or reformulate the proposed topics, please use the box below.

Section J: Type of joint actions or activities

J1. Please rank possible activities of a future SPP.

	1 - low priority	2	3	4	5 - top priority
Mapping specialisation in agro-food traceability technologies and specialisation in each region	☐	☐	☐	☐	☐

	1 - low priority	2	3	4	5 - top priority
Mapping of key regional businesses in specific food value-chains to identify potential synergies	☐	☐	☐	☐	☐
Partner search, match-making and brokerage services for joint project development	☐	☐	☐	☐	☐
Building inter-regional innovation communities to jointly work on solutions and applications for agro-food chains	☐	☐	☐	☐	☐
Create a network of (open access) research and innovation centres that regional firms can access	☐	☐	☐	☐	☐
Co-invest in demonstrators, pilot applications, technology validation actions, etc.	☐	☐	☐	☐	☐
Cooperation on mobilising financial support for agro-food traceability projects.	☐	☐	☐	☐	☐

J2. If you wish to propose a specific additional activity or reformulate the proposed types of activities, please use the box below.

Section K: Governance and membership of the future SPP

K1. What role is your region willing to play in the future activities?

	Yes	Uncertain	No
Lead region for a topic or 'flagship action	☐	☐	☐
Co-finance future activities (e.g. studies, future meetings, etc.)	☐	☐	☐
Host a match-making event	☐	☐	☐

K2. Other (please specify)

Section L: Governance options

L1. What would be your preference for future governance arrangements?

- Create a distinct legal entity ☐
- Signature of a memorandum of understanding – cooperation agreement ☐
- Integrated in an existing network ☐

Project based co-operation only (e.g. through existing European funding programmes) ☐

L2. You may add a comment or suggest an alternative option

Section M: Membership

M1. Would you recommend that additional regions be invited to join future activities? If so, please list them and indicate why (e.g. existing co-operation, specific expertise located in the region, etc.).

Region:

1 ☐

2 ☐

3 ☐

4 ☐

5 ☐

Specific expertise relevant for the proposed activities:

1 ☐

2 ☐

3 ☐

4 ☐

5 ☐

Thank you for your time!