



SMART AGRITECH & SMART AGRIFOOD

IoT, AI and Blockchain based platform improving livestock Farming

With the contribution of



FIWARE - OPEN APIs FOR OPEN MINDS

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Challenge & Context

Back in 2015, the three co-founders of Digitanimal Carlos Callejero (CEO), Ignacio Gomez-Maqueda (CTO) and Rubén Blanco-Carrera (Commercial Director), were colleagues in an ICT company focused on development of solutions in the field of security and defense. One day, Rubén's father, who is a livestock farmer, asked his son if a solution could be developed to track his cows, avoiding losses during the grazing session. Rubén approached his colleagues with this request and that was the start of an amazing adventure. They found that for those small farms, there were already devices working via Wi-Fi or Bluetooth, but there was nothing for free range and extensive livestock farming, where connectivity was a challenge. This represented a great market opportunity to capture so in 2016, Carlos, Ignacio and Rubén created their first company together, named: [Digitanimal](#).

The world of remote farming is managed as it was 100, or even 200 years ago. Although animals may be kept inside during Winter and are thus easier to monitor, in Summer they are sent to pasture in nature to take advantage of free grazing. Cattle are managed like this from Australia to Patagonia and also in the north of Spain, especially the Pyrenees, where animals can graze more than 100km apart.

Moreover, before Digitanimal, livestock farmers didn't know about the health conditions and location of their animals, taking weeks to locate them, often with some livestock losses with the significant economic impact this brings specially to small farmers.

Some of the major challenges of the cattle sector include:

- **Low profitability.** Nowadays almost 50% of livestock farms in Europe are not self-sufficient and rely on public subsidies¹, such as those from the Common Agricultural Policy (CAP). In Europe, this accounts for more than the 30% of the EU budget² which demonstrates that farms urgently require greater management efficiency;

¹ [Farm Economy Overview 2016: Beef Sector](#)

² Navarro & López-Bao (2018). Nature Ecology and Evolution, 2(12):1830-1833

- **Low adoption of digital solutions and low connectivity in rural areas.** Current smart tools for cattle farming optimization require expensive implementation, e.g. for improvements in the connectivity of farm locations, but without guaranteed return of investment;
- **Increasing concern on animal welfare and climatic impact of cattle require better value chain monitoring:** Consumers are increasingly demanding more information regarding animal health and welfare, better food quality and traceability. However, transparent information flows not always exist, hampering its availability for all operators in the food value chain. This is partly due to the low availability of simple tools for measuring these parameters. Farmers still implement manual time-consuming tracking systems to provide required information to retailers and consumers, especially when offering a premium product (e.g. local breeds, organic, region certification). Furthermore, manual operations cannot provide full guarantee that any step in the process will not be manipulated.

In the past years, smarter tools, such as decision support systems, have been developed to help livestock farmers to optimise their operations and overcome the aforementioned challenges. In this context, the implementation of monitoring devices to track animals' health and behaviour is a growing trend. However current solutions and systems often present the following drawbacks that are limiting adoption:

- **Cost-effectiveness:** expensive implementation without guaranteed return of investment;
- **User-friendliness:** difficult management requiring specific knowledge and training;
- **Scaling capability:** limited transfer of information and value generated to next steps in the value chain;
- **Standardized data integration and interoperability:** large amounts of data from a variety of sources.

In addition, today, the Madrid-based start-up is helping farmers to perform a cost-effective scalable solution for livestock monitoring but soon will allow them to comply with EU standards for animal welfare in a fully trustworthy manner. Building on Digitanimal's existing health - and location - tracking functions and thanks to the integration of blockchain technologies piloted in the EU H2020 [Cattlechain](#) project, the solution will also guarantee animal welfare indicators.

Solution

To overcome the sector challenges and to democratise the access to smart technologies by livestock farmers, **Digital animal** aims at increasing farm **productivity, sustainability, and animal welfare** with a complete monitoring solution for beef cattle **based on a “powered by FIWARE” architecture that combines IoT wearables, Artificial Intelligence (AI) algorithms, Sentinel satellite imagery and blockchain technologies**. The current version of the product provides farmers with digested and **relevant information** on their animal status (**health, location, feeding and reproductive condition** among others).



Figure 1 - Added Value of the Solution

Thanks to integration of AI and blockchain technologies first piloted in the Cattlechain project, support for smart decisions as well as a full traceability on the dairy/meat products will be provided in the new version of the product.

The solution brings an alternative to traditional paper tracking and manual inspection systems, preventing that supply chain data from being vulnerable to inaccuracies while guaranteeing it remains unaltered. This alternative is based on the integration of FIWARE and blockchain technologies and guarantees trustworthiness of animal welfare indicators, providing a single version of truth to all actors in the meat/dairy supply chains.

FIWARE brings in a standardized open source implementation for context information management which is core to any Smart Solution. The **incorporation of blockchain technologies in “powered by FIWARE” architectures provides a trustworthy and immutable tracing of certain context changes linked to steps in smart farming and food value chain processes**. This definitively positions FIWARE as a platform of reference for Smart Solution developments in which creation of a trustworthy traceability of certain transactions is cornerstone.

The French livestock institute, IDELE, contributes to the solution with its knowledge regarding Precision Livestock Farming and Animal Welfare.

How it works

The new version of the Digitanimal solution which will integrate results of the Cattlechain EU project is based on the following pillars:

- **Internet of Things (IoT) wearables to gather data** from animals, farms and even during transportation by using collars, ear-tags and gateways. The collar and the ear-tag have different sensors to record different animal conditions like temperature, position or movements. The collar supports IoT connectivity with the cloud using the Sigfox network, while the ear-tag communicates via Bluetooth 5.0.

The IoT wearables send the data to a FIWARE-based cloud platform. Both devices, collar and ear-tag, have batteries that perform reliably for more than one year;

- **FIWARE-based cloud platform** in which the data received from the collars is harmonized according to a standard data model and analysed using Artificial Intelligence (AI) algorithms that translate the data received into insights regarding animal welfare, health and behaviour. The platform generates notifications to farmers and authorities when a welfare or health issue is detected;
- **Blockchain technology** to assure full traceability and transparency along the whole supply chain. Data coming from IoT sensors is directly stored (without human intervention) and made available for traceability purposes. Data generated by farmers and veterinarians is also uploaded.
- **Farmer management apps** through which farmers **access the data and information generated** in a comprehensive way and receive alerts in case any issue arises (e.g. a cow is about to give birth). Through the app, and thanks to the IoT devices, certain paperwork tasks can be performed automatically (e.g. transfer records, health records) so, therefore, workload is significantly reduced;
- **Consumers apps** to access traceability information and be able to rate the dairy and meat products that are getting purchased.

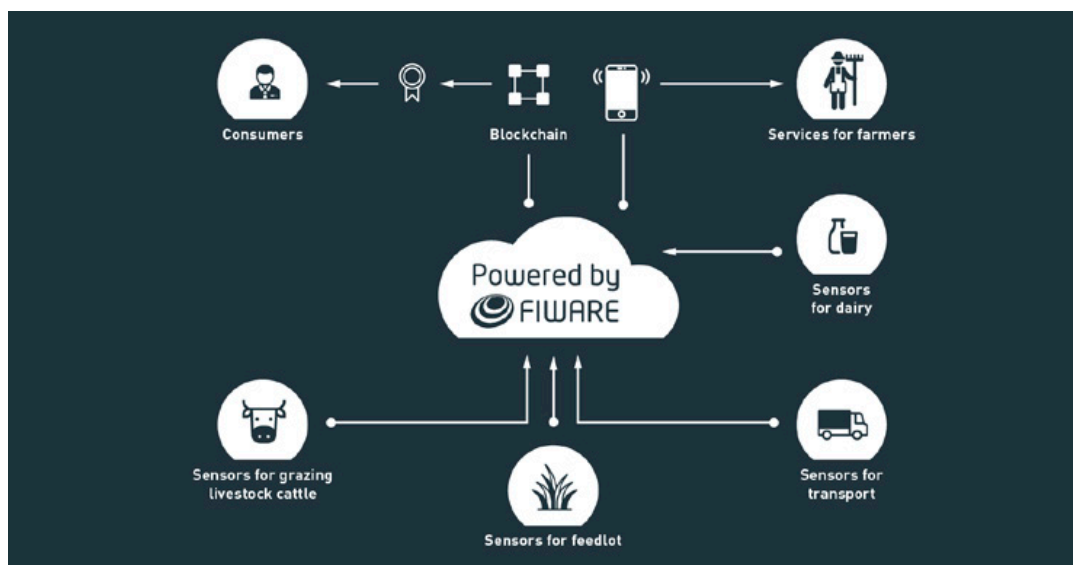


Figure 2 - Solution description

Benefits & Impact

Digitanimal, Spain's market leader in livestock location and monitoring, **provides services to more than 3.000 farmers in 50 countries around the world, with +65M data processed yearly.**

Integrating results of the Cattlechain project, the new commercial version improves the farm management and productivity by:

- **cutting-down operating costs** with an average of € 5,700/year savings³ (leakage reduction, early detection of health problems, fuel savings, animal search labour cost, Increase in the rate of successful calving), **optimizing reproductive cycles** and **reducing animal losses;**
- **providing animal welfare indicators and full traceability** of food from farm to fork thanks to blockchain technologies.

More than 100M hours observing the behaviour of cows under different management systems made it possible to match recorded data with critical events and predict animal's health problems using **AI algorithms** with an **accuracy of 85%**.

With the aim of producing smarter devices with greater connection capacity, the **technology has been validated with 15,000 animals** and optimized by implementing a blockchain based traceability and integrating cutting-edge sensor-specific architecture, which has been tested in experimental farms.

The company provides a Farming as a Service model adapted to specific needs, type of farmer, business, size of the farm and value of the animals. On the other hand, consumers are increasingly concerned about sustainability and the environment, as well as about the treatment of animals. Relying on the integration with blockchain technologies piloted in the Cattlechain project, Digitanimal will provide a direct response ensuring that meat and dairy products have been produced following the highest welfare and health condition standards.

³ * in a livestock farm of 100 cows with 20% monitored animals

Based on results of the Cattlechain project, Digitanimal aims to become the global market leader in the digitalization of the cattle farming sector by 2026, with a geographical focus on the EU and US markets with roughly 140,000 farms.

Customers

- [Coolindown Farms](#)
Belinda Lay Australia;
- [Goss Moore](#)
England;
- [Ganadería Las Albaidas](#)
Spain;
- **Farm's association and cooperatives:**
established collaborations with farmer's associations such as UPA, Aseava, COAG , UGAMA, and cooperatives like COVAP, COOPRADO;
- **Public Entities:**
several strategic partners which act as prescribers for the commercialization of our solution, via special subsidy programmes or promotion campaigns. This is the case of the Government from Asturias Region (Spain) and La Rioja. Having access to technical reports and updated data (i.e. our Data Service) will allow them to control fair rewards, which today require a large investment to control them, and not always with the expected success.

Added Value through FIWARE

Digitanimal's history has been linked to FIWARE since the beginning in 2015, having been part of the programme in the Smart AgriFood FIWARE accelerator. Since then, the integration of FIWARE technology has been continuously extended. In 2018, Digitanimal also participated in the "[IMPACT Growth](#)" FIWARE accelerator.

The solution itself employs several FIWARE enablers. These enablers provide a rather simple yet powerful set of functions allowing a much faster development of

new services at significant lower costs due to the Open Source nature of the FIWARE components. Within the FIWARE framework, Digitanimal's solution uses the following components:

- **Orion Context Broker:** core of any “Powered by FIWARE” architecture, this component implements the NGSI API which allows the handling of information coming from animals out of the farm;
- **IDAS:** Easing the connection between IoT sensors with the Context Broker, it provides several IoT agents which transform data received through different IoT protocols (e.g., Sigfox) into NGSI;
- **Complex Event Processing (CEP) module:** The CEP GE analyses events linked to context data updates in real-time, generating immediate response to changing conditions. The module allows to program rules which trigger certain actions when certain conditions around animals in a farm occur;
- **Cosmos and Cygnus:** Enabling the injection of historic context data from farms and stakeholders into Real-time Big Data Analysis and AI processing tools for supporting smarter decisions and the identification of new patterns of animal behavior and farm processes which provide the basis for the development of new services.
- **Canis Major Blockchain Adaptor:** enabling the integration of the Context Broker with multiple blockchains. This component allows configuring which concrete updates on context will be logged in the blockchain.

Next Steps

Further innovations are already foreseen in Digitanimal's planning:

- the development of useful tools to promote the ‘From Farm to Fork’ strategy through direct sales;
- the adaptation of innovative models that support farms to stay within environmental limits provided by new guidelines or regulations like the “European Green Deal” including current consultation results to positively impact the future Action Plan on Organic Farming. Adapted software modules will measure relevant parameters (e.g. CO₂ emissions, carbon sequestration, methane and nitrogen release) to assess the environmental footprint of the farm.

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Author & Contributors

Carlos Callejero

CEO @ [Digitanimal](#)

Contact @ ccallejero@digitanimal.com

www.digitanimal.com

www.innovation.digitanimal.com

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