



VIRTUOUS CASES REPORT

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SUMMARY

In this report, we provide a detailed description of case-studies of technological innovations and technical assets applied in the Dairy Value Chain across the Mediterranean that will be used to promote the technology transfer through TRANSDAIRY's Living Labs. The virtuous cases presented herein were selected through Activity 3.4.1 - Identification of existing relevant virtuous cases for dissemination purposes. These case reports are produced by AUA's (PP4), K46's (PP6), ICCS's (PP7), Berytech's (PP8) and ESIM (PP9) Living Labs as part of the scouting activities in Greece, Italy, Lebanon and Tunisia. The virtuous cases will be further exploited in TRANSDAIRY activities for on-hands training activities and training on success stories with presentations in entrepreneurship courses.

AUA (PP4) - GREECE

CASE STUDY #1 KRI-KRI INDUSTRY

TRACE THE MILK

This virtuous case describes innovative technologies deployed at a large Greek Dairy Industry based in Northern Greece. Kri Kri is a profitable dairy industry, the second largest dairy industry in Greece. Kri Kri flagship products include yogurt and ice cream which are Kri Kri's largest market niches. The latter dairy products are exported to more than 37 countries worldwide. The company was established in 1954 and specializes in yogurt, milk and ice cream that are exported to European countries and the Middle East. Kri Kri's principles include the use of excellent quality primary raw materials, mainly originating from Northern Greece (Serres), an aspect which strengthens the company's unique selling proposition (USP). Kri Kri today annually processes more than 60.000 tons of 100% Greek cow milk. The company has strategic alliances with scientific experts, livestock milk producers and veterinary university departments, having as generic target quality assurance and end product increased levels of market penetration competitiveness.

Due to the company's vision and singular principles it has invested in a new technological framework that enables the company to monitor the production, supply and transportation cycle for its main raw material (i.e. Milk). A technology prototype which is being deployed, tested and evaluated for further admission to normal industrial operation has the code-name 'Trace the Milk'. The overall goal is to maintain milk quality and security through a novel technological framework. Technologies used involve milk sensors at livestock farmers milk silos and freezer tank transportation lorries, including location tracking and alarm procedures marked at the company cloud portal. The resulting achievements deliver:

1. Improvement of "Food Defence" levels in the milk transportation chain from the farm and milk silos to the industry and company delivery stage.
2. Traceability of the milk quality and analysis for all parameters affecting its quality throughout the transportation chain.
3. Milk quality assurance from the point of temporary storage at milk silos of livestock milk producing suppliers until its delivery and acceptance by the industry.

This is currently being evaluated in the light of establishing total quality control and safe and secure products for the end consumer market.

CASE STUDY #2 AGROMILK IKE

Agromilk IKE is the owner of a modern, intensive small ruminant farm at the region of Attika. The farm has recently been established by a family of mechanical engineers. Farm operations are directed by the farm owner. The farm consists of about 300 Chios and 150 Lesvos breed sheep, which are the two most productive indigenous dairy sheep breeds in Greece. It also consists of 150 dairy goats of the most prolific indigenous breed, namely, Skopelos goats. The farm is expanding every year and currently the building infrastructure has the capacity to house more than 700



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animals (ca. 1200 m2). The farm is milk-production oriented, which is used primarily for the production of Feta cheese and Greek yoghurt. It also produces breeding stocks of the three breeds, whereas, meat production is of secondary importance. Milking ewes and goats are machine-milked three times per day for three months and thereafter, twice a day until the end of the milking period, which lasts about eight months. The milking parlour is a parallel two-by-twelve one, equipped with an automatic milk recording system (SAE Afikim - Afimilk). The farm has invested on labour, infrastructures and equipment to ensure increased productivity and appropriate health and welfare status. A commercial farm management software, operated by the animal scientist of the farm is available, with updated animal records. The hygiene status of the farm is generally high with the preventive medicine plan being regularly revised by the farm's veterinarian. Agromilk IKE can serve as a pilot site for intensive farming systems and can offer breeding stocks and facilities for recording, sampling, and testing, health and welfare indicators recording as well as, recording of traits associated with the intrinsic quality and safety of goat milk. It can also offer the assessment of intensive systems and their compatibility with consumer-driven demands in real-world conditions.

CASE STUDY #3 DAIRY SHEEP FARM HOSTING RESEARCH PROGRAMME

Ovine progressive pneumonia (OPP) is a viral, chronic, incurable disease of sheep, with a very long incubation period that leads to a life-long infection. It is caused by a non-oncogenic exogenous retrovirus belonging to the Lentiviridae subfamily (Maedi-visna virus), similar to HIV infection that causes AIDS in humans. Currently, there is





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considerable evidence that the prevalence of OPP increases rapidly across several farms, an alarming situation that could potentially threaten the viability of the dairy sheep farming sector. Animals with clinical symptoms indicative of OPP are frequently reported by farmers, however, the trade of breeding stocks from farms with unknown OPP status continues, despite the fact that in the majority of flocks the prevalence of seropositive animals is likely high. "Development of a nucleus dairy sheep farm for the production of maedi-visna free breeding stocks in Sterea Ellada prefecture" (OPP-free) aims to address the considerable shortage of certified OPP-free sheep breeding stocks in the Greek market, which is obvious in newly established intensive sheep farms, where the interest to buy breeding stocks with high productive potential is large. The project will facilitate the implementation of an integrated program for the control of OPP in Chios and Lacaune sheep breeds through the early detection of the causative virus and the development of mitigation strategies. The latter approach will pinpoint the management of the disease at the farm level and the development of virus-free breeding stocks. The main objectives are i) the investigation of the epidemiology of OPP in intensively reared Chios and Lacaune sheep, ii) the development and evaluation of innovative diagnostic procedures for the efficient diagnosis of animals infected by the Maedi-visna virus, iii) the exploration of possible risk factors related to the occurrence and transmission of the disease, and iv) the identification and implementation of specialized husbandry practices and general preventive veterinary measures for the strategic control of the disease and the development of a protocol for OPP-free Chios and Lacaune sheep breeding stocks. A modern dairy sheep farm (one of the most prolific in Greece) is enrolled in the study and adjusts its management scheme to fully comply with the demands required for the control of the disease and the production of OPP-free breeding stocks. This is the first time a dairy sheep farm in Greece attempts to prioritize its management to fit the requirements for the elimination of OPP as a first priority. Innovations utilized for the purposes of the project include i) the development and assessment of diagnostic procedures for the early and accurate diagnosis of OPP infections, ii) the pasteurization and management of colostrum, iii) the application of artificial suckling, iv) the development of pathogen-transmission mitigation protocols, iv) the proposal of a sustainable, active surveillance system at the farm level with the potential to be adopted from intensive farms, and v) the assessment of grouping and culling strategies efficiency. The innovation include the use of specialized technical equipment to achieve the main goals.

K46 (PP6) - ITALY

CASE STUDY #1 ROTALACTIS s.r.l.

Donkey's milk protein against rotavirus

According to the World Health Organization, rotavirus is the most common cause of pediatric gastroenteritis, especially in infants and children under the age of five. Every year, the disease causes 500,000 deaths, 85% of which occur in developing countries, where there is poor sanitation and it is difficult to receive rehydration treatment and other medical care.

Even in high-income countries, rotavirus gastroenteritis is very common, but rarely fatal. Nonetheless, the disease represents a major burden to healthcare spending. In Italy alone, every year there are over 300,000 episodes of illness at home, 80,000 visits to the doctor, and 10,000 hospitalisations for rotavirus infections. Moreover, specific medicines are still unavailable and the only possible treatment is to replenish fluids and correct the body's acid-base and electrolyte balance.

In this context, the innovative strategy and activities of Rotalactis - the company based in Colletterto Giacosa (Turin, Piedmont) operating in the field of food supplements, paid off with the development of a patent for the economic exploitation of the new technology for the Dairy Value Chain. The relevance is both economic and social. Indeed, the partners at Rotalactis, biologists and neonatologists with significant experience in the world of scientific research, discovered the properties of an equine milk protein and its derived peptides, which prevents rotavirus infection by

avoiding the contact between rotavirus and its target cells. This discovery gave rise to compounds for use in medicine or food - for which the patent application has been filed - that can be used as a dietary supplement for children. Rotalactina protective against rotavirus infections, and may be used as an ingredient to improve the quality of the various types of baby growth milk currently on the market. In other words, it is a new nutraceutical, derived from the natural components of donkey milk.

CASE STUDY #2 Azienda Agricola La Primula - F.lli Rovei



The company is located in Pianezza,



Società agricola La Primula
Impresa locale

company in Turin,

Piedmont. The reference sector is that of dairy cattle breeding, production of raw milk, production and sale of UHT milk and cheeses. The professional history of this family began with the great-grandfather of the current owners in 1911 "with two cows, a horse and 80 days of land". Over time, tradition has been accompanied by an ambitious business development project where the element of innovation plays a leading role. In 2008, in fact, "La Primula" was the first company in Piedmont (and among the first 20 in Italy) to introduce robots for milking their cows, thus becoming a point of reference on the technological front and for the genetic improvement of reared animals, with an important impact as regards the quantities of milk produced, but also on animal welfare and on the quality of the final product. The complete robotization of the milking cycle in addition to advantages in the management of work processes, allows individualized management of the cattle feeding process and precise, meticulous and real-time control of the health of the herd and of the milk collected.

CASE STUDY #3 ALCE S.R.L.

ALCE S.R.L. (Novara, Piedmont)



MICROBIOLOGIA CASEARIA

For over sixty years ALCE has been an authoritative point of reference for all those who work in the dairy sector by providing cultures of lactic ferments, rennet, coagulating enzymes, fungi (molds and yeasts) for marbling and other technological adjuvants prepared by combining technological innovation and respect for the dairy tradition. The assistance provided by technologists specialized in the various Italian and foreign dairy transformations, combined with the possibility of conducting chemical-physical, aptitude and microbiological analyzes in multifunctional laboratories of over 1,000 square meters, allow you to monitor the entire milk production chain, processing in the boiler and maturation of the cheese until it is marketed, identifying the critical issues that can compromise the quality of the finished product. In the knowledge that every typical Italian cheese, I.G.P. and D.O.P. is strongly linked to the territory and to the agro-zootechnical and technological habits of the communities that inhabit it, ALCE has always understood that it is difficult to design in the laboratory cultures of lactic ferments more functional than the traditional grafts used in the dairies located in the production areas. They are generally articulated microbial cultures, consisting of multiple biotypes often belonging to



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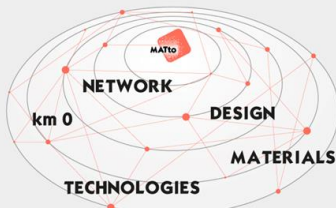
different species, capable of carrying out those complex and sequential biochemical transformations that make many Italian cheeses inimitable. ALCE, using sophisticated control technologies, is able to reproduce in a constant and standardized way the best natural crops (lacto-grafts, whey-grafts and scald-grafts) found in specific production areas, respecting the same microbiological complexity of the original crops. Furthermore, ALCE technicians are obviously able to supply, in addition to natural cultures for typical Italian cheeses, super-performing cultures of lactic ferments for the production of any cheese manufactured worldwide. High bacterial concentration, vitality, functionality, efficiency, constancy and multiplicity of lysotypic rotations are the parameters that characterize these modern cultures. The company additionally provides technologies and services for the so called functional foods such a probiotic ice cream and probiotic yogurts.

CASE STUDY #4 MATTO MATERIOTECA DEL POLITECNICO DI TORINO

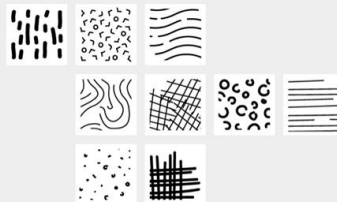


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We build relationships between companies and, thanks to research, we bridge the gap between design needs and the technical solutions they require with a view to **sustainable and sensory development**.

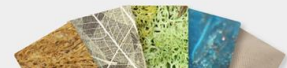


Our database boasts over 700 of the latest materials and semi-finished products, catalogued according to their technical characteristics, their possible sustainable use, physical forms and sensory features.



MATERIALS LIBRARY

- a **tailor-made consultancy service** adjusted to suit each individual company
- guidance in **understanding materials**
- an **innovative and environmentally sustainable** approach to design projects
- over **13 years of experience** in the design industry
- support provided by **researchers from the Politecnico di Torino**



MATto is the material library of the Polytechnic of Turin which, together with the Turin Chamber of Commerce, provides manufacturing companies with some consulting services on materials and production processes to boost and support the innovation of industrial and craft companies. The MATto material library aims to help companies and their designers achieve success by improving their production processes and guiding them in choosing the most suitable material for every need: MATto offers companies a personalized consultancy service for the search for innovative materials, with the aim of supporting them in the search for the most suitable solution to solve the problems of their projects and products, and to evaluate their perceived





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quality. MATto has at its disposal an archive of over 700 new generation materials and semi-finished products filed according to the technical characteristics, their possible sustainable use, the forms of presentation and the sensory characteristics. Most interestingly for the DVC their activities include alternative packaging materials exploitable for the Dairy Value Chain products.

ICCS (PP7) - GREECE

CASE STUDY #1 ANIMAL HOSTING ENVIRONMENTAL CONDITIONS MONITORING

In the last years, animal control techniques and farm environmental monitoring have been developed, with increasing intensity, through the integration of Information Communication Technology (ICT) systems and models for the analysis and interpretation of the data collected. The integration of different type of sensors, different type of data and different type of models is at the base of the modern techniques for herd management and of the tools aiming to increase the dairy sector sustainability. Monitoring and maintaining consistent living conditions for livestock is essential to maintaining their comfort, health and production. This is particularly prevalent in the dairy industry, as dairy cows have a lower critical temperature than other livestock as temperatures above 15°C reduces the dry matter intake of dairy cows resulting in reduced milk production. In addition to this, humidity is an important factor as high-level milk production will produce around 10kg of moisture per day in the area the cows are kept in. In maintaining these conditions, barn monitoring of temperature and humidity are essential. Optimum temperatures for these animals are between -5°C and 15°C with a humidity of 50%-80% to ensure optimum milk production and livestock health. In addition to the productivity of the industry, these factors should be monitored to ensure conditions are met to protect livestock health as stress can be caused by cold, heat or hunger causing cortisol levels to rise and reduces the function of the immune system. In addition to this, high humidity levels can allow pathogen growth, over all increasing the spreading of disease and viruses amongst livestock. In addition to dairy cows, barn monitoring is also important in the rearing of calves, whose immune systems are still developing and who grow better in a warmer climate (5°C to 25°C).

The specific virtuous case concerns the acquisition of big data time series about physical and environmental conditions of the facilities hosting animal (eg. Cow) herds starting from the collection of both indoor and outdoor environmental features, and leading to enabling a smart control of the facility, a diagnosis of the operating conditions, and early alerts in case of anomalies. A specific system has been developed to work in several environmental situations and is able to make the data remotely available in real time in a cloud. The Device Hub / Industrial Prototype was





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tested in the laboratory and is ready for installation in real environments.

CASE STUDY #2 - ANIMAL PASTURE CONDITIONS MONITORING

GPS tracking of livestock is being used more frequently by farmers to monitor the movements of their animals as they evaluate land utilization and improvements through grazing. GPS tracking data helps farmers understand a great deal about how pastured animals interact with the land, an activity equally important for land preservation and recovery activities. Livestock tracking also contributes significantly in developing strategies for the utilization of limited feed supplements such as cassava foliage and legume trees in the most effective and efficient manner. A tracking device can help the farmers getting real-time information about their livestock: in which areas they grass, which areas they sleep and which areas they just roam around without eating. The device can track the position of the head so for example if the head position is low, it probably means the animal is grassing. The data can tell various things about the animal: if the data shows that the head position hasn't been low for days, it might indicate that there is not enough grass where it is located. It can also indicate the opposite if the flock has been in the same place for various days and with the head mostly down (grazing). Then it might be time to move the livestock before they cause overgrazing and erosion. It can also indicate a pattern of where the animals prefer to eat and which areas they pass without eating for future management.

To satisfy the above requirements a system should include: • Positional Data (GPS with Galileo support for the EU area) • Accelerometer to deduce gate and positional features • Environmental data to associate with animal behaviour • Low power • Energy Harvesting • Good RF connectivity. To that end the functionality provided by the NORDIC "Thingy 91" development platform, combined with an Amorphous Silicon Foldable Solar Panel plus super capacitor backup for power supply and energy harvesting has been utilized. A specific system has been developed to work in several environmental situations and is able to make the data remotely available in real time in a cloud. The Device Hub / Industrial Prototype was tested in the laboratory and is ready for installation in real environments.

CASE STUDY #3 - INLINE MILK PH AND TEMPERATURE MONITORING

Milk – pasteurized, canned, or dry – is an acid-forming food. Its pH level is below neutral (7.0) due to the fact that it contains lactic acid. The pH of a glass of cow milk ranges from 6.4 to 6.8. Milk fresh from the cow typically has a pH between 6.5 and 6.7. The pH of milk changes over time. As milk goes sour, it becomes more acidic and the pH gets lower. This occurs as bacteria in milk increase its acidic content by converting the sugar lactose into lactic acid. The first milk produced by a cow





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contains colostrum, which lowers its pH. If the cow has a medical condition of mastitis, the pH of the milk will be higher or more basic. Whole, evaporated milk is slightly more acidic than regular whole or skim milk.

Another important parameter for milk “health” is temperature. In general milk must be maintained at a temperature of 7 °C or below. Bacteria in milk exhibit minimal growth below 7 °C. However, temperatures well below 4,5 °C are necessary to protect the milk’s quality. It is critical that these temperatures be maintained through warehousing, distribution, delivery and storage. It is thus evident that PH and temperature are two important factors that need to be monitored in all stages of milk production from animal to consumer distribution points.

To that end we have utilized the functionality provided by our custom build Device Hub platform to which a temperature and a PH measurement probe are attached. The system has been developed to work in several situations and is able to make the data remotely available in real time in a cloud. The Device Hub / Industrial Prototype was tested in the laboratory and is ready for installation in real environments.

BERYTECH (PP8) - LEBANON

CASE STUDY #1 Goûtblanc

A Lebanese company that manufactures and markets goat’s milk products under the brand “Goûtblanc” was selected as a virtuous case. Located in Annaya at 1000 meters above sea level, the modern farm includes 1200 goats of European Alpine and Saanen breeds. The dairy farm, occupying a surface of 5000 sqm, is designed in accordance with the French AFNOR standards that guarantee the quality of its products. Founded in 2013 and covering a surface of 1000 sqm, the cheese factory at Goûtblanc uses only fresh goat milk produced locally. Each stage of the manufacture of their products is very precisely defined to obtain products of high quality while respecting the hygiene regulations in force. Today, Goutblanc has over 9 different dairy products and produces 2500 liters/hour of goat milk due to continuous pasteurization and the integration of novel technologies in its value chain. With proper design of the farm and the use of appropriate technology, Goutblanc was able to maximize the yield while saving time and resources. With the use of a perforated slated floor for animals to sit on, the farm was able to save up on hay and hand labor. It also installed an automatic feeding belt to avoid the use of trucks and labor force while maintaining the right provision of food quantity and quality for the animals. Goutblanc is now operating on automatic cleaning, automatic feeding, and of course automatic milking. With the introduction of this machinery, Mr. Daher confirmed that their value chain has been largely improved in terms of reduced contamination, more efficiency while maintaining the same taste and homogeneity,





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and a much smaller margin of error (can get to 1 gram only). Finally, Mr. Daher mentioned that they are only using medium-level technologies and that more professional and efficient machineries exist that can produce high quality cheeses with affordable prices. Goutblanc aims to attain this level of technology someday.

CASE STUDY # 2 - Kobayat Coop

Kobayat coop is a 50-year-old cooperative which supports local farms in many ways. They launched a new initiative when the crisis hit and farmers started getting rid of their cows because they could not provide them with the right amount and quality of feed and medication anymore. Kobayat coop decided to integrate the hydroponics system to create a better quality and less costly fodder system to help farmers feed their cattle green and healthy products while saving on cost.

The innovation lies within the process adopted. Instead of putting the grain in the land and use a lot of water, they put them in a vertical container that saves up to 7 times on land and monitor the environment using led lights that simulate sun and a controlled water irrigation system that mimics the rain - all operating on clean solar energy. Farmers can apply this technique in any farm - whether big or small - all they need is water and the right seeding cycles. This product can substitute up to 50% of the mix they feed the animals and is available at a much lower price. Kobayat coop is conducting the necessary research to integrate new ingredients and vitamins to increase the percentage of substitution and make the product more profitable.

Kobayat coop is launching its product on August 15, 2022 and will be conducting a marketing campaign to not only enter the market, but to also spread awareness. They are targeting small Lebanese farms and can provide fodder to up to 50 cows per day.

CASE STUDY # 3 - LibanVet

LibanVet is a Lebanese company that aims to serve farmers to enhance their productivity and adopt modern techniques. It imports quality products and technologies ranging from pharmaceuticals and feed additives to integrated sensors and management software. It also provides free consultancy to farmers to help them develop essential skills and owns the only certified diagnostic lab in Lebanon.

The smart sensors technology service is divided into 2 parts: the hardware and the software. The hardware is a smart neck tag that can be connected to the Internet and gathers live data, analyzes it, and draws conclusions out of it. It can mainly be used in dairy farms and can give insights on rumination, fertility, and eating time . The



results of this technology cannot be easily achieved using human labor, they thus increase efficiency; but also provide accurate and true data, allowing the farmers to make the right decisions. The software could help farmers in managerial aspects and decision making if the data is entered correctly on daily basis. It consists of a simple data entry platform that can perform analyses and provide results. The asset of the software is that it can comprise any kind of data, whereas the hardware collects pre-set data. Efficiency is maximized when both services are used together. Implementation of this technology has allowed farmers to improve their monitoring of the cows, has helped with data collection, has improved accurate data access, and has subsequently allowed farmers to know the patterns and make more convenient decisions. LibanVet is currently working on raising awareness among farmers, giving crash courses on software usage, and basic computer skills, farm management techniques and even working English skills.

ESIM (PP9) - TUNISIA

CASE STUDY #1 Farm Lait Espoir

Lait Espoir is a successful private company with extensive knowledge of dairy milk farming. Its mission is to educate and empower farmers around the world about the good and positive impact of using Technology in agriculture. Their main achievement is helping farmers to have a better control and provide a happier environment for their cows.

The project Lait Espoir, started first by creating a dairy milk farm in Jendouba (in north west Tunisia) which adopted a scientific approach discarding conventional ways in cattle farming.

Good practices adapted to the cow's potential and environment results in better health for the herd and increased profitability for the farmer.

They developed a Smart Farm application that helps early detection of illnesses in cows. It also helps easier monitoring and follow up of the herd. With a photo taken of cow dung, the application analyzes the appearance of the dung and subsequently determines whether the cow's digestive system is functioning normally and if the food ration provided is balanced or not (too fibrous or too protein).

CASE STUDY # 2 - Moome Company

A mobile application that optimizes cattle breeding available on Playstore and Huawei AppGallery, MooMe helps pastoralists prevent or correct recurring problems, such as low fertility, parasitic diseases, and reduced milk production.

The application helps to accurately detect heat periods of cows which vary from 7 to 30 hours on average, facilitating artificial insemination at the appropriate time. It also helps in monitoring the farrowing, as well as the state of health of the animals. The farmer thus has a real-time overview of the herd and can make better managerial decisions.

MooMe works with a sensor collar placed on the animals, which provides a variety of data, including rumination, movements, sleep time, etc. The information is sent to MooMe boxes installed in the barns, then translated into algorithms which are in turn transferred to Lifye's headquarters in Tunis to be analyzed and provided to farmers.

MooMe claims to have registered more than 1,500 users since the launch of its solution in 2019. The application is used in several other African countries such as Morocco, Senegal, Algeria, Zimbabwe, Egypt, Kenya, Uganda, Nigeria and Rwanda. The start-up is working on improvements.

CASE STUDY # 3 - Moome Company

Bio-Capteur is a Startup that developed an Innovative process in the production of sensors, based on the transformation of the biological signal into an electrical signal. A bioelectronics sensor that



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ensures continuous monitoring of milk quality while respecting nature. It helps farmers and milk collectors to detect contamination of milk by germs. It offers a quick and less expensive analysis, time and money saving, less antibiotic use, and better milk quality.

DISCUSSION

Technology innovations in the DVC cover a wide range of applications from IoT and sensorized animals, infrastructure and equipment to Biotechnology and functionalized food, modern breeding schemes and production of animal fodder in arid conditions. Given the recent crisis in animal and food production and the disruption of trade and supply chains caused by political, financial and social changes, technological innovation may be the only way to maintain production in the dairy value chain and safeguard income and food, especially in limited resource settings. The virtuous cases presented herein aim to raise awareness to the public about the technological innovations in the DVC and inspire young entrepreneurs. The virtuous cases will also be exploited in upcoming activities of the TRANS DAIRY project including hands-on training and demonstration of research results.

