Third overview of business models for all 33 IoF2020 use-cases based on sessions on value proposition, product description and challenges.
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EXECUTIVE SUMMARY

This is the third version of the IoF2020 business model overview and after 3 years of IoF2020, the economic important phase of product launches and market penetration is starting. However, the main challenge in 2019 was clearly the on-boarding of 14 new IoF2020 use-cases. In order to tackle this challenge of providing now individual business support for 33 use-cases, the product support restructured and staffed up its team quite significantly. Therefore, a major focus in 2019 was on analysing the product and service proposition of the new use-cases, developing their business model roadmaps and to integrate them into the synergetic network of IoF2020 use-cases. Next to this individual business model development, the business support team also brought some first concepts on the road that could potentially sustain part of the infrastructure and ecosystem that IoF2020 already established.

In the field of business models, we still see a majority of use cases implementing the software-as-a-service (SaaS) model with monthly or yearly subscriptions. However, also the platform model is getting stronger and became actually in many sectors a key enabler for interoperability, distribution and accelerated product development. We saw the launch of the Data Connect initiative at the Agritechnica in 2019 where Claas, John Deere, CNHi and 365FarmNet declared to use common cloud API to make data available to smart services, but also the launch of the enterprise platform of Connecterra to monetize the data exchange with third-party services. Learn in the first section about the successes and challenges in the business model development of the IoF2020 use cases and discover the positive influence of our business support team. In 2019, the business support also significantly staffed up its team of business model experts to keep up delivering the excellent support and we like to take the chance to shortly introduce them to you as they are all co-authors to this publication.

As already identified and discussed in the previous version there is clear potential in the distribution of smart farming services via digital marketplaces on farm management information systems (FMIS) that already manage the master data and bureaucracy of the farm. In this context, 365FarmNet announced as well on the Agritechnica their new Connect API that allows third-party services to integrate easily with the FMIS and accelerate the development of new impactful solutions. Next to the service marketplace there was also progress in the field of data exchange solutions that make data from different machinery source available to smart service providers. The Agrirouter adjusted its business models and repaired some limitations that were also identified in last version by the IoF2020 business support team. Furthermore, the Agrirouter consortium secured with CNHi one of the missing big manufacturer as a full member and announced now as well a collaboration with the competing JoinData initiative from the Netherlands. Read about these developments in the section on economic successes and challenges.

While all the points above mainly reflect the economic infrastructure for a proper exploitation of smart agrifood solutions, the IoF2020 business support team also further developed its approach for the implementation of a connected innovation ecosystem. In a first concrete step it started monitoring 45 accelerators and their connections in the ecosystem with a monitoring tool that uses machine learning to crawl the digital communication of companies. This tool that is called DataScouts collects, sorts, analyses and visualizes complex ecosystem data to find connections, call & product launches, topic trends and investment deals. The objective of this exercise is to support IoF2020 partners to setup their own innovation accelerating programmes and initiatives by having easy access to a pool of innovation service provider like digital innovation hubs, accelerators and competence centers. Read about first results of this ecosystem monitoring in the section on the mapping of agrifood tech accelerators.

Next to the ecosystem mapping, the business support team also transformed the idea to turn part of the 140 test farms in IoF2020 together with test farms of regional initiatives, corporates and universities into a sustainable European Digital Test Farm Network further into a tangible concept. This initiative directly takes up demands of use-case companies within IoF2020 for a more professional and reliable product validation service provided by a connected network of test farms. Many SMEs invested quite some time and money in identifying, convincing, keeping and developing of test farms, which delayed in some cases the product roadmap quite significantly and also takes away key company resources as the acquisition is usually not a core competence of these SMEs. But also larger corporates are more
and more struggling to provide test farms that can cope with the demand for multi-actor and cross-vendor testing. IoF2020 secured right from the beginning close collaboration on this concept with existing initiatives like NEFERTITI, SmartAgriHubs, EIT Food and existing structures like test farms of corporates and universities. Furthermore, IoF2020 experts constantly validate the value proposition of a test farm network and develops now the concept further in a multi-actor approach by conducting co-creation sprints with key stakeholders like service providers and farmers. In order to inform and win interested farmers and services providers as supporters, IoF2020 organized a webinar in November 2019 that attracted 193 registrations and prepared a low-profile website with a registration function. In 2020 the concepts will be further developed and tested to be ideally established by the end of IoF2020 as a sustainable entity providing validation service for digital farming services. Read more about it in the section on the European Digital Test Farm Network and learn also about the opportunity for farmers to get finally a comparable benchmark of available smart services and drive with informed investment decisions the uptake of IoT solutions in agriculture.

After this summarizing introduction to success stories and challenges as well as the ecosystem activities of the business support, the document delivers finally detailed insights into current status of the business model for each of the 33 use cases. A major focus in 2019 was on the on-boarding and definition of the new 14 use-cases. Therefore, the main addition to the business model overview are product descriptions, value propositions and revenue models of these new use cases. For the old 19 IoF2020 use cases the business model experts added more details on the cost structure, distribution channels, marketing strategies internal resources, horizontal activities and partner networks. For some use cases it documents changed and adapted product description and value proposition after feedback and advice from the business support team.

A good example is use-case 2.4, Remote Milk Quality, which discarded on advice from their business model expert the development of a remote sample preparation tool in favour of a quality test directly on the milk truck. This adaptation brings now a potential solution with a better value proposition and an attractive business model opportunity.

As the section on the use-case business models is designed as an evolutionary documentation of the progress and changes of the economic exploitation plans, this section contains parts from the previous deliverable D4.9 and only additions and changes where the use cases changed or further developed their planning.

Finally, the outlook section, gives some preview on the major objective for the business support in the final year of 2020. This phase will be under the clear objective of bringing products for all use cases to the market and clearly demonstrate their positive economic and environmental impact as the sustainability of the business model behind it.
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1. INTRODUCTION

1.1. STATUS OF BUSINESS SUPPORT

The IoF2020 business support of 2019 restructured its services and team composition quite significantly. This adjustment was due to answer the challenges of on-boarding and supporting 14 additional new IoF2020 use cases which joined the project in January/February through the open call. With now 33 use cases and more than 50 products and services in development, the business support decided to take three measures:

- significantly staff up the individual business model expert team
- offer intensive individual business model support
- offer 6 webinars with various business topics

Therefore, we would like to give you in this chapter a short overview on some important achievements and successes of our IoF2020 use cases, challenges for data-driven business models that our use cases and the business support team provided services.

1.1.1. Highlighted successes and achievements of IoF2020 use cases

1.1.1.1. UC2.6 – Private funding of 400k€ secured / strategic investors

The MicroFeeder A/S behind UC2.6 successfully secured a private investment of €400,000 by two strategic investors, who are also serving in the executive board of Microfeeder now. With Thorkild Hvid as new CEO and Erik Hougaard as vice-president of MicroFeeder A/S, the company could secure crucial knowledge and experience for its further expansion and international sales ambitions.

Furthermore, the use case has a strong business model, which is due to good support from IoF2020 and by local Danish startup support.

Find more details in section 2.15. of this document.

1.1.1.2. UC2.1 – Adapted service from dairy to meat production for higher impact & margin

Following an analysis and suggestion of the business support, UC2.1 dedicated their tracking and monitoring system with its outstanding battery lifetime to the herd management in the beef production.

1.1.1.3. UC2.4 – QLIP develops new IoT solution for quality sampling directly on the milk truck

QLIP abandoned the old product development of a remote sample preparation device as a result of the intensive business support showing the limited value proposition and achievable margin in favour of a remote sampling solution for milk trucks. This new product solves the clear need for direct milk quality assessment at the stage of collection on the farm level. This way milk companies are able to assess the milk quality directly on the farm and not only when a milk trailer arrives with several milk loads from different farms at the dairy factory. This way dairy companies can directly value higher quality milk from farmers and sort milk loads in different quality levels.
1.1.1.4. UC5.1 & UC5.2 – Porphyrio got acquired by Evonik

Porphyrio is the service provider behind the Smart Broiler Chain Optimizer and as soon as it will be launched to the market also the Smart Pig Monitoring Tool. The strategic acquisition provided Porphyrio with new extensive resources and a wide-distribution network. The company documents very well the professionalization of the company. https://www.porphyrio.com/en/home/

1.1.2. Business model Challenges

1.1.2.1. Data exchange cross value chain

In some cases, the value proposition of the service does not directly translate into productivity or efficiency gains on the farm or respective end-user level, but only unfolds its positive effect when a seamless dataflow across many actors is established. Especially the IoF2020 use cases that are working on transparency and traceability along the value chain rely on the involvement of many actors in order to achieve the full effect of their service. The final goal is to win the consumer's trust in food products of a specific quality, like use-case 5.3 is supporting the transparent certification of antibiotic-free meet with KDV.

A clear challenge for these use cases is to get access to the different data pools as winning the trust and developing a win-win proposition for each value chain actor. This causes in some IoF2020 use cases significant delays in the product development and actually led in many cases to a breakdown of the final solution into several auditing support tools.

*Answer to this challenge by IoF2020:*

The support team on ethical data exchange developed together with the business support team a concept for a temporary data exchange inside of a kind of data sandbox. The service provider and every involved partner sign an agreement to exchange data for limited timespan of about 3-12 months while all partners ensure to delete the data of the respective other party by the end of the development period. IoF2020 is supervising this process as a neutral partner. This concept limits and manages the risk that could be inflicted on each partner from the data exchange and the subsequent transparency to third-parties.

Furthermore, the business support works intensively with individual workshops conducted by IoF2020 business model experts on sustainable business models for each partner in the value network. The experts Gerard Stinistra and Olivier Guido are working on a fair distribution model for any additional value that derives from revenue increases or economically-relevant productivity gains. This new model builds on experiences in the energy sector and will help to foster the necessary investments in technologies and digitalization to establish data exchange across the value chain.

1.1.2.2. MVP concept not common in agrifood sector

The business support team experienced in nearly all use-cases that there is a very low acceptance of the minimum viable product concept. Short recap: a minimum viable product (MVP) is a product with just enough features to satisfy early customers and provide feedback for future product development. Gathering insights from an MVP is often less expensive than developing a product with more features, which increases costs and risk if the product fails, for example, due to incorrect assumptions.

Therefore, the inherent planning of IoF2020 foresees the market testing of consecutive MVP versions including their potential business models. Unfortunately, the MVP concept was finally applied only to a relatively small target group of test farms within IoF2020, while there was hardly a rollout of initial products or services to the market. The reason for this hesitation is mainly the fear of established companies to damage their brand recognition with a half-ready service as the common practice of the agricultural industry is to launch only full-ranging services with a rich set of features. Another important reason is that many services unfold their full effect only after a wider integration of other value chain
partners and additional farm equipment. Therefore, service providers fear that their current value proposition is not good enough to convince the farmer or on the other side that a customer group of farmers with the necessary digital equipment is too small for proper market roll-out.

**Answer to this challenge by IoF2020:**

The business support team organized a webinar on the topic of agile product development in order to introduce the general concept and its advantages for faster development and validation cycles. Furthermore, the business model expert together with our product development support offered individual advice for each IoF2020 use case.

1.1.2.3. Limited availability of interoperable machine data

It is still a major barrier for the quick adoption of smart services that machine data from the various equipment manufacturers present on a farm is not available in a standardized and interoperable way. The current situation shows that many service providers are still selling their own equipment for the sensing of relevant parameters, but struggle in the seamless integration of third-party equipment data into their service. The biggest steps forward is this challenge made by the arable sector and its machine manufacturers. IoF2020 was a key supporter of this positive development on the one hand by its use case 1.4 and the on the other side with the sector discussion inputs of the IoF2020 business support.

**Answer to this challenge by IoF2020:**

On a more strategic level, the business support team actively consults initiatives like Agrirouter or Data Connect, which are working on a standardized data exchange for farm machinery. In a special sector discussion meeting at CEMA/AEF in Brussels, our team specifically drew attention to the business models and the ethical implications of the data exchange. As an outcome of these discussions and partly based on the advice of the support team, we achieved the following improvements and successes:

- **Foundation of Data Connect**

  DataConnect is the first direct, manufacturer-independent solution that enables the seamless, automatic and real-time exchange of important machine data between the various machine brand platforms. With John Deere, CLAAS, CNH Industrial and 365FarmNet as part of the initiative, producers operating Deere, CLAAS, New Holland, Case IH or Steyr brand farm equipment can easily access and view basic machine data elements including current and historical machine location, current fuel tank level, working status and forward speed from these connected machines via the portal of their choice. These include the John Deere Operations Center, AFS Connect, MyPLM Connect, CLAAS TELEMATICS or 365FarmNet portals.

- **Business Model Adjustments at Agrirouter**

  The IoF2020 business support team critically discussed the business model of the Agrirouter already in the last version of this deliverable. Now the Agrirouter changed significantly the model for the involvement of new manufacturers. In the new model a manufacturer that joins the consortium does not have to pay a share of the historical costs of the platform development, but the investment is used to fund further developments and the on-boarding of the machinery of the manufacturer.

  Furthermore, the business model for the data exchange changed from a volume-based approach to a fixed annual fee per farmer and application. The new annual fee of 50€ is payable by the service provider and not anymore by the farmer. Therefore, the Agrirouter implements now into the interface of the services and can be fully rebranded to assure a coherent look and feel of the applications.

  Furthermore, the Agrirouter could win CNHi as an important new partner and also integrated the JoinData initiative from the Netherlands.

  These developments already increased the value proposition of many services and products in IoF2020 and accelerated the product development by using standard APIs of the machine data implementation.
1.1.3. Structure & Team of IoF2020 business model support

After the very positive results of the individual business model support in 2018, the business support of IoF2020 staffed up its pool of business model experts to ensure also with 33 use cases that every use case is individually supported on their business model development. Each use case received about 40h of direct support through experts in 2019 and WP4 plans to offer a comparable support in 2020.

As the business model experts are the backbone of the IoF2020 business support and as they all contributed with their individual use-cases descriptions to this document, they deserve a short introduction:

Jos Verstegen, Senior Researcher at Wageningen Economic Research
Jos is a key expert at WUR Business Innovation (wurbiz.nl) which facilitates businesses in the green domain (agriculture, horticulture, fishery, forestry, etc.) with the design and implementation of innovative and sustainable business models. He also advises the General Board of Regio Rivierenland on the selection of project proposals.
Advisor of IoF2020 use-cases: UC1.1, UC1.2, UC3.1, UC3.3, UC5.5, UC5.6

Nadim Choucair, CEO & Founder of 2030 Cabinet
Nadim is an expert in conceptualizing digital solutions supporting the UN sustainable development goals (SDG) and in building partnerships with relevant ecosystem stakeholders. Furthermore, he is founder of 2030 Cabinet, a collective of talented individuals aiming for sustainable impact. He’s the initiator of the Global Goals Jam in Berlin.
Advisor of IoF2020 use-cases: UC2.1, UC2.2, UC2.3, UC2.4, UC3.4, UC4.1

Rafa Aguado, CEO & Founder of Bolt
Rafa founded BOLT and leads now this prominent early stage acceleration and investment program in Spain for technology startups that want to go global. His mission is to match startups, corporates and venture capital which believe first and foremost in scaling by sharing. Over 18 years he helped technology startups to scale, enter new markets or getting acquired.
Advisor of IoF2020 use-cases: UC3.2, UC4.2, UC4.3, UC4.4, UC5.2, UC3.6

Alexander Berlin, CEO & Founder of Berlin Thinking Consulting
Alexander is a professional data business model expert, digital transformer and startup developer on the European level. As CEO and Founder of Berlin Thinking Consulting, he provides acceleration and transformation services for tech startups and larger corporates pushing for digitizing their business models through IoT technology.
Advisor of IoF2020 use-cases: UC1.3, UC1.4, UC1.6, UC1.7, UC1.8, UC5.1, UC5.3
Carlijn Savelkouls, Business Innovator at Wageningen Economic Research

Carlijn works as Business Innovator at Wageningen Economic Research. In this role she assists companies in the search for new business models and in shaping and embedding innovations in the agri-food domain. She is mainly focused on digital innovations at the sector level where various companies innovate together. She is involved with the fruit 4.0 project as project lead.

Advisor of IoF2020 use-cases: UC5.4

Harry Kortssee, Innovation Researcher at Wageningen Economic Research

Harry is a key researcher on the verge of consumer behaviour and sustainable business model for agricultural entrepreneurs that a looking to distribute data-driven value across the whole value chain. He is very well connected in the Dutch ecosystem of famers, corporates, processors and retailers especially in animal farming.

Advisor of IoF2020 use-cases: UC2.5, UC2.7

Olivier Guiot, Scientific Advisor at ILVO + CEO & Founder of Zenith4u

Olivier is an experienced advisor and entrepreneur, who worked for as an associate and head of communication for McKinsey while being as well the managing partner of the talent management platform Minds in Action and founder of Zenith4u. He is a professional networker and helps entrepreneurs and corporates to validate their products and services in the market.

Advisor of IoF2020 use-cases: UC1.5, UC3.5

Gitte Schober, Entrepreneurship Expert at StartLife

Gitte is coordinator of the Center of Entrepreneurship (CoE) at StartLife in Wageningen responsible for the valorisation of scientific research by prototyping and creation of start-up companies. She has more than 20 years of experience working as a consultant, coordinating the entrepreneurship education and start-up activities within the Food Valley region.

Advisor of IoF2020 use-cases: UC4.5

Gerard Stienstra, Founder & CEO of New Technology Value


Advisor of IoF2020 use-cases: UC1.9
1.1.4. IoF2020 business webinars

Next to the intensive individual support by business model experts, the IoF2020 business supports offered in 2019 also 6 webinars on topics with relevance across all use cases. The webinar programme is professionally managed by Gerben Splinter, who consults the use cases and business model experts for pressing business topics that could be tackled in a broader webinar. In 2019 the business support offered 4 webinars that attracted over 320 registrations in total. Please find below a recap of the topics and links to the webinar recordings:

1.1.4.1. 1st Webinar - Platform service business models in agriculture | 29 May 2019

What are the business model challenges of platform service models in Agriculture? Learn how Platform Service models are changing the way data or information is exchanged in the agri-food sector. Different type of platform service models allow for value co-creation by offering complementary components and applications that are developed in emerging ecosystems of third party developers. Introducing you to this topic is Jos Verstegen of Wageningen Economic Research. Expert speakers will be Patrick Honcoop of 365FarmNet on distribution platforms for software services. Vik Vandecaveye of CNH industries will tell you more about possible business models for open data exchange.

Find the recording of the webinar on business model challenges here: https://youtu.be/KBfzwb6jCxw

1.1.4.2. 2nd Webinar - Price setting for IoT solutions | 17 September 2019

In today's world of digital farm tools, the value of data and data-driven knowledge reaches far across the value chain and business models tend to become rather complex. Costs and benefits are spread across many players and it is hard for a service provider to set a price for their services. In this webinar you will receive practical tips and considerations to define your pricing strategy and price level for IoT services and hardware based on experiences gained in IoF2020. Introduction to the topic by Carlijn Savelkous of Wageningen Economic Research. Second presenter on hardware price setting experiences from Sensowave was Carlos Callejero. Last speaker on software price setting experiences from Agricolus, is Andrea Cruciani. Followed by a Q&A part with participants.

Statistics: 94 webinar registrations

Find the recording of the webinar on price setting for IoT solutions here: https://youtu.be/j00IUSedymU

1.1.4.3. 3rd Webinar - European Digital Test Farm Network | 20 Nov 2019

The market is full of digital solutions for farmers ranging from simple tools to full-blown farm management systems. However, the objective benefit and impact for the farmer is in many case not clear and some cases not even validated. Therefore, IoF2020 was started and equipped over 100 farms all over Europe
with sensors and software to assess and measure the impact of digital solutions directly and independent on the farm level. After investing with EU support into the equipment of test farms within IoF2020, we now have the chance to form a network of interested farmers to become professional test farms and therefore independent validators, demonstrators and multipliers for digital farm services. These farms could create additional income by offering capacities for product testing to corporates, investors, universities and startups and become educational hubs for digital farming in their region and domain.

This webinar is dedicated towards farmers, digital service providers, investors and educators in the agrifood tech domain and gives insights on the test farm concept. IoF2020 is very interested for your feedback on this initiative which already received a lot of support across our corporate partners and the investor community. Please use the chance to get in touch with us and share your opinion and ideas. The test farm network is currently a concept supported by IoF2020, SmartAgriHubs and NEFERTITI.

Statistics: 193 webinar registrations
Find the recording of the webinar on European digital test farm network under: https://youtu.be/VyEXLjzl-m4

1.1.4.4. 4th Webinar - Investment deals and pitching in agrifood | 11 Dec 2019

In order to drive your business innovation, it needs at a certain point of time as well some financial fuel by private investment. While you think pitching might be easy, the negotiation with investors can be tough. This webinar gives you some insights and tools for successful deal negotiation and is based on experience. Furthermore, we will if you want or not repeat shortly on the crucial criteria of a good pitch.

Statistics: 44 webinar registrations
Find the recording of the webinar on Investment deals and pitching in agrifood soon under: https://www.iof2020.eu/latest/education

1.1.4.5. Marketing, communication and topic curation for 2020

The communication and marketing strategy around the IoF2020 Business Webinars Series 2019 was very successful and attracted more than 320 registrations. The business model team prepared a professional social media communication package with images, social media text and Eventbrite registration links. This communication package was then spread throughout the whole IoF2020 network and the networks of partners like EIT Food, SmartAgriHubs and some agrifood accelerators.

The webinars were open for the general public with the aim to share knowledge and concepts from within IoF2020 with the rest of the community. After the success in 2019, the business support team prepares already the collection of topics for 2020 and sent out already requests for ideas to the network. Please see below some examples of the visual communication:
Figure 1: IoF2020 Webinar marketing visuals
1.2. SUSTAINABILITY OF IOF2020 PROJECT INFRASTRUCTURE

Next to the overall objective of developing competitive and sustainable business models for the products and services of our IoF2020 use cases, the business support addresses as well the challenge of making part of the IoF2020 ecosystem and infrastructure self-sustainable after the end of the project in 2020. Therefore, our team identified two major shortcomings in the current innovation ecosystem of agrifood. One is the lack of innovation programs of larger corporates with the aim to integrate third-party innovations into their distribution catalogue or to use external innovations to transform their own business model. However, many corporates in the IoF2020 consortium are very interested in this opportunity to source innovation and stay ahead of the international competition. Therefore, the business support team started mapping the current landscape of accelerators and digital innovation hubs in order to identify trending topics, potential partner and to unite the different local initiatives into a network offering acceleration as a service.

The second challenge is the lack of access to professional product and service validation by test farms especially for SMEs. We experienced with many use-cases how much time and resources it takes to identify farms with the fitting equipment and the will to exchange their data with an external service provider. Especially when the service is still in development and the actual impact is not yet proven, it is very difficult to convince farmers to test the service. IoF2020 successfully attached 140+ test farms to the project that are validating the services and products of our use cases. This infrastructure is perfectly starting to build together with projects like NEFERTITI, which builds a network of 400+ demonstration farms, SmartAgriHubs, which builds a network of 140+ digital innovation hubs and EIT Food, which is an interesting, long-lasting umbrella for project results in the agrifood sector.

The following two paragraphs will give a short introduction into both initiatives that aim already now, one year before the project end, towards sustainable business models and structures to maintain important parts of the IoF2020 project for the European agrifood tech innovation ecosystem.

1.2.1. Mapping of agrifood tech accelerators & DIHs

The business support of IoF2020 started in Q4 2019 to monitor the activities of key market players in the field of agrifood tech innovation, which were already identified and listed in an excel sheet by the business support team. These market players include accelerators, digital innovation hubs, corporates, investors and research institutes.

The aim of the first step is to obtain deep insights into the current relationships and offers of acceleration service providers in Europe. The business support team wants to identify underrepresented sectors and value chain players in the current ecosystem as well as trending, but underserved topics in the agrifood innovation ecosystem. In parallel, the business support team worked on a business model that offers acceleration services, like business support, industry knowledge transfer, product validation, etc. as a service to corporates and many more as full-fetched acceleration programmes over longer periods.

Based on this knowledge and the new business model, the business support team plans to offer corporates in IoF2020 the acceleration services of 140 digital innovation hubs and 30+ accelerators on a tailored basis. If a corporate only intends to run a simple innovation challenge in a defined number of countries or cities, the acceleration network can offer a dedicated set of accelerators and DIHs that offer their local services and physical capacities for one challenge or a one-time acceleration programme. This way the prices for an acceleration or innovation sourcing activity can be smaller and therefore also affordable for smaller and medium-sized companies.

1.2.1.1. DataScouts – AI-driven information sourcing, curation and analysis

As the above objectives require quite some effort in market research, we decided to look for a digital tool that can support us. Therefore, we looked for a service that helps achieving the following objectives:
• Visualize the connections of the existing market players in the field of innovation acceleration in agrifood tech based on the IoF2020 partner research;
• Monitor the ecosystem in terms of trending topics, product launches, acceleration programs and open call publications;
• Make this information visible for the whole agrifood tech community and validate if the service could function as a portal for services of SmartAgriHubs and other innovation accelerators in the field of agrifood tech;
• Pick a solution where the curation effort is the least as this is a major barrier for the sustainability of a solution.

The business support team performed a mapping numerous potential tools in the market and made a selection of 3 relevant tools that would solve best the actual challenge of mapping the innovation ecosystem of the agrifood tech sector. WP4 compared these 3 selected tools with the core functionalities that we identified to perform the task and we arrived at the following ranking of the tools that showed “Data Scouts” as the best available service for the money:

<table>
<thead>
<tr>
<th>Features</th>
<th>DataScouts</th>
<th>Meltwater</th>
<th>Mention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>0-10 points</td>
<td>0-10 points</td>
<td>0-10 points</td>
</tr>
<tr>
<td>Media monitoring</td>
<td>8</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Partnership mapping</td>
<td>10</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Self-curated content</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Visualization quality</td>
<td>10</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Open call management</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>38</strong></td>
<td><strong>28</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td>Country of origin</td>
<td>Belgium</td>
<td>California, USA</td>
<td>France</td>
</tr>
</tbody>
</table>

1.2.1.2. Current implementation & testing

The first dataset consisted of 40 accelerators in a simple excel table that was uploaded to the DataScouts platform. After a first review the insights are already quite impressive as well as the good visualization of complex connections in the ecosystem. The platform offers insights on social media communication, multidimensional connections between ecosystem players, map view and numerous analytics on business activities, most represented industries or investment flows.

IoF2020 offered also SmartAgriHubs access to the platform in order to assess if the tool could be interesting for their innovation portal. A self-curation system provides valuable insights with a very low effort and support the case of sustainable infrastructure after the project end.

For first insights, please visit: https://iof2020.datascouts.eu/
1.2.2. Concept of a European Digital Test Farm Network

1.2.2.1. Objective and background

Over the last 3 years, IoF2020 successfully pioneered in developing and validating over 50 IoT services from SMEs and corporates on over 140 test farms all over Europe. Significant funds from IoF2020 as well as private investments from partner flew into the equipment of farms and into the development of a validation methodology of comparable impact and performance indicators for IoT solutions.

A major learning was that the test farms played a crucial role in the product development especially for SMEs as it provided direct and iterative feedback from end-users. The short and intensive test and feedback cycles led to an acceleration of the product development and improved the user acceptance of the final service.

At the same time, the management of test farm relations is currently rather time consuming for both sides, the service provider testing products as well as for the farmer. After a rather long process of identifying a fitting farm and winning the farmer’s trust to get involved with your solution, the relation with the farmer is in many cases based purely on the goodwill and interest of the farmer. This led also in IoF2020 to cases where farmers dropped out in the middle of the product development procedure causing severe delays in the go-to-market timeline.

*Identification of fitting farms, winning farmer’s trust and the management of test farm relations is time consuming leading to shaky relation mostly based on goodwill and interest of the farmer.*

Furthermore, it proved to be very difficult in all sectors to win the farmer’s trust on sharing data from his/her farm with external service providers and even more difficult with other partners in the agrifood value chain. Even so code of conducts for the ethical and fair exchange of data like the one provided by CEMA and Copa-Cogeca are already in place, it takes quite some effort for service providers to win the...
trust of the farmer for every step on the product development journey. This way it is especially difficult to establish traceability and transparency services across the whole value chain as these services only create their full value and distribute it back when all partners provide data.

Very difficult to win trust for data exchange across value chain partners.

Therefore, the business support team of IoF2020 developed a concept on how part of the existing test farms and other test site in IoF2020 can be turned into a sustainable European Digital Test Farm Network (EDTFN) offering a wide set of service for the agrifood tech ecosystem:

- Impact and performance validation for product development (Digital Service Providers)
- Independent and comparable validation of impact/performance of agrifood tech services (cooperatives, farmers associations)
- Data pool of digital farm twins to train machine learning algorithms (Digital Service Providers)

1.2.2.2. Value proposition

**Informed IoT and digital investment decisions**

One major value of the EDTFN is to provide independent and comparable performance and impact data for the most promising digital agrifood tech solutions on the market. In order to ensure the independence of the results, the testing process is not financed by the agrifood tech industry, but by cooperatives and farmers associations. The results are made publicly available to farmers and their advisors to make informed investment decision when it comes to IoT and digital tools.

Independent and comparable benchmarks for available digital agrifood tech solutions would finally trigger the needed investments to grow the sector and to steer public subsidies towards the most effective systems. Furthermore, the comparable impact and performance data would foster and accelerate competition by identifying quickly the best players in the market. This would lead to less parallel development of the same solutions for a problem, but force a higher level of innovation and a clear benchmark for all new market players.

**Improved and accelerated product development**

By providing the ready set network of professional test farms, the EDTNF saves significant amounts of time and costs for turning innovations into market-ready products. Service provider receive more reliable feedback as farmers are trained and experienced in the process. Furthermore, EDTNF ensures a basic set of digital infrastructures on the farm which offers most necessary data inputs and allows the integration of third-party service into a FMIS.

1.2.2.3. Current status and next steps

At an IoF2020 webinar on 20 November 2019 the concept of the European digital test farm network was first introduced and received significant interest by IoF2020 partners, but also from farmers outside of IoF2020. In total 193 people registered for the webinar and the distribution shows abroad interest across startups, corporates, researchers, public bodies and farmers.
For information about the European test farm network, please refer to the website: www.edtfn.eu and view the webinar under the following link on IoF2020 YouTube channel: https://youtu.be/VyEXLjlzI-m4

The next steps are to wait for farmers and service providers to show their interest. So far, the EDTFN received 8 registrations of farmers and 1 registration of a service provider. In the beginning of 2020, the IoF2020 business support together with supporting projects and partners plans a series of co-creation workshops with farmers and service provider to further detail the business model of the network.

1.2.3. Sharing of business model learnings & template material

In the course of IoF2020 the business support team created many templates, guidelines and webinars for the consulting and improvement of the business potential for our IoF2020 use-cases. A major objective for 2020 is to transform this valuable knowledge into as far as possible white-label templates and share it with a wide-range of innovation and support initiatives around agrifood tech in Europe. The planned innovation portal of SmartAgriHubs which aims to centralize all relevant information, contacts and knowledge around agricultural innovation will be such a hub and an excellent opportunity to make also IoF2020 material available to a larger audience of digital innovation hubs, SMEs, research institutes, accelerators and other relevant and interested stakeholders.

Therefore, the business support of IoF2020 already created a list of available resources with their respective links if already available and responsible contact persons in case of questions. For 2020 our team will be working on a proper documentation on how to use the different templates.

Furthermore, a lot of business model related information which is rather use-case specific will be available on the IoT Catalogue of IoF2020. Unfortunately, the depth of information will not be the same for all use-cases as it was up to consortia to decide up to which level they want to allow IoF2020 to share insights on the their business model as well as key performance indicators. The first step of publishing insights is already taken. As you can see below for some use-cases the KPIs are already
visualized and present the interested stakeholder a quick understanding of the performance and impact of specific use-case and its product or solution.

Figure 4: Example of KPI visualization in IoF2020 IoT Catalogue

The final version of the use-case catalogue will contain more information on the respective business models of the developed solutions. Currently most solutions in IoF2020 are still under development and final end-user review before the enter the market in 2020.

In the meantime, please find in the next chapter a detailed business model description for all 33 IoF2020 use-cases and their individual products and services. As IoF2020 supports currently the development of over 50 individual products and services, the chapter is rather long and suggest the reader to turn back to the table of contents and choose an interesting use-case from there. In order to receive quick overview of the 33 use-case we kindly refer you to our IoF2020 website, which presents you under the links below all use-cases in 5 supported sectors:

- 9 Arable Use-cases UC1.1 – UC1.9
- 7 Dairy Use-cases UC2.1 – UC2.7
- 6 Fruit Use-cases UC3.1 – UC3.6
- 5 Vegetables Use-case UC4.1 – UC4.5
- 6 Meat Use-cases UC5.1 – 5.6

If you prefer to stay in this document, we recommend you to read the first paragraph under the headline of each use-case which contains a short summary of the scope and product of the use-case.
2. USE-CASE BUSINESS MODELS

2.1. UC1.1 – WITHIN-FIELD MANAGEMENT ZONING

This arable use-case is working on a suite of smart data and task maps to foster further automation and a higher variety in the potato production. It is preparing the future of automated precision farming by a 3-stepped approach. It offers an application that turns soil data from sensors, scanners and satellites into virtual soil maps with concrete information on the nutrition levels, water capacities etc. by the precision of a few meters.

In a second step, it provides the farmer with smart maps of application rates for fertilizer, pesticides, water and seeds that ensure the most efficient usage of the production assets and its application at the right time.

In the final step of this use-case stands a fully circle communication reaching towards the farm machine in order to automate the application of farm inputs (seeds, pesticides, fertilizer etc.) directly on the field. For this step the use-cases incorporates the communication standards and platform developed in UC1.4 by leading European farm machine manufacturers.

Regarding the **agricultural value chain**, the services of this use-case focus mainly on farmers as end-users and develop their visual interfaces for this target group. However, the use-case explores also exploitation opportunities for data on the level of farm production (seeds, pesticides, fertilizer etc.) and the processing industry (fries producers etc.).

![Figure 5: UC1.1 - Value Chain Position](image)

2.1.1. Product Description & Value Proposition

2.1.1.1. Product description of Field Map Service Suite

This use-case develops a suite of services for potato farmers that support the reduction of production assets like fertilizer or pesticides, increase the yield and improve the potato quality. The service suite subdivides into the following applications:
Soil Analysis

This service provides a digital map of a farm visualizing the soil conditions like soil fertility, concentration of organic matter, clay content, water storage capacity for a specific geolocation in the field. This gives the opportunity to define certain zones within the field with specific growth conditions. In the course of the project the resolution of this analysis is aimed to reach a level of highest accuracy in market.

The physical soil analysis itself is carried out in two ways:

1. Stationary Sensors for Electro-magnetic soil analysis
   Measurement of soil structure, texture, mineral composition and organic matter with scan technology.

2. Soil sampling and Chemical analysis
   This analysis needs to be applied in an annual cycle and consists of smart soil sampling and soil analysis on organic matter and clay content, nutrients, pH-level, etc.)
**Variable Rate Application Service**

This service uses advanced algorithms to calculate based on the soil map data the optimal application quantity of fertilizer, pesticide, seeds and water for each geolocation in the field. This service works also with soil maps from other sources. However, its precision is dependent on the resolution and data quality of the soil map.

The farmer can review the application map in his/her Farm Management Information System (FMIS) and take the advice into account in further asset application decisions.

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**Automation & Machine Communication Service**

This service translates a variable rate application map into a task map that farm machines understand. Based on standards and a communication framework developed in UC1.4, the data will be securely transmitted to farm machines from various manufacturers and the right amount of inputs will be applied automatically at the right location in the field.

---
The mapping services for UC1.1 are already integrated into the Dacom Farm Intelligence platform and provides the following maps:

- Seed Density Maps
- Herbicide Application Maps
- Nitrogen Application Maps

Furthermore, the use-case is close to implement a map visualization on existing FMIS like Akkerweb and 365FarmNet.

**Technical issues**

At this moment, there are some open endings. Data still has to be collected from the farm machinery. Different data export formats that have to be converted.

2.1.1.2. Value Proposition of Field Map Service Suite

The major value of this service suite is to optimize and reduce the usage of farm inputs like fertilizer, pesticides, water while at the same time increase the yield and quality of the potatoes harvested. Through in the precise zone definition within the field it is furthermore possible to plant a higher diversity of potato plants in one field and to treat them individually.

This higher diversity may lead to better resistance of the field against insects (especially if combined with other crops), a higher variety of potatoes and tastes for the end-consumer and a higher premium with quality potatoes for diversified products in the processing industry. (e.g. Red French Fries)

![Figure 10: UC1.1 - Benefits for Potato Farmers](Image)

- **Without our Product or Service**
  - **Standard plant distance**: Could be better with more seed potatoes along tramlines and high lutum, less plants in shade
  - **Standard soil herbicide application**: Less herbicide could be used in zones with lower lutum and organic matter content.
  - **Standard additional N spraying**: Could be more effective when related to canopy and soil.

- **With our Product or Service**
  - **Variable potato planting on sprayer tramlines, shade and lutum (clay)**: Variable planting based on NL tree database, tramline plan and soil map.
  - **Variable soil herbicide application**: 23% less soil herbicide realized, by lower application at lower levels of lutum and organic matter, plus higher yield.
  - **Better N advice with soil map**: Canopy index advice can be improved on subparcels with high growth capacity.

- **Here is the difference**
  - Homogenous crop and product
  - Less herbicide use, better product
  - More effective use N

**Target User – Small to medium size farms (50ha – 200ha)**
- Less production costs
- Less adverse side effects
- Higher yield and quality
2.1.2. Exploitation & Monetization

2.1.2.1. Revenue model for Field Map Service Suite

The major revenue model is a pay-per-map online shop by Loonwerk GPS where the farmer can input all necessary GPS data to locate the field parcel and receives the requested variable rate application map in return.

Another option is that the mapping service will be offered to farmers as a module of existing farm management systems like Dacom Farm Intelligence (former CropR) and Akkerweb. Following the revenue models of these platforms, the farmer can book the mapping service on a yearly subscription subdivided into packages according to the field sizes. UC1.1 would receive revenues either as a direct share of monthly or yearly payments by the farmers for the service module on the platform or via a license fee for each usage of the algorithm by the clients of the platform.

Additional services like the physical soil analysis with high-precision soil sensors will be provided by third-party service providers for fee based on the size of the field to be scanned. Soil sampling is as well another business opportunity, but it will be provided at cost price basis to support the growth of the end-user base.
2.1.2.2. Pricing of Field Map Service Suite

The pricing of the mapping service depends on the size of the field and is currently estimated at 100€/per hectare.

2.1.2.3. Additional data revenue model

No additional data revenue models considered at this moment by use-case 1.1.

2.1.3. Customers & End-user Relations

2.1.3.1. Distribution of Field Map Service Suite

The standalone distribution channel for the Field Map Services is the Loonwerk GPS website by Jacob van den Borne Potatoes, the current end-user test partner in UC1.1. Loonwerk is so far only targeting the Netherlands and does not provide any visual interface to view the maps. Therefore, the mapping services of UC1.1 will also be available to farmers in the Netherlands and Germany through the farm management systems of Dacom’s Farm Intelligence, Akkerweb and 365FarmNet.

2.1.3.2. End-customer relation of Field Map Service Suite

UC1.1 already planned activities for maintenance and functional product support and offers telephone support for farmers through the following partners:

1. Service line of Dacom/Akkerweb
2. Service line of LoonwerkGPS (Louis) & Fleuren (Yannick)
3. Service line of van den Borne Potatoes

The direct contact at the moment for support service on scanning to contractors and machine firms is:

1. Service line of van den Borne Potatoes
2.1.4. Partner Network & Horizontal Activities

The current challenge is to keep the three big potato farm machinery companies connected. This entails Grimme (market leader), AVR and De Wulp/Miedema (small).

2.1.5. Cost Structure & Internal Resources

2.1.5.1. Cost structure of Field Map Service Suite

Will be discussed at the UC 1.1 Business modelling workshop on October 23rd 2019

2.1.5.2. Internal resources for Field Map Service

The development resource inside the project provided by the use-case partners are:

- Programming capacities: 1000h/year = 7,000€
- Data connection technicians: 10h/year = 1,000€

Furthermore, the use-case receives additional resources from Dacom and Akkerweb.
2.2. **UC1.2 – PRECISION CROP MANAGEMENT**

This use-case is working on a farm management tool for advanced plant growth and health. The focus is now on wheat but the tool can also be upscaled to other crops. A crop monitoring dashboard with high precision crop maps to realise a real-time monitoring is developed using IOT sensor data and satellite data. Next, a water and nitrogen manager using application maps and time schedules is developed by combining monitoring data with farmer practices, crop models and decision rules. Cooperatives can also use the crop monitoring observations to better forecast harvest.

The use-case offers therefore solutions for the farm production stage as well as the processing stage of arable value chains.

![The Value Chain](image)

*Figure 13: UC1.2 - Value Chain Position*

### 2.2.1. Product Description & Value Proposition

#### 2.2.1.1. Product description of the Crop Monitoring Dashboard

The Crop Monitoring Dashboard gives an overview of plant growth and health through a user interface. It combines IOT ground data and satellite images to provide high precision crop maps of biophysical variables (crop status, soil and meteorological conditions) on near real time. The aim is

1) to support farmers to detect earlier, to respond quicker, to save time and to make better decisions
2) to support cooperatives with better harvest forecasts.
2.2.1.2. Product description of the Water and Nitrogen Manager

The Water and Nitrogen Manager provides farmers with application maps for nitrogen and water, for in season crop management. Crop monitoring data will be combined with farmers practices, crop models and decision rules.

Water and nitrogen management

Application maps for nitrogen and water, for in season crop management.

Target Groups

Cooperatives
Farmers

Major Challenge

Data management is a major challenge, to combine monitoring data with farmers practices, crop models and decision rules.

Core Product Features

Accurate monitoring technologies for a high level of precision and robustness for real time crop management.

04 2018 – Maps for nitrogen management and time schedule for irrigation.

02 2019 – Application maps and time schedule for nitrogen and water management, based on IOT + satellite data.

Here is what we aim to improve (KPIs)

Saving nitrogen
Saving water
Better yield and quality

These values derive from comparison of a standard farm’s performance prior to the installation of our system and after.

Figure 15: UC1.2 - Product Factsheet for the Water and Nitrogen Manager
2.2.1.3. Value Proposition of the Crop Monitoring Dashboard

The core value for farmers of the Crop Monitoring Dashboard consists of early detection of problems allowing for a quick response, i.e. to act better. Besides this, it will save time for the farmers to manage the crop.

For the cooperative the crop monitoring allows for a better harvest forecast although the value of this is not very clear yet, and will depend very much on the type (delicateness) of the crop and the logistics in the processing industry and retail. In theory, the cooperative can use the dashboard data to know how much they can harvest and sell early in the market. Yet, it is too early to propose it to them. First, we have to collect the data. Every year you have to invest but according to Benoît, not many cooperatives want to invest in R&D. They want to buy a read-product.

Farming situation is bad; market prices are low for most of the crop: sugar beet, wheat, corn, (sugar beet only recently but now a big problem because of end of quota).

---

**Without our Product or Service**

**With our Product or Service**

**Here is the difference**

<table>
<thead>
<tr>
<th>Farmer’s visual monitoring</th>
<th>Crop Monitoring Dashboard</th>
<th>Time saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low frequency of visit</td>
<td>Daily measures are available for the fields. It enables early detection of problems</td>
<td></td>
</tr>
<tr>
<td>Time consuming</td>
<td></td>
<td>Early detection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farmer’s decision</th>
<th>Water &amp; Nitrogen Manager</th>
<th>Better planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen and water management are decided using standard tools</td>
<td>Better planning despite changing climate conditions.</td>
<td></td>
</tr>
<tr>
<td>Farmers decision</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farmer’s application</th>
<th>Farmer’s application map</th>
<th>Saving of inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen and water are done uniformly in the field</td>
<td>Farmer uses an application map for variable rate application.</td>
<td></td>
</tr>
<tr>
<td>Farmers application</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Target User – Medium to large size farms (> 80 ha)**

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**Figure 16: UC1.2 – Farmer benefits of the Crop Monitoring Dashboard and Water & Nitrogen Manager**

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**Without our Product or Service**

**With our Product or Service**

**Here is the difference**

<table>
<thead>
<tr>
<th>Satellite and manual acquisition</th>
<th>Crop Monitoring Dashboard</th>
<th>Large scale monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing of data acquisition is not regular, satellites alone provide a part of the information</td>
<td>High spatial and temporal resolution monitoring of the whole collecting area</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forecasting the business</th>
<th>Forecasting the business</th>
<th>Cost optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation of harvest is done based on the climate only</td>
<td>Better forecast of harvest using crop monitoring observations</td>
<td></td>
</tr>
<tr>
<td>No analysis at large scale</td>
<td>Analytics for improvement</td>
<td>Large scale monitoring</td>
</tr>
<tr>
<td></td>
<td>Big data analysis of datasets to identify factors of success.</td>
<td></td>
</tr>
</tbody>
</table>

---

**Cooperative / Agri-business company**

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**Figure 17: UC1.2 – Cooperative benefits of the Crop Monitoring Dashboard**
2.2.1.4. Value proposition of the Water and Nitrogen Manager

Through the provision of application maps, the Water and Nitrogen Manager will support the farmer in his or her work planning and helps to save nitrogen and water. Consequently, it will result in a better yield and product quality.

The service should first be sent to experts to make a completely automated tool. Fine-tuning of the advice is still needed. Nitrogen-availability model is tricky. Advice was not to give nitrogen but this was too risky.

2.2.2. Exploitation & Monetization

2.2.2.1. Revenue model for the Crop Monitoring Dashboard

The Crop Monitoring Dashboard will be sold via the agricultural cooperatives in France. One revenue model is that farmers pay 500 euro for crop monitoring plus 20 euro per hectare. They get it for 15 euro per hectare and resell it to arable farmers for 20 euro per hectare.

The cooperatives themselves benefit from the system as well. It allows for large scale monitoring, time saving, cost optimization by better forecast of harvest using crop monitoring observations. So far it is unclear what this means for the revenue model. Harvest forecasts can be very valuable for perishable crops or fruits in a situation with complex logistics. This occurs for instance when there a huge peak in harvests, and processing capacity is a limiting factor (i.e., bottleneck) in the value chain. In wheat production a better harvest forecast will also have value but how much is unclear. If there turns out to be a considerable value, there will also be a revenue model for partner Arvalis who is in charge of delivering the statistics to the cooperatives, based on aggregated individual farm data. Farmers may ask themselves why they do not benefit from this as well. They may ask for a reduction on the 20 euro per hectare as they are the ones providing the data for the harvest forecast. This again may lead to higher sales prices of the tool from the owners. So far, the partners in the consortium remain owner of their own developed parts. How to allocate revenues to the partners is still to be discussed.

Another revenue model may be that cooperatives give away this product for free to their loyal clients (farmers) who frequently buy other products (e.g. fertiliser) and services (e.g. farm advice) from the cooperative. It all depends on the strategy of the cooperative. This may change in time as debate is now going on in France claiming that cooperatives should split their product sales (e.g., fertilizer sales) and service sales (the work of Arvalis for instance).
2.2.2.2. Revenue model for the Water and Nitrogen Manager

Most likely the Water and Nitrogen Manager will be sold in a package with the crop monitoring dashboard, but decisions still have to be made for this.

2.2.2.3. Pricing for the Crop Monitoring Dashboard

In one possible revenue model (see above) the Crop Monitoring Dashboard is sold to the farmers for 500 euro plus 20 euro per hectare. This is still a guess. Yet, it is based on experience with a very popular existing service named FarmStar. Apparently, farmers are willing to pay 15-20 euro per hectare for a good service.

The project partners aim to sell the service for 15 euros to the cooperatives and they can sell it for 20 euros because they have the tasks to promote the product (e.g., on agricultural fairs), to explain the service to the farmers and to collect the subscription fees.

2.2.2.4. Pricing for the Water and Nitrogen Manager

Most likely the Water and Nitrogen Manager will be sold in a package with the crop monitoring dashboard, but decisions still have to be made for this. A competitor offered a service for 10-15 euro per hectare. It was offered by a drone operator (competitor Airinov); also with nitrogen application advice; the latest news however is that the owner (Parrot) stopped this service because it was not enough profitable. Yara still has a service using a sensor, satellite and drone based. So you can’t go much higher with the price. Accuracy of Arvalis should be better. Otherwise the cost to produce the service should be lower.

Here is a challenge as Bosch has mentioned that they expect over 60 euro per hectare of revenue for their own part of the solution.

Some farmers (in the GPS cooperative) are now moving towards organic farming. This gives a higher value crop and then the farmers need more security to produce the agreed yield amount.
2.2.2.5. Additional data revenue model

No selling of data considered yet; Arvalis works with the farmers’ own data and has no right to sell this.

2.2.3. Customers & End-user Relations

2.2.3.1. Distribution for the Crop Monitoring Dashboard

The French agricultural cooperatives will be responsible for the distribution of the dashboard. At this moment the cooperative GPS organises the sales. They are innovative, small but active (are also selling FarmStar). Bosch is an important network player, who also has connections to other cooperatives. They are active to promote the system. The idea is that the cooperatives promote the products to the farmers, distribute (and if needed install) the products and educate the farmers how to use it. Also they will be responsible for collecting the yearly subscription fees from the farmers. Arvalis will distribute the statistics to the cooperatives.

2.2.3.2. Marketing strategy for Crop Monitoring Dashboard

The cooperatives are also responsible for promoting the product. Here is a short recap on the market analysis. France has 11 million hectares of cereals (incl. maize). Today, 2.5 million hectares is managed by sensors. This project tool / system has the potential to double this area within 5 years. This means that a market of 2.5 million hectares is possible. Many farmers will retire in the next 5 years. It is uncertain what will happen with the land. Land grabbing by Chinese investors is not an issue (yet).

2.2.3.3. Distribution for the Water and Nitrogen Manager

Most likely the Water and Nitrogen Manager will be sold in a package with the crop monitoring dashboard, but decisions still have to be made for this.

2.2.3.4. End-customer relations for the Crop Monitoring Dashboard

Two types of end-customers can be defined in this use case. First the farmers. The cooperatives maintain relationships with the farmers; they promote the products, distribute (and if needed install) the products and educate the farmers how to use it. Also, they will be responsible for collecting the yearly subscription fees from the farmers. Second the cooperatives. They are (or may become) end-customer as well. They can use aggregated farmer statistics from the crop monitoring to forecast harvest in a certain region. Arvalis is probably the partner who executes the data analysis to come up with the relevant statistics. This means that Arvalis will have contact with the cooperatives to specify their requests and to explain the statistics.

The French agricultural cooperatives will be responsible for the end customer relationships (to get, keep, grow the customer base).

In the short run, Arvalis (Guy?) is collecting feedback from the farmers during an Open Day. He will present the result to the commercial farmers and asks how the interface should be. Later this year, after the harvest, he will also present the results and will ask feedback.

2.2.3.5. End-customer relations for the Water and Nitrogen Manager

The actual behaviour of users is very promising:

- Advisors are giving advices close to the system and very different than from the classic systems.
2.2.4. Partner Network & Horizontal Activities

2.2.4.1. Partner network for The Crop Monitoring Dashboard

Multiple actors (Bosch, Hi-phen, Orange) are involved in the development of the system. The business model depends on the other actors, too. All these actors bring in a part of the puzzle. Applied research institute Arvalis brings in the agronomy part and the APIs. Arvalis derives advice by comparing data of different fields. This can be used by the cooperatives directly to give to other companies. Arvalis develops the map for the Water & Nitrogen Manager but for instance does not make the link to the fertilizer machinery. The focus of Arvalis is to provide accurate application map. They are not the specialist connecting it to machinery. This is done by other companies. There are common formats. The specialism of Arvalis is agronomy and deriving the best advice for farmers. Hi-phen is the dashboard developer.

Arvalis tries (together with Bosch) to find new cooperatives for upscaling. Also, to explore if new crops can be included. Arvalis is working with wheat, barley, corn, tobacco and potatoes, but for instance does not work with sunflowers. But they have a good relationship with institutes that do work with sunflowers.

Figure 19: UC1.2 – Key partners in crop precision farming

2.2.4.1. Horizontal activities for The Crop Monitoring Dashboard

Feedback was asked from farmers (May/June 2019). They asked how much they saved with both tools. The answer: 50 euro per hectare. However, it is unsure whether farmers are actually willing to pay this. In recent years the durum prices were low as well as the yield.
2.2.5. Cost Structure & Internal Resources

2.2.5.1. Cost structure of the Crop Monitoring Dashboard

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.2.5.2. Cost structure of the Water and Nitrogen Manager

*Currently under development and will be discussed in the next version of this evolutionary business model overview*

2.2.5.3. Internal resources for the Crop Monitoring Dashboard

It seems like there is no real issue with respect to the needed and available resources. In Figure 8 this is explained by Arvalis. They have enough people to deliver their tasks and according to Arvalis also the cooperatives appear to have enough resources to promote and distribute the products and to educate the farmers on how to use these properly.

2.2.5.4. Internal resources for the Water and Nitrogen Manager

*Currently under development and will be discussed in the next version of this evolutionary business model overview*
2.3. UC1.3 – SOYA PROTEIN MANAGEMENT

Donau Soja and Soia Italy are working together in this use-case on two services to improve the competitive situation of soy farmers in Europe. The aim is to improve the quality of European soy in terms of protein content and production conditions. In order to prove these advantages to the end-consumer it is planned to elaborate the already existing Soya Quality labels ‘Donau Soja’ and ‘Europe Soya’ further, through even more data availability on so certified soybeans.

In order to reach this objective, the UC1.3 is implementing a software, for

1) supporting soya producers with their decisions during propagation (Soya Production Advisor, Soya-DSS), towards harvesting higher protein contents and
2) to support the data availability of the already existing Soya Quality labels ‘Donau Soja’ and ‘Europe Soya’, towards a Premium Soya Label.

The Soybean Production Advisor is focused on soy farmers and especially interesting for farmers who are technophile in general and, in particular, who have the possibility to irrigate their soya fields. The second tool for the quality documentation and traceability that tracks all relevant information for a European Soy Quality Label shares its data across the value chain and unfolds its value especially for processors and end-consumers.

Figure 20: UC1.3 - Value Chain Position

2.3.1. Product Description & Value Proposition

This use-case develops a production advisor for soy farmers and an advanced traceability solution for European soya quality labels. The major objective is to increase the protein content of European soya. The production advisor collects and processes sensor data on various levels (soil, weather, harvest indicators) and hence assist soya producers to learn about the production efficiency of different field zones - and adapt practices in that regard. In a second step, the vision of Donau Soja is to extend data availability for the already existing labels for soya produced in the EU: Donau Soja and Europe Soya and to give European soya farmers, as well as consumers, a more comprehensive differentiation opportunity against imported soya.

For the development of its services, the UC1.3 will closely collaborate with further developed use-cases like UC1.1 and UC3.1. UC 1.3 uses part of their hardware equipment and collaborates in terms of data interoperability. The evaluation of a collaboration with UC 5.3, which is also concerned with traceability,
showed that the potential for direct synergies is low, as UC 5.3 is concerned with meat – for direct human consumption, while Soya as feed for livestock has very different processing steps and hence different requirements regarding traceability. (e.g. The silos in which soya is stored normally contain a mix of soya beans from many sources (farmers, fields).

2.3.1.1. Description of Soya Production Advisor (SPA)

**Software component:** The Soya Production Advisor (SPA) supports farmers to learn about the production efficiency of their fields in more detail, as it manages data from their soya fields, with the aim to harvest higher protein contents. It provides suggestions for soya varieties that fit best with the geographical and metrological conditions of the field. Furthermore, the service provides advice on irrigation.

A premium feature will be harvest analytics. This service uses data of the protein content at the moment of harvest and connects it with the geolocation of the plant. This data can be correlated to soil data, asset application and meteorological conditions, in order to give better advice in the next growth cycle and to better predict the protein content at the next harvest.

**Figure 21: UC1.3 - Product Factsheet for Soya Production Advisor**

The software development of the Production Advisor is done by Sysman (UC 3.1) an Italian IT company, which developed also the irrigation- and fertility- management suite Bluleaf. Bluleaf is already a registered trademark with a good market reputation especially in the Italian market. With this decision, Donau Soja and Soia Italia win a strong distribution partner with an existing sales network and do not have to introduce a completely new brand with all additional marketing expenses to grow it. The Soya Production Advisor is a standalone version, but connected with the Bluleaf system for the irrigation feature. The crop model for soybeans, on which the irrigation feature is based on, was developed by UC 1.3, and is available in the Production Advisor through an interface to the Bluleaf software.

**Hardware component:** The SPA requires the following hardware components installed on the farm in order to produce proper decision-making knowledge and advice:

- NIR Protein Sensor (installed directly on combine, only used during harvest)
- Weather station (with 8 sensors: temperature, humidity, wind direction and intensity, solar radiation, rain gauge, barometer)
- Wireless module for weather station (GPRS; Sigfox)
- soil moisture sensors
- For CNHi combines: telematics kit for the wireless transfer of the combines yield monitor to the SPA (collaboration with UC 1.4)
2.3.1.2. Description of European Premium Soya Label

Donau Soja is the standard-holder of the quality labels Donau Soja (DS) and Europe Soya (ES). UC 1.3 actually examines the added value - for farmers, consumers and processors - of extending the data availability about DS/ES certified soya even further.

Several scenarios are under investigation. The most promising one is to extend traceability (which is now starting by the collector) further towards the field on which the soya was grown. Through connecting the data within the Soya Production Advisor – which is field specific - with the data in the existing Donau Soja Quality Management Software (traceability information starting from the collector along the further value chain up to the final product available already), full traceability, from the field to the plate is facilitated. Hence it provides full documentation and traceability of the production condition and the quality of soya and shares this data among the value chain. This promotes security and lets the end-consumer make a more informed purchase decision.

![European Premium Soya Label](image1)

**Figure 22: UC1.3 - Product Factsheet for European Premium Soya Label**

2.3.1.3. Value Proposition of Soya Production Advisor (SPA)

The major benefit of the SPA is to serve with comprehensive data on soybean production conditions as well as precise data on harvest indicators. Through superimposing data from these different layers, insights on the production efficiency of different field zones can be gained and production practices adapted accordingly.

Based on a solid soya crop model, with adaption possibilities to local circumstances and practical experiences through an interface in the SPA software, irrigation efficiency is increased. With enough soya producers working with the SPA and thus availability of big data, the software can be adapted in regard to smart advice based on swarm experience in the future.
Figure 23: UC1.3 - Benefits for Soybean Farmers & Farms Associations

2.3.1.4. Value proposition of European Premium Soya Label

Data availability on soya production will be increased, as production conditions and actions done by the producers are monitored comprehensively – from the field to the final product. Furthermore, paper work, both for farmers and collectors is minimized.

Increased data availability creates higher trust, which leads to higher competitiveness on the market. It is awaited that this advance leads to more licensed tons, which leads to higher revenue through more license fees flowing to the Standard holder.

The additional data available may also be further exploited which again brings direct revenue as well as an advance in the benchmark to other Soya quality standards (see section 5.3).
### 2.3.2. Exploitation & Monetization

#### 2.3.2.1. Revenue Model for Soya Production Advisor (Software)

**Software**

The SPA software is offered under a SaaS model with flexible monthly or yearly payments. The contract duration for an initial trial is set to 12 months after this period the farmer can cancel at any time. Furthermore, the exploitation model foresees a fee for additional customization if needed by the farmer.

The product suite contains of one always required basic module on top of which the customer can add optional components for the management of weather data, irrigation, and protein optimization.

![Figure 25: UC1.3 - B2B Business Model for Soya Production Advisor](image)

**Hardware**

Currently, it is planned to offer the hardware bundle (described here) at a lump sum price at cost level and an additional installation fee for the implementation and configuration of the hardware. The total hardware installation for an average soy farm adds up to about €23,000, for the premium version, including protein optimization. Please find further information on the costs connected with the hardware equipment under the section: 4.3.7. Cost Structure & Internal Resources.

However, this current model still brings an initial cost barrier for farmers to actually try out the software solution and sign-up to a SaaS contract. Therefore, WP4 currently investigates the model of hardware-as-a-service or equipment-as-a-service where the hardware is initially pre-financed by the software provider through banks (e.g. leasing models) or through private investors. In this case, the farmer would sole pay an initial implementation fee and a higher monthly or yearly rate for the software service. In this model the farmer does not become the owner of the equipment and if the farmer decides after the end of the 12 months test period to terminate the contract the equipment is rebuild and collected by the service provider.

Another option would be the offering of a “light” version of the service that relies on weather forecast data instead of sensors in the field. This setup would save the deployment and hardware costs, but would be in return less accurate than the sensor solution.
### 2.3.2.2. Pricing of Soya Production Advisor

The current pricing for the soya production advisor is solely based on a first internal costs analysis of UC1.3. It considers an individual price for each software component as well as an option to receive the pre-financed hardware in return for a monthly fee. The presented price model contains about 33% margin for the software components and 13.6% margin for the hardware leasing. The total average margin of the complete software suite including the hardware is at 29.65%.

<table>
<thead>
<tr>
<th>Product Module</th>
<th>Type</th>
<th>Monthly Price</th>
<th>Monthly Price</th>
<th>Total Monthly Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Software</td>
<td>Hardware</td>
<td></td>
</tr>
<tr>
<td>Weather analytics</td>
<td>Required</td>
<td>410,15 €</td>
<td>45,19 €</td>
<td>455,34 €</td>
</tr>
<tr>
<td>Fertilization</td>
<td>Optional</td>
<td>54,43 €</td>
<td>0,00 €</td>
<td>54,43 €</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Optional</td>
<td>54,43 €</td>
<td>9,88 €</td>
<td>64,32 €</td>
</tr>
<tr>
<td>Variation selection</td>
<td>Optional</td>
<td>54,43 €</td>
<td>0,00 €</td>
<td>54,43 €</td>
</tr>
<tr>
<td>Protein optimization</td>
<td>Optional</td>
<td>73,18 €</td>
<td>238,59 €</td>
<td>311,77 €</td>
</tr>
</tbody>
</table>

**Figure 26: UC1.3 - Monthly Price Calculation for Suite**

<table>
<thead>
<tr>
<th>Product Module</th>
<th>Profit</th>
<th>Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Software</td>
<td>33,33%</td>
</tr>
<tr>
<td>Weather analytics</td>
<td>136,72 €</td>
<td>33,33%</td>
</tr>
<tr>
<td>Fertilization</td>
<td>18,14 €</td>
<td>33,33%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>18,14 €</td>
<td>33,33%</td>
</tr>
<tr>
<td>Variation selection</td>
<td>18,14 €</td>
<td>33,33%</td>
</tr>
<tr>
<td>Protein optimization</td>
<td>24,39 €</td>
<td>33,33%</td>
</tr>
</tbody>
</table>

**Figure 27: UC1.3 - Calculation of monthly profit**

#### 2.3.2.3. Revenue model for European Premium Soy Label

Increasing the information availability and proofing it through gapless transparency, creates a quality standard with high competitiveness among other certified standards. This will lead to higher trust and reputation and more tons of soya will be licensed, which results in more revenue through license fees.

#### 2.3.2.4. Pricing of European Premium Soy Label

The costs of implementing the premium soy label are covered through a fee per licensed ton. In consideration of being in the middle of the evaluation of the implementation of the European Premium Soya Label, it’s too early to set a certain price for the intended fee per licensed ton.
2.3.2.1. Additional Data Revenue Model

Collecting georeferenced, field specific data, both regarding production conditions as well as quantitative and qualitative harvest parameters, is a valuable data source for swarm intelligence, especially concerning the statistical evaluation of correlations between soil, genetics, weather and the outcome (harvest). Such data cannot only be used for supporting decisions during production, but also for training prediction models of soya yield and protein outcome, for evaluating land use change, calculating CO2 footprints and Life Cycle Assessments.

2.3.3. Customers & End-user Relations

2.3.3.1. Distribution of Soya Production Advisor

The Soya Production Advisor will be distributed through Donau Sojas and Soia Italias network of soya producers, processors and advisors. Through the further elaboration of the existing Quality Standards towards the premium label with increased data availability, the SPA will be the tool to be used by the producers in order to provide this information. A free-of-charge basic module of the SPA will facilitate the collection of the additional data and build the first stock of users for the further, chargeable, modules (weather data, irrigation etc.)

Furthermore, Sysman is a possible distribution partner for direct sales on the Italian market, as they are already present there for other crops with the Bluleaf system.

The use-case aims to enter in a first step the following European countries:

<table>
<thead>
<tr>
<th>Country</th>
<th>Distribution Partner</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>Sysman, Soia Italia</td>
<td>Royalties flow to Donau Soja &amp; Soia Italia</td>
</tr>
<tr>
<td>Austria</td>
<td>Donau Soja</td>
<td></td>
</tr>
</tbody>
</table>

Figure 28: UC1.3 - Distribution partners for Soya Production Advisor

2.3.3.2. Marketing strategy for Soya Production Advisor

The Soya Production Advisor shall be promoted through the Donau Soja Quality Standards. Through a basic module – free of charge, but mandatory to use for collecting the additional information necessary for the Premium Soya Label (field specific information) users are acquired. The further chargeable modules of the SPA (weather station, irrigation etc.) are offered to them.

2.3.3.3. Distribution of European Premium Soya Label

The major issuers of the European Premium Soya Label will be Donau Soja and Soia Italia which target together the main European protein producers starting with Italy and Austria. After the further development of the Donau Soja /Europe Soya Standards towards the above described European Premium Soya Label, distribution channels for the Premium Label are the same as for the existing Donau Soja /Europe Soya Standards, as the Premium Label replaces the existing Standards. This means a distribution network is available already.
2.3.3.4. Marketing strategy for European Premium Soya Label

The marketing strategy for the Premium Soya Label needs to be further elaborated. Envisaged anchors are: trust through increased information availability, proof of Land-Use-Change free soya, reduced CO2 footprint; all in comparison to other Soya Quality Standards.

2.3.3.5. End-consumer relation for Soya Protein Advisor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.3.3.6. End-consumer relation for European Premium Soya Label

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

### 2.3.4. Partner Network & Horizontal Activities

2.3.4.1. Partner network for Soya Production Advisor

Sysman, Bluleaf, Soia Italia, Donau Soja

2.3.4.2. Horizontal activities for Soya Production Advisor

Interface to bluleaf system

2.3.4.3. Partner network for European Premium Soya Label

Soia Italia, Donau Soja

2.3.4.4. Horizontal activities for European Premium Soya Label

- Benchmark to other soya quality standards
- Monitor market trends
- Strategic decisions on how to position in that environment (beyond UC 1.3)
2.3.5. Cost Structure & Internal Resources

2.3.5.1. Cost structure of Soya Production Advisor

Please see below the cost structure of the product components of the Soya Production Advisor:

<table>
<thead>
<tr>
<th>Direct Software Costs</th>
<th>Basic Product</th>
<th>Feature 1</th>
<th>Feature 2</th>
<th>Feature 3</th>
<th>Feature 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weather</td>
<td>Fertilization</td>
<td>Irrigation</td>
<td>Variation</td>
<td>Protein</td>
</tr>
<tr>
<td></td>
<td>analytics</td>
<td></td>
<td></td>
<td>selection</td>
<td>optimization</td>
</tr>
<tr>
<td>Personnel Overheads</td>
<td>40%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Marketing &amp; Customer Acquisition</td>
<td>480,00 €</td>
<td>180,00 €</td>
<td>180,00 €</td>
<td>180,00 €</td>
<td>180,00 €</td>
</tr>
<tr>
<td>Product support</td>
<td>280,00 €</td>
<td>105,00 €</td>
<td>105,00 €</td>
<td>105,00 €</td>
<td>105,00 €</td>
</tr>
<tr>
<td>Total Service Overheads</td>
<td>760,00 €</td>
<td>285,00 €</td>
<td>285,00 €</td>
<td>285,00 €</td>
<td>285,00 €</td>
</tr>
<tr>
<td>Direct Investment Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development costs - Basic</td>
<td>40,00 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development costs - Fertilization</td>
<td>50,00 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development costs - Irrigation</td>
<td></td>
<td>50,00 €</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development costs - Variety</td>
<td></td>
<td></td>
<td>50,00 €</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development costs - Protein</td>
<td></td>
<td></td>
<td></td>
<td>100,00 €</td>
<td></td>
</tr>
<tr>
<td>Total Investment Costs</td>
<td>40,00 €</td>
<td>50,00 €</td>
<td>50,00 €</td>
<td>50,00 €</td>
<td>100,00 €</td>
</tr>
<tr>
<td>Reoccurring Service Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs for meteological data</td>
<td>2.400,00 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Server capacities</td>
<td>0,80 €</td>
<td>0,30 €</td>
<td>0,30 €</td>
<td>0,30 €</td>
<td>0,30 €</td>
</tr>
<tr>
<td>Total Indirect Service Costs</td>
<td>2.481,20 €</td>
<td>100,45 €</td>
<td>100,45 €</td>
<td>100,45 €</td>
<td>200,45 €</td>
</tr>
<tr>
<td>Total Costs</td>
<td>3.281,20 €</td>
<td>435,45 €</td>
<td>435,45 €</td>
<td>435,45 €</td>
<td>585,45 €</td>
</tr>
<tr>
<td>Margin</td>
<td>1.640,60 €</td>
<td>217,73 €</td>
<td>217,73 €</td>
<td>217,73 €</td>
<td>292,73 €</td>
</tr>
<tr>
<td>Total Revenue per year</td>
<td>4.921,80 €</td>
<td>653,18 €</td>
<td>653,18 €</td>
<td>653,18 €</td>
<td>878,18 €</td>
</tr>
<tr>
<td>Monthly Price</td>
<td>410,15 €</td>
<td>54,43 €</td>
<td>54,43 €</td>
<td>54,43 €</td>
<td>73,18 €</td>
</tr>
</tbody>
</table>

Figure 30: UC1.3 - Cost structure of Soya Production Advisor

2.3.5.2. Internal resources for Soya Production Advisor

Aim: Include in Quality Management and Standard Team at Donau Soja. SPA as tool to use for collecting the field specific data mandatory for the Premium Label. Hosting and maintaining of software by Sysman (against fee).
2.3.5.1. Cost structure of European Premium Soya Label

For the time being, details on the cost structure of the Premium Label cannot be shared.

2.3.5.2. Internal resources for European Premium Soya Label

Donau Sojas Quality Management and Standard Team.

2.4. UC1.4 – FARM MACHINE INTEROPERABILITY

Every farmer wants his equipment to work seamlessly together, designed as one integrated system. Since farmers also want freedom of choice to select the best equipment for their needs, they expect equipment, machinery and software to work together in an interoperable way, regardless of vendor. Interoperability of IoT devices and machinery today is in its infancy. For the farmer it is a challenge to make all devices work together in the digital space, as there are different platforms using vendor specific communication.

Therefore, UC1.4 is implementing a common data communication standard for all farm machine communication. It is based on the ADAPT data object developed by AgGateway. All farm machine manufactures are currently writing plugins to translate their vendor machine data object into the common ADAPT data model.

“Only an overall API architecture connecting all farm machines enabling secure two-way communication can enable smart farming on a large scale.”

The use-cases target mostly the farm production level of the value chain, the data created however is important for the stages before and after the farm level.

Figure 31: UC1.4 - Value Chain Position
2.4.1. Product Description & Value Proposition

2.4.1.1. Description of IoField Gateway

The product is a joint API architecture connecting machinery of all major farm machine manufacturers in Europe in a safe way allowing to receive real-time data from the farm machine and to send orders back to the machine for automations of production processes on the field. (like seeding, fertilization, spraying or harvesting)

The platform sets the ADAPT standard for inter-machine communication and for the delivery of data to third-party software providers. Furthermore, it offers secure hardware to connect farm machines and to make sure that no harm can be created through orders send by software applications.

If a software or platform provider would like to gain access to farm machine data and gain the ability to directly communicate with farm machines of their clients, they need to agree to the terms of the farm machine manufacturer platform. Some of them will ask the software companies a data access fee, some of them are integrating it in services sold to the farmer, and others consider data streams a product feature for which no additional fees should be charged.

Telematics Gateways on Farm Machinery will be mostly OEM specific for various reasons;

- Safety, Security, and Liability (the OEM has to ensure this in the first place)
- Remote Servicing, Remote Display, Firmware updates over the air
- Specific machine settings and optimizations

As such these OEM specific Telematics Gateways will be used for first and above all a secure data communication path to the OEM Cloud Portal, providing different data communication streams;

1. Telematics and Machine specific data capture (OEM interest)
2. Wireless data exchange of Task/Field Data (Farmer or Contractor interest)
3. Fleet Management data (Contractor interest)

![Figure 32: UC1.4 - Product Factsheet for IoFieldGateway](image-url)
DataConnect

In November 2019, a first market application derived from the work of use-case 1.4. With the introduction of DataConnect, farmers will now be able to securely exchange and view machine data using their telematics platform of choice without having to switch portals or manually transfer data from one system to another. The initiative is a collaboration among John Deere, CLAAS, CNH Industrial, and 365FarmNet.

As the first direct, manufacturer-independent solution, this common interface enables farmers who operate John Deere, CLAAS, New Holland, Case IH, or Steyr farm equipment to easily access and view basic components of machine data from a single portal without the need for any additional hardware or software. This includes current and historical machine location, current fuel tank level, working status, and forward speed from connected machines through farmers’ preferred portals like the John Deere Operations Center, AFS Connect, MyPLM Connect, CLAAS TELEMATICS, and 365FarmNet.

As members and supporters of the Agricultural Industry Electronics Foundation (AEF), John Deere, CLAAS, CNH Industrial, and 365FarmNet will share their experiences with AEF to encourage a standardized data interface architecture, similar to ISOBUS, across the entire equipment industry.

Other equipment manufacturers, software providers, associations, and standardizations committees are invited to help develop and participate in the interface. The four companies plan to roll out DataConnect in the later part of 2020.

2.4.1.2. Value Proposition of IoField Gateway

Farmer
The farmer is able to seamlessly connect all his devices and machines to one farm management platform and to potentially automate many production processes on the field. For this he is using the same methodology, which works for different equipment and different software. The UC1.4 APIs rely on secure methods for authentication for protecting the farmer’s data and securing machines from hackers in the best way.

- Overall device interoperability
- Secure data transmission

**Without our Product or Service**

- Inefficient data transfer
  - Currently, data is predominantly transferred manually between machinery and FMS.

**With our Product or Service**

- Effortless data transfer
  - Seamless data transfer by a common application programming interface and data modeling.

**Here is the difference**

- Hands-free data collection: the means to collect data from various sources without manual interference.

**Software Provider**

Software developers gain access to new sorts of data directly from the machine that enables new management and forecasting algorithms. Based on the smart data, the software can create precise acting propositions for farm machines and send these orders directly to a machine on the field.

- Access to real-time precision data from the field
- Secure connection to farm machines
- Overall device interoperability

**Software Platforms**

Software platforms can offer their application providers safe access to farm machine data and enable further process automation on the farm level. This saves development costs and enables the development of various applications that enrich the marketplace producing further revenue.
Farm Machine Manufacturer

This platform produces new revenues for farm machine manufacturers deriving from monetization of the data from farm machines and to give access to external software applications, such as for example independent brand Fleet Management applications. Furthermore, the digital interoperability will increase the value of the farm machine for the farmer as it provides now access to automation and a more efficient farm management.
2.4.2. Exploitation & Monetization

2.4.2.1. Revenue model for IoField Gateway

The standards are decoupled from the business model. Standards are a building block of a system or product. That product can be monetised in several ways. The additional value of using standards is that more connectivity will lead to more (agronomic and machine) services to be developed, with more competition and choice for the farmer. Whatever business model is used, standards will always be beneficial.

Standards are important for the emergence of the agricultural data eco-system. McKinsey estimates that standards account for 20 to 40% of the value created by IoT. There is a big risk that we miss a big part the IoT opportunity without interoperability.

But there is a peculiarity with data exchange which does not help the implementation of standards. There is a bit of a chicken and egg problem. Equipment manufacturers don’t implement standards because no software is supporting them. The way around software companies don’t implement the standards because they can’t use them to pull data. And at the same time the farmer doesn’t want to pay because he does not see the value added. At this point we are in a development phase where the final point of view is not set, and we slowly need to work through this limbo with proof of concepts and evangelisation.

The aim is to develop a business model that allows the farm machine manufacturers as well as the service providers to benefit from the open exchange of data across vendors. Therefore, the business model needs to offer on the one side an additional revenue stream for farm machine manufacturers in order to keep them motivated to develop data standards forward, evolve the data security dimension and to further foster an open data exchange approach. On the other side the model needs to offer all service providers affordable access to farm machine data and a solution to safely transfer data commands with no further liability to farm machines of their clients.

When we’re looking at the data streams, this is the current situation for value generation:

- Farmers will be able to work more efficiently, nonetheless they don’t perceive the value added as a monetary revenue stream generated by IoT systems for which they want to pay.
- Software and service providers will be able to develop new services and grow their revenue, but are facing difficulties in getting their tech sold.
- Equipment manufacturers have to implement standards for value creation by others. There is no direct value for them from standards, but only a cost.

The value chain participants therefore use different business models to pay for the data streams:

- The farmer is paying the subscription fees for the data from his products.
- The software companies are paying the equipment/tech providers to get access to the data.
- The equipment providers provide the data free with the product. The costs for the data streams is as such baked into the cost of the product. Potential internal data monetisation may off-set the costs for the data features.

There are pro and cons for the different models in use. All three models are in use by the different members of use case 1.4. The market will decide which model is most applicable. One important thing to ote is that the business models used influence the perception of the ownership of the data. For the scope of this chapter we will omit this discussion.

The ATLAS Project

The newly launched EU project on the development of an Agricultural Interoperability Analysis System (ATLAS) will build on the results of UC1.4 and aims for the farmer to be able to share data from his machine network with other European companies on the ATLAS platform. The special feature of the
platform is that every farmer can decide for himself which data he wants to release. In addition, the system should be compatible with all agricultural machinery. The platform will allow the flexible combination of agricultural machinery, sensor systems and data analysis tools to overcome the problem of lacking interoperability and to enable farmers to increase their productivity in a sustainable way by making use of the most advanced digital technology and data.

Figure 37: UC1.4 - ATLAS data exchange concept

**The DataConnect Model**

**The Agrirouter Model**

The only reference business model in use today money upstream the value chain was introduced in November 2018 by DKE Data GmbH & Co. KG with the Agrirouter and is shortly described in the paragraph below.

**Current business model**

The Agrirouter simplified its business model quite drastically in 2019 to a simple fixed yearly fee of 50€ per connected farmer and service payable by the service provider. There is no more any direct contractual relation of the farmer with the Agrirouter and the Agrirouter interface can be fully integrated into the farm service. So if a farmer uses three different services from three different service provider each of these provider pays 50€ to Agrirouter to get access to the farmers machinery data. So in total the farmer has indirect data exchange costs of 150€ per year. The more services in use the higher the
costs, not taking anyhow the volume or number of data points into account that are being transferred. 1 data point a year or 1m data points per minutes result both in 50€ / year for the service provider.

**Old business model**

The Agrirouter business model foresees a data subscription based on the amount of data transferred through the platform. Each farmer can easily connect machines and devices to the platform and offer their data to selected service providers. The service provider (farm app or farm management and information systems) books a subscription for each client farmer and pays according to the amount of data transferred. The Agrirouter offers data plans from 0,2GB up to 2,5GB of data transfer per year at a rate of 55€ / GB.

![Figure 38: UC1.4 - Agrirouter old business model](image)

The legal structure is an open non-profit shareholder company in order to not convey the impression of a cartel of manufacturers with a potential monopoly in data transfer of agricultural machines. The current shareholders of the DKE Data GmbH & Co. KG are Agco, Amazone, Exel Industries, Grimme, Horsch, Krone, Kuhn, Lemken, Pöttinger, Rauch and SDF. There is no privilege for founding companies as each party is required to pay its partnership share according to its current company revenue with farm machines and gains one equal vote in the shareholder assembly.

There will be more of such 'Router' providers; As an example you can look to Join-Data in The Netherlands. Web: [https://www.join-data.nl/](https://www.join-data.nl/). They are having a similar approach as AgriRouter.

**Critique:** The business model has of the Agrirouter is a very good first step in the right direction, but has still a couple of shortcomings. One point of criticism is that these services do little more than Authorization and Routing of data flows, without value creation. First of all, it does not generate any additional profit for farm machine manufacturers as it fears to be a seen as a cartel of manufacturers that try all together to create a data exchange platform with a monopoly on data transfer that as soon as it is established in market will dictate prices to service providers.

Then as a final consideration, most OEM manufacturers sell worldwide, so how many of such router platforms will pop-up, and how do we connect and maintain all these connections?

It does not equally involve service providers as shareholders with a vote on how to develop the platform forward. Even so the actual value is generated on this side of the value chain. Therefore, needs of service providers should be key for the further development.

**The IoF2020 Model**

IoF2020 - Use-Case Business Models
Therefore, the proposal for an IoF2020 business model foresees a slightly adapted revenue model and legal construction. The core of this business model is to form a company that acts as an independent collection agency on behalf of its stakeholders. Manufacturers sign up to the platform and register all their connectable devices to the platform catalogue. If the farmer wishes to connect any of the farm machines there are two options:

- Option 2: Connect the machine to specific service (Data Subscription Plan)
- Option 1: Monetize data and share with third party services (Data Marketplace)

**Option 2**: If the farmer wants to use a specific service for example a disease detection system, he simply registers to the service, connects all necessary machines and sensors requested by the service to work properly and gives the service permission to use the data for this specific purpose. In return the farmer pays the fee for the service to the service provider. There is no contractual relationship with the farmer.

The service provider automatically signs a subscription plan for the farmer with the fitting amount of data to transfer per month or year. When the farmer pays the subscription, the service provider transfers the data subscription fee to the platform. The contractual relation between the service provider and the platform stays active as long the farmer keeps the machines registered and data is flowing.

50% of the subscription fee remains with the platform to cover its running costs and further development. The other 50% flow directly to the manufacturers of the connected machines or sensors. The share would be divided by the manufacturers of the devices registered by the farmer either equally by the number of devices, the amount of data transferred or the quality of the offered data. This is will be tested within the IoF2020 project and is still under assessment.

**Option 1**: The other option is that the farmer simply wants to monetize or share part of the farm data via the data marketplace of the platform. The farmer defines the sharing criteria that will then be part of the license under which the data is offered. The data flows in return for a regular fee or on-time payment by a third-party service or can be offered for free by the farmer. If there is money flowing back to the platform again 50% of the revenue flows to the platform, while the other 50% are equally shared between the farmer and the manufacturer.
On-boarding Fee for Manufacturers

Lump-sum fee setting up a manufacturer account and for registering each farm machine to the data platform payable by the machine manufacturer. Furthermore, there might be fees for updates of machine interfaces.

2.4.2.2. Pricing of IoField Gateway

The pricing of the data transfer is currently not clear. The only indication in market is the pricing of the Agrirouter. This exchange platform charges each services provider a fixed yearly fee of 50€ per farmer payable by the service provider.

The old Agrirouter business model set the volume-based price to an average of 55€ per GB of data transferred. Back then it offered the following data packages:

<table>
<thead>
<tr>
<th>Data Package</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 GB</td>
<td>13€ per year (65€ per GB)</td>
</tr>
<tr>
<td>0.5 GB</td>
<td>113€ per year (45.20€ per GB)</td>
</tr>
<tr>
<td>1.0 GB</td>
<td></td>
</tr>
<tr>
<td>1.6 GB</td>
<td></td>
</tr>
<tr>
<td>2.5 GB</td>
<td></td>
</tr>
</tbody>
</table>

2.4.2.3. Additional data revenue model

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.4.3. Customers & End-user Relations

This machine data platform is in its core dedicated towards farm software or platform providers that are interested in real-time? machine data and control of farm machines and their equipment.

As the ADAPT data object is an internationally recognized standard and the platform is purely data and not context based, the target group is fully international and only limited by the spread of compatible farm machinery in the world.

2.4.3.1. Distribution of IoField Gateway

As the ATLAS project will build in central parts on the results of UC1.4, it will also take over the distribution and dissemination of the results. The overall objective of ATLAS is next to the development of an open digital service platform for agricultural applications to build up a sustainable ecosystem for innovative data-driven agriculture using the platform. The benefits of data driven agriculture will be demonstrated using the ATLAS platform within a multitude of pilot studies. Around these pilot studies, so called "Innovation Hubs", a network of end-users, service providers, researchers and policy makers along the agricultural value chain, will be established to exploit the benefits of digital agriculture to a larger audience. Innovative companies will be attracted through seed funding to provide their services through the platform. With the knowledge created from these pilot studies, ATLAS will put significant effort into the definition of the next generation standards for data driven agriculture."

Therefore, IoF2020 and UC1.4 will closely collaborate on the distribution activities with the ALTAS project as well as the SmartAgriHubs project, which is working on the setup on an innovation ecosystem of digital innovation hubs and competence center for the development of agrifood tech innovations.

2.4.3.2. End-customer relation for IoField Gateway

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.4.4. Partner Network & Horizontal Activities

2.4.4.1. Horizontal activities for IoField Gateway

In order to make the platform a success, there are a couple of horizontal products and services that need to be brought into place.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine connectivity toolkits</td>
<td>Development of hardware to connect older or third-party farm machinery to the platform.</td>
</tr>
<tr>
<td>Innovation partnerships &amp; investments</td>
<td>Farm machine manufactures should engage into activities that foster the development of farm machine innovations and to create an open ecosystem with financial and strategic support of startups that develop hardware innovations complementing the offer of current farm machine portfolios. Smaller companies gain the advantage of a large and professional distribution and maintenance network, while farm machine manufacturers gain new innovations to sell with their core machine products.</td>
</tr>
<tr>
<td>Hardware onboarding</td>
<td>The platform needs to be open for new hardware and manufacturers to join the platform. There the machine platform needs to provide common procedure for the onboarding of new manufacturers to the system. The onboarding of new partners is general open to everyone and can only prohibited by a majority decision of the current partner assembly.</td>
</tr>
<tr>
<td>Code compliance</td>
<td>In order to support only applications that are compliant with the security and ethical framework of the platform, there need to be a code revision like Google or Apple putted in place to secure the quality of their app catalogue.</td>
</tr>
<tr>
<td>Consulting</td>
<td>There will be as well individual consulting being offered to service providers, manufacturers as well as farmers if needed.</td>
</tr>
<tr>
<td>Farm networks for secure transmission</td>
<td>Support on setting up secure farm networks to allow 2-way communication with farm machines.</td>
</tr>
</tbody>
</table>

2.4.5. Cost Structure & Internal Resources

2.4.5.1. Cost structure for IoField Gateway

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.4.5.2. Internal resource for IoField Gateway

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.5. UC1.5 – POTATO PROCESSING DATA EXCHANGE

The focus of UC1.5 is on data exchange between the field and the potato processing industry. Opening & Enabling data flows between the farmer and the processing industry (and eventually other stakeholders in the supply chain like retailers and consumers) is considered as an important step in smart digital farming. The general objective of this project is to enable access for potato processing companies and other stakeholders in the chain of potato processing to certain specific data elements collected on the field and in the shed. This enables the processing companies to optimize logistical and quality processes to ensure the continuity and quality of their activities. Stakeholders further down the supply chain could also benefit from this but are not considered in this project (even if access to data could be quite easily arranged with the consent of the farmer). Besides a technological component we also want to create value for all stakeholders in the potato agricultural sector.

More specific the goal of this project is to measure and integrate following specific data points:

- in-season growth model data (yield prediction)
- real-time caliber and quantity yield data during harvesting (yield caliber measurement)
- traceability data from field to shed after harvesting (focus on location – “where are which potatoes stored”)

The objective of UC1.5 is to turn the current value chain into a complete electronic process flow between farmers and processing companies, specifically for the potato industry. This integration process and data flow can also be extended if wanted towards other stakeholders further down the supply chain.

2.5.1. Product description & value proposition

2.5.1.1. Description of Potato Monitor

**Hardware - Product description:**

Potato harvester with sensors measuring size and shape (AVR) □ MS Azure IoT platform

Drones with videos sensing the growth stage (Aurea)

**Software - Product description:**

Decision support system for farmers to increase yield output with integration to farm management system. Transparency and traceability platform to exchange data across the potato value chain with supply management interface or frontend – details on regional potato supply and sizes

The product is this use case is mainly data. We have several data elements which can be considered as the product:
Data elements:

- Yield prediction per field
- Yield measurement in terms of size of the potatoes
- Traceability information where are which kind of potatoes stored

2.5.1.2. Value proposition of Potato Monitor

Processing companies will have access to (1) yield prediction data during the growing season and (2) real-time place specific harvesting yield calibre data and (3) traceability information in order to integrate this data into their ERP and planning software. By doing so, they will be able to optimize their forecasting, quality and processing processes while keeping costs as low as possible.

**Hardware - Value proposition:**
Connectable potato harvester with sensing equipment to measure potato size and yield per GPS position

Drone sensing service network like Uber

**Service – Value proposition:**
Better prediction of potato supply with processing adjustment to available sizes

2.5.2. Exploitation & monetization

2.5.2.1. Revenue model for Potato Monitor

Two initiatives were taken to discuss the business model. A small potato consortium in Belgium discussing the value of the data stream and the need for a win-win model to share the value between all stakeholders.
One of the main ideas that will be explored is a win – win model by which farmers get benefits from processing industries when they are sharing their data via e.g. AVR or Aurea Imaging.

A second initiative is the interaction with WP4. In this interaction we also discussed the more basic business models between AVR e.g. and end customers like farmers.

Opportunities:
- Access to potato consortium (Delaware, Bayer, AVR, Aristo)
- Synergies with UC1.1 focused on soil analysis and decision support service for potato farmers
- Potential integration in existing farm management information systems (like 365FarmNet, Akkerweb)

Challenges - Product:
- Missing partners in the further value chain – retailer is missing
- Part of the service already available in other use-cases
- Conflict of equipment manufacturer and service provider – danger of vendor login for farmer

Challenges - Business Model:
- Business model for platform not yet clear – rather complex as investments are with the farmer while added value occurs mainly on the processing and retail level

Figure 41: UC1.5 - Data & value flow in potato value chain
2.5.2.2. Pricing of Potato Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.5.2.3. Additional data revenue models

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.5.3. Distribution & marketing strategy

2.5.3.1. Distribution and sales channels for Potato Monitor

AVR plans to establish as platform provider for transparency in the potato supply chain

2.5.3.2. Marketing strategy for Potato Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.5.4. Customer & end-user relations

2.5.4.1. End-customer relations & loyalty for Potato Monitor

2.5.4.2. Product support services for Potato Monitor

2.5.5. Partner network & horizontal activities

2.5.5.1. Partner network for Potato Monitor

2.5.5.2. Horizontal activities for Potato Monitor

2.5.6. Cost structure & internal resources

2.5.6.1. Cost structure for Potato Monitor

2.5.6.2. Internal resources for Potato Monitor
2.6. UC1.6 – DATA-DRIVEN POTATO PRODUCTION

The UC1.6 for a data-driven potato production aims at building on top of gaiasense, an innovative market-ready IoT-based Smart Farming solution, and extend it to enable the development of services for irrigation, pest management and fertilization for potato producers in Cyprus, Poland and Ukraine. The services, which aim at reducing the costs of potato production per hectare of cultivation while improving its quality, will use scientific models tailored to the specificities of the targeted areas, the different potato varieties and the specific requirements of the targeted markets. The models will be fed with data from a network of telemetric IoT stations (Gaiatrons) installed in the field collecting atmospheric and soil measurements, satellite data (Sentinel 1 and 2), as well as data provided by the producers and agronomists involved, including information related to inputs - outputs but also to all those parameters whose values identify the specificity of each production unit in the vast variety of cases.

These services will be used by the agronomists and farming advisors (employed by the IoT4Potato business partners) consulting the involved producers, which will feed the provided applications with their own observations, and produce the specialized advice (on a case-by-case basis) in a form accessible and understandable by each producer.

![Figure 42: UC1.6 - Value chain position](image)

2.6.1. Product description & value proposition

2.6.1.1. Description of Gaiasense IoT4Potato

Neuroreplus extends in this use-case its existing Gaiasense platform by adding potatoes as a supported crop. The Gaiasense platform is a multi-dimensional, integrated smart farming system that collects data from the field by the Gaiatron sensing stations as well as satellite images and provides decision support knowledge to farmers, consultants and researchers. The current system supports mainly fruits and vegetables like lettuce, grapes, olives, peaches, kiwi, cotton, pistachio, tomato, oranges, garlic, beans and broccoli.

Gaiasense remote is the first data dimension where information is acquired from sources such as satellites, aircrafts and other aerial vehicles that are equipped with imaging capturing systems. This
aerial data is the basis for the calculation of indices measuring aspects like plants health or soil status over longer time periods.

**Gaiasense field** is the second data dimension where information is collected by the Gaiatron telematic station, which are installed at selected points of specific parcels of the field in order to deliver representative data for grown crop. Gaiatron stations are manufactured, installed and operated by Gaiasense with no further investment or maintenance burden for the farmer or agricultural advisor. The Gaiatron stations are specifically designed for a selected crop and measures a wide range of atmospheric, soil and biological parameters, like air and soil temperature, soil salinity, leaf wetness, rainfall, solar radiation and others.

**Gaiasense field** is the observation level within the field and offers farmers or advisors several specifically designed smartphone applications to map symptoms of infections, counting of insects in traps as well as the management of soil and leaf samples.

**Gaiasense farm** offer computer and mobile applications to farmers and advisors for the daily recording of cultivation work and farm tasks.

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**Figure 43: UC1.6 - Gaiasense system dimensions**

Based on the IoT data from the special Gaiatron stations for potatoes, the core decision support features of the IoT4Potato module are the following:

- **Plant protection advice** – Prediction of the occurrence of the most important potato pest and diseases in the monitored areas.

- **Irrigation advice** – Advice on the right balance of water usage to reduce the waste of water while preventing potential risks imposed from dehydration.

- **Fertilisation advice** – Based on all connected information from soil, atmosphere and plants the support systems advices on the most efficient application of fertilizer to protect ground water while ensuring that plants have access to necessary nutrition for optimal growth.

Specific feature that UC1.6 adds within the IoF2020 programme:

- Context-based decision support
- Low cost weather stations
IoT-based solution generating big data and making use of the data with machine learning

2.6.1.2. Value proposition of Gaiasense IoT4Potato

The key value of the Gaiasense IoT4Potato module for the farmer is the reduction of production inputs and cultivation risks while increasing or at least maintaining the yield per hectare. This way Gaiasense supports the farmer to become more efficient and reduce risks what results in sustainable costs savings. The performance indicators of the Gaiasense system show that it can realize reductions up to the following rates:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Reduction</th>
<th>€/ha/year</th>
<th>Total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of nitrogen</td>
<td>-15%</td>
<td>37,50 €</td>
<td>250,00 €</td>
</tr>
<tr>
<td>Reduction of plant protection</td>
<td>-15%</td>
<td>105,00 €</td>
<td>700,00 €</td>
</tr>
<tr>
<td>Reduction of water</td>
<td>-25%</td>
<td>132,50 €</td>
<td>530,00 €</td>
</tr>
<tr>
<td>Total costs</td>
<td>-19%</td>
<td>275,00 €</td>
<td>1,450,00 €</td>
</tr>
</tbody>
</table>

*Figure 44: UC1.6 - Economic objectives & KPIs*

As show above, the application of the Gaiasense system could result in cost saving of up to 275€ per hectare per year compared to an average European potato farm this year.

In the following, we want to assess in how far this increase in average the margin earned by a potato farmer. Therefore, we have to calculate the average production amount per hectare and the average price for a ton of potatoes. The following calculation is based on 2018 data from Eurostat:

<table>
<thead>
<tr>
<th>Statistical data for 2018</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total potato production (EU28)</td>
<td>51,922,000 t</td>
</tr>
<tr>
<td>Total production area (EU28)</td>
<td>1,689,500 ha</td>
</tr>
<tr>
<td>Total potato revenue (EU28)</td>
<td>11,327,400,000 €</td>
</tr>
<tr>
<td>Average price per t</td>
<td>218.16 € / t</td>
</tr>
<tr>
<td>Average production per ha</td>
<td>30.73 t / ha</td>
</tr>
<tr>
<td>Total average revenue per ha</td>
<td>6,704 €</td>
</tr>
</tbody>
</table>

*Figure 45: UC1.6 - Average revenue of European potato farmer*

Therefore, by the usage of the Gaiasense system an average farmer could improve the margin on potato sales by about 4%. This is an excellent result in a very low margin business.
Furthermore, the farmer becomes more attractive as supplier for the processing industry, which is interested in predictive data on production conditions, quality and supply of potatoes in order to reduce machine downtime and optimise the overall quality of the final food product.

By connecting data and knowledge from farms in different geographical regions and various sizes, the Gaiasense systems improves constantly over time and gives dynamic advice in times of climate change and demands for new varieties and crops.

### 2.6.2. Exploitation & monetization

#### 2.6.2.1. Revenue model for Gaiasense IoT4Potato

**Fixed monthly/yearly service fee (subscription)**

Neuropulic offers the Gaiasense support system as a service including the Gaiatron sensing units. The farmer or farm advisor pays a fixed yearly or monthly rate per hectare of fields monitored by the Gaiasense system.

Neuropublic offers also a profit share to cooperatives that are interested to foster their productivity and gain better insights in the production conditions of their members. With this offer Neuropublic can reach a larger number of farmers while saving on sales and partly maintenance costs as this is taken over by the cooperatives.

**Performance-based service fee**

We designed a second business model with a performance-based pricing approach, in order to address the farmers’ distrust on market entry of IoT decision support systems. The aim of the performance-based model is to reduce the risks for the farmer as it would create no additional if the system does not realize the promised savings in production costs. The final price of the service will be calculated as 20% of the actual amount earned through the cost reduction. This 20% will be shared among the respective business partners in each country, i.e. a) NP to cover the costs of operating the infrastructure and the support, and b) to the cooperative and/or the advisory service provider that provides the agronomist(s). For example, in Poland the annual profit to be shared between NP, Delphy and FFP2 would be € 440K (€2.2M *20%), in Ukraine € 720K and in Cyprus € 280K. It is estimated that these numbers will be reached within 3 years after the end of IoT4Potato.

This business model however is very difficult and partly dangerous to implement into a multi-factor environment like a farm business. The production costs are not under full control of the Gaiasense system and still subject to changes due to shifting market prices, weather, other technologies used or simply by management mistakes by the farmer. Therefore, this model is only advised for special clients with a wide implementation of Gaiasense and further cooperation with Neuropublic.

**Brokerage Fee for data exchange**

In addition, IoT4Potato provides a platform for selling data to 3rd parties collected through its core business activity. Farmers remain in control of their data (provided through farm logs), deciding whether or not to sell to third parties. IoT4Potato merely remains an intermediary, charging a brokerage fee.
2.6.2.2. Pricing of Gaiasense IoT4Potato

Fixed monthly/yearly service fee (subscription)

The current pricing for full access to the Gaiasense system including the Gaiatron sensing unit is 50€ per hectare. This would amount for an average farm of 30ha to 1,500€ per year for the access to the service. At the same time the Gaiasense IoT4Potato service would reduce the production costs of the farmer by 8,250€ per year. In this scenario, the farmer would achieve a total costs reduction by 6,750€ while reducing further cultivation risk and maintaining the yield.

Performance-based service fee

In case of the performance-based fee, Neuropublic would charge 20% on the realized cost savings for the farmer. In our example above with cost reduction of 8,250€ the final yearly fee would amount to 1,650€. This is only slightly higher than the fixed rate model.

2.6.2.3. Additional data revenue models

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.6.3. Distribution & marketing strategy

2.6.3.1. Distribution and sales channels for Gaiasense IoT4Potato

Neuropublic targets on its market entry the large Eastern European potato producers. In order to grow quickly, the distribution targets at the beginning larger cooperatives and offers them a profit-share on sales that include all member farms of an association. This way Gaiasense does not need to be introduced by Neuropublic to the farmer, but the product will be tested and introduced by the cooperative, which already has trustful relationships with its farmers. This creates a win-win situation as also the cooperative is interested in an increase of efficiency and better management of the cooperative as a whole.

A major partner for this distribution strategy for the Gaiasense IoT4Potato service is Delphy, an advisory service provider in both target countries Poland and Ukraine with an overall sales network in 50 countries. Delphy is offering services to the potato producers in both target countries currently has an ~50% share of the Dutch market and a network in 50 different countries (the most important being Belgium, UK, Denmark, Germany, Poland, China, Japan, Kenya, Ethiopia and South Africa). Delphy has committed to the role of the local business partner in the countries it operates. Delphy will also offer its local connections to reach 3rd party providers of SF services in the countries that IoT4Potato services will be used. NP has direct access to 70 Cooperatives with >151K farmers in Greece, through its partner GAIA EPICHEIREIN. 680K subscribed clients of the existing services of NPs digital agriculture platform are a direct target group for expansion in Greece; farmers that are subscribers of these services and satisfied with them are likely to trust new services offered by the platform as well. After establishing its position in Greece, NP’s strategic plan envisions an expansion to the markets of Poland, Cyprus, Ukraine, Romania and Belgium, working together with Delphy and, where appropriate, the other IoT4Potato partners.

Expansion in other sectors in agriculture will also take place, as all technological components and the business networks of NP and Delphy are built to cover multiple perennial and annual crops. Gaiasense, the solution used as basis for IoT4Potato, currently offers services to 17 crops all over Greece.

2.6.3.2. Marketing strategy for Gaiasense IoT4Potato

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.6.4. Customer & end-user relations

2.6.4.1. End-customer relations & loyalty for Gaiasense IoT4Potato

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.6.4.2. Product support services for Gaiasense IoT4Potato

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.6.5. Partner network & horizontal activities

2.6.5.1. Partner network for Gaiasense IoT4Potato

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.6.5.2. Horizontal activities for Gaiasense IoT4Potato

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.6.6. Cost structure & internal resources

2.6.6.1. Cost structure for Gaiasense IoT4Potato

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.6.6.2. Internal resources for Gaiasense IoT4Potato

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.7. UC1.7 – TRACEABILITY FOR FOOD AND FEED LOGISTICS

2.7.1. Product description & value proposition

2.7.1.1. Description of IoTrailer

The IoTrailer system ensures the 100% correct identification of storage facilities like silos to ensure the correct loading and unloading of bulk contents throughout the complete supply chain. The product consists of a redundant detection system based on NFC and Airflow that detects the correct storage facility and loading point by reading a NFC tag or an airflow sensor in close proximity to the correct loading/unloading point.

The loading process

Most trailers are loaded at central bulk load stations that are operated by a central control system. This means that the different compartments of a trailer are usually fully loaded at one central place where the central control system of the bulk load station connects via WIFI to the PLC system of the trailer in order to correctly identify it and load it according to its transport plan.

The unloading process

The driver of a trailer identifies the correct point of loading or unloading with a small handheld device that contains the NFC and Airflow reader and is connected to the trailer via a LoRa connection. When the driver scans the tag, the ID information is transferred to an edge computer on the trailer and matched with its transport plan. If the scanned silo is a correct delivery location the trailer unlocks the unloading of the ordered volume of bulk content and releases the correct amount after being connected to the silo.
The transport plan

The trailer receives its digital transport plan via a mobile internet connection and saves it directly on an on-board edge computing device. Therefore, the identification process works also on remote places with no internet connection available. The transport company is even able to update transportation plans with new loading or unloading jobs on the fly or reroute certain deliveries as far as the trailer is having an active internet connection.

Product setup + maintenance

In case, the bulk feed company is the contractor of the IoTrailer service it arranges the equipment of the trailers by an arrangement with their transport providers or simply installs all necessary on their own trailers if they do not subcontract the transporting. If the bulk company is using a subcontracting company for the transport, it rents it out for free to the transport company for a number of vehicles and takes over the costs for maintenance and replacement of devices after defects or devices got lost. The service agreement with the bulk company includes as well a maintenance service agreement with the bulk companies which somehow grants Lamprecht access to the trailers for repairs and replacements. This requires actually a contract as well with the transport company.

Furthermore, the bulk feed company issues via mail the NFC silo tags to their customers to pin it to their delivery silos. The animal farmer simply pins the NFC tag to the correct silo, scans the tag with the IoTrailer App on this smartphone and adds the location of the silo via GPS, its name and a short description. The app transfers this information safely to the bulk feed provider who uses this data for matching orders of the client to the correct silo.

Data management

While Lamprecht is collecting the location of silos in its own cloud, it can offer the location data of the farmer’s silo with his/her consent to other bulk companies as well in case the farmers orders at different bulk companies that support IoTrailer identification. This way it would be always possible to use the same NFC tag even so deliveries arrive from different bulk companies.

On the farm side, the data of the delivery should be made available to the farm management information system so the farmers can keep digitally track of current silo loads and the costs for feed deliveries.
Hardware

The handheld reader should contain as well as a GPS unit to if necessary, correct the location of the silo when scanned by the driver.

2.7.1.1. Description of IoTrailer 2.0

In a future step, the IoTrailer system could evolve to a full management system for dynamic on-demand deliveries directly from the feed producing farm to the animal farm reducing the need of central storage facilities. The trend towards digital marketplaces that arrange deals directly between growers and buyers for grains and feed is already disrupting the market in the US with high investments in companies like Indigo.

In this new market context, Lamprecht with its IoTrailer platform could become an enabler or even a provider of on-demand delivery services by working closely together with digital feed markets, feed experts, feed growers and animal farmers. The IoTrailer platform could bundle information on feed quality, origin, transportation and supply it to other players in the value chain. In order to offer this, the IoTrailer platform would need to be extended with a quality sensing system that detects not only the correct silo, but also scans the quality of feed deliveries that they pick up. This way it would be possible to track feed deliveries and its quality throughout the complete supply chain while at the same time reducing central storage facilities.

Let’s play that through with a practical example. Imagine a feed farmer in France is selling 10t of grain to an animal farmer in Germany on a digital platform. As soon as this deal is sealed, a transport order will be created on the IoTrailer platform with information on volume, quality, precise pick-up and drop-off information. This order goes either to a transport company or Lamprecht as a service company takes it with its own trailers which dispatches a trailer to the feed farm. The trailer driver identifies through the IoTrailer service the correct silo and while the feed is transferred to the trailer scans the quality of the load. This information is transferred to the deal platform in order to check if the quality matches the deal criteria and apply changes if necessary. The trailer transports the feed in the meantime to the animal farmer and identifies on arrival again the correct silo to unload the feed.

An additional product feature for the trailers could be the active mixture of feed following specific diet recipes created by feed experts.

2.7.1.2. Value proposition of IoTrailer

Fail deliveries of bulk contents happen every day all across the agricultural value chain. Sometimes it is a driver who confuses a silo and delivers that load to wrong location. Sometimes it is the wrong load being collected due to a confusion of a silo at the pick-up location. These identification mistakes result in severe and costly consequences. If the incident was detected right away it would the full emptying and cleaning of the silo as well as the replacement of the load. Even worse is if they fail delivery stay undetected as that might result in animal illness or a delay of growth due to the wrong feed. In cases of bio feed this could lead to the withdrawal of the farm’s bio certification and severe loss in sales prices.

IoTrailer reduces the risk of wrong deliveries of animal feed to practically zero which results in lower costs as well as possibly better rates for transport insurance. The solution promises a 99% secure delivery of bulk goods into the right silo and with full traceability across the whole delivery process. Furthermore, it adds more security to farmer as well as the credibility of food labels as all relevant stakeholders receive insights to delivery data and the process in general gets more trustworthy than ever before.
2.7.2. Exploitation & monetization

2.7.2.1. Revenue model for IoTrailer

Lamprecht plans to offer the IoTrailer tool as a service to bulk feed companies or their transport companies including all necessary equipment like handheld device, trailer base station and silo tags on a subscription base. The contractor pays for each vehicle that is equipped a monthly fee which includes the following:

- Provision and usage of all necessary devices
- Maintenance of the devices in case of malfunctions falling under the warranty
- Access and interfaces to tracking data for bulk company, transport company and farmers
- Free access for farmers to an app to store and edit location of silos

All hardware stays property of Lamprecht and is only rented to the contractor for the time of the contract. If a contract is terminated, the contractor has to return all equipment and loses access to the tracking service.

The farmers will remain their access to the Lamprecht silo location system and location app even so the contractor that provided the farmer with the NFC tag terminated the contract. Therefore, the farmers remain the opportunity to share the location of silos based on his/her consent with other bulk feed companies in the future.

2.7.2.2. Pricing of IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.2.3. Additional data revenue models

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.3. Distribution & marketing strategy

2.7.3.1. Distribution and sales channels for IoTrailer

Lamprecht will utilize its existing relationships with transport and bulk companies to offer the service.

2.7.3.2. Marketing strategy for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.4. Customer & end-user relations

2.7.4.1. End-customer relations & loyalty for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.7.4.2. Product support services for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.5. Partner network & horizontal activities

2.7.5.1. Partner network for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.5.2. Horizontal activities for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.6. Cost structure & internal resources

2.7.6.1. Cost structure for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.7.6.2. Internal resources for IoTrailer

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.8. **UC1.8 – SOLAR-POWERED FIELD SENSORS**

Solarvibes offers smart sensors and AI-based precision farming solutions. The sensors are solar powered, plug and play. Our software analyses the soil-crop compatibility, crop requirements and nutrient deficiencies. Our solution brings soil laboratory to the fields and for the first time they can monitor and treat their crops in real time. This architecture directly benefits the farmer to save water, operating costs and reduce the risk of crop failures. The primary intent of this proposal is to demonstrate large-scale impact and scalability of Agri Module Smart System (AMSS) through the deployment of 2,000 smart sensor units. The deployment potentially extends the usage of IoT technology, i.e., AMSS across 800+ Hectares of farmland located in multiple European countries and with further coverage of 2,000+ Hectares within respective networks. The test beds are secured across Romania, Hungary and Germany. Aligning with the open call objectives, the proposed project involves a wide range of stakeholders – IoT hardware R&D, certification & manufacturing partners; Agricultural institutions & Organic Research centers; System integrators – Cloud & Database infrastructure, Customer facing application; Business development & end-user networks (Individual farmers, Farming associations).

![Figure 49: UC1.8 - Value chain position](image)

**2.8.1. Product description & value proposition**

2.8.1.1. **Description of Solarvibes Sensor System**

The core hardware product of Solarvibes is an affordable sensing system that consists of sensor modules and a master network module with a mobile internet connection. The sensing unit is equipped with weather sensors measuring temperature, humidity and pressure as well as with soil sensors measuring pH-level, soil humidity, temperature and conductivity. The network unit functions as a gateway to connect several sensor modules to the internet via the mobile phone network. Both modules are solar powered and operate autonomous from any power connection in the field.
The network module connects up to 10 sensor units via LoRaWAN in a radius of approximately 20km to the internet by connecting to the mobile network via GPRS/LTE and an in-build SIM card. Therefore, a data plan with a local mobile network provider is necessary.

In the future, Solarvibes plans to offer also premium sensor modules that offer for example camera pictures for disease detection, biodiversity measurement and crop growth monitoring. These modules will very likely not be solar-powered and requires an on-site power connection.

2.8.1.2. Product description of Solarvibes Knowledge Platform

The Solarvibes knowledge platform is a software tool that analyses and visualizes the data delivered by the sensing system. Based on the input data, the platform simulates several scenarios of crop growth and provides decision support services to the farmer. This support reaches from timing and amount planning for the application of fertilizer, plant protection and water as well as supporting the farmers measures for soil conservation.

The Solarvibes knowledge platform is planned as an interconnected, partly self-learning network of sensors on farms in different regions that all train and enhance the support algorithms over time. In the background of climate change and eroding soil in many regions, the Solarvibes platform supports the farmer in the quicker adoption of tailored and more effective growing techniques and the choice of the best varieties with the highest yield under the specific local conditions.

Solarvibes is targeting with its affordable hardware a broad range of smaller farmers in regions like Eastern Europe and developing countries in Africa and Asia. Therefore, the input of data and interpretation of support recommendation is organized in crowdsourced or community-based approach with one trustful, educated person of a community at its center. This person would have access to network module that is managing other secondary devices of individual farmers. This way Solarvibes makes sure that the hardware is correctly maintained, that the community of farmers makes full use of the recommendations and that knowledge of new growing techniques can reach even smaller farms in remote areas.

In a later step, Solarvibes could build up together with partners in different regions an online shop where smaller farmers and communities can order necessary equipment, seeds, fertilizer and anything else needed to put a recommended growing technique into practice.
2.8.1.3. Value proposition of Potato Monitor

Solarvibes provides the epicentre of the much-needed precision farming infrastructure with its IoT network, smart sensors and brings instant soil and crop health diagnostics to the hands of every farmer. Easy to use, robust smart soil sensor does not even need a power connection and sells for less than 300€ while comparable system would cost a multitude of this price. The hardware is easy to install and requires little to no maintenance. These are key values for smaller farmers that would like to increase the efficiency and yield produced on their fields.

By making smaller farmers in a large scale more efficient and competitive, especially in developing countries, Solarvibes aims at achieving a significant effect on regional food security and rural economic stability.

2.8.1.1. Value proposition of Solarvibes Knowledge Platform

The Solarvibes Knowledge Platform offers high-end agronomic knowledge on the growth condition of many crops and varieties, which give small farmers with limited access to information a unique advantage to increase their yield and to quickly adapt to the challenges of climate change. The key advantage is that the support and knowledge derived from the data of the users themselves and is not biased by any corporate interests to sell certain products.

This way Solarvibes can become a trustful and independent advisor of farmers. The platform brings also small farmers in many regions together in order to exchange on common challenges. This way Solarvibes is not just a decision support system, but also a community for crowdsourced agronomic knowledge.

2.8.2. Exploitation & monetization

2.8.2.1. Revenue model for Solarvibes Sensor System

Lump-sum payment for device with sales margin (30%) + profit margin (30%)

2.8.2.2. Pricing of Solarvibes Sensor System

*Current pricing*: 1499€ per master network module = 350€ (production cost for 2 gateways), 250€ (support tools and training costs), 350€ (acquisition cost) + 449€ (profit) + VAT extra (depending on the country) + Shipping cost extra (depending on the country)

*Current pricing*: 299€ per sensor module = 52€ (production costs) + 44€ (Customer acquisition, office and software costs) + 203€ (profit share ratio (Solarvibes: network operator = 85:15 to 50:50, depending on the sales, increases with number of orders) + VAT extra (depending on the country) + Shipping cost extra (depending on the country)

**Agrimodule Smart System**

- Option 1: Software subscription for master module software 499€ / year  41.58€ / month
- Option 1: Software subscription for sensor module software 99€ / year  8.25€ / month
- Option 2: Revenue from hardware sales: Master module 1499€/master kit (one-time fee)
- Option 2: Revenue from hardware sales: Agrisensor 299€/sensor (one-time fee)

2.8.2.3. Pricing of Solarvibes Knowledge Platform

- Free for users
- Revenue through ads, planned in the longer run
2.8.2.4. Additional data revenue models

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.8.3. Distribution & marketing strategy

2.8.3.1. Distribution and sales channels for Solarvibes Sensor System

Solarvibes applies a crowdsourcing or community-based sales approach with one trustful, educated person of a community at its center with a master device managing other secondary devices, who receives a sales share of 15% to 50% for hardware sales and service contracts.

Incentivising small businesses and Distributors and Network operators: Initially network operators are incentivised with a profit share of 15% per sensor sale for first 10 devices. For additional sale of every ten sensors increases their profit share by 5%. Enrolling for network operator in the beginning with sensor orders for 40 sensors, will enable network operators to be onboarded for just 66% discount. Similarly, for 75 sensors, they will be onboarded for free and share of profit is 30%. After achieving sales of 150 sensors, their profit share is 50% and it continues for all future orders.

Furthermore, Solarvibes aim for a collaboration with the India government by becoming the core supplier a public programme that foresees to give a free sensor to every farmer. The objective of the government is to increase the efficiency of regional small farms and to reduce the environmental footprint of farming. If Solarvibes would become a partner of this project it would immediately own a significant market share for smart farming equipment and services in India.

2.8.3.2. Marketing strategy for Solarvibes Sensor System

The business development team has been able to form a core go-to market approach which can be adjusted accordingly to different regions based on the research conducted and market entrance scenarios built. The market research and scenario building provided a better understanding of how to approach our end users. Building the scenarios helped identify which clusters and associations to target partnerships with. While Germany was not included in the market research activity, this strategy was also built on the Solarvibes current performance in the German market. Hence this strategy was designed primarily for expansion in the German region and market entrance in Hungary and Romania.

The core go-to market strategy is broken into two main steps aim at creating and strengthening our customer relationships in any target region:

1. Building solid relationships and networks with farmers, farming associations, clusters and cooperatives. Through the relationships, Solarvibes’ will build the credibility necessary to push our target end users to trust us and our products. This reflects our values as we strongly believe in involving all actors in the value chain in order to create a sustainable and transparent food chain. We identified seed producers, fertilizer suppliers, pesticide suppliers, food processing companies, agricultural cooperatives and our local partners to form the Agrimodule Network as the crucial stakeholders that will enable us to access the market via partnerships.

2. Using farm fairs, exhibitions, expositions, trade shows and events to demo our product and get potential customers familiar with our product, brand and company name. This will be backed with strong social media campaigns geographically focused to increase visibility with our target users. A feasibility study validated our approach, confirming access to 7500 customers through partnership with large consortium partnerships and 3000 orders across 14 countries via an online crowdfunding campaign.
3. Our sensors will always be made readily available through direct sales on our online platform. Supporting our online channel, sensors will be available for purchase at farm trade shows and fairs.

2.8.4. Customer & end-user relations

2.8.4.1. End-customer relations & loyalty for Solarvibes Sensor System

Option 1: Incentivising farmers for images of crops, diseases, pests and deficiencies.

Option 2: Incentivising peer to peer performance improvement aid through data studies among fellow farmers in the local and global community.

Option 3: Discount code for purchase using our partners of several products such as seeds, fertilizers and other farming services, on several platforms.

2.8.4.2. Product support services for Solarvibes Sensor System

Option 1: Provision of guidelines for easy onboarding for the incentives program.

Option 2: Weekly popups and alerts on new tips related to their crops to make effective use of the incentive models.

2.8.5. Partner network & horizontal activities

2.8.5.1. Partner network for Solarvibes Sensor System

The first approach was to partner with credible institutions that could provide Solarvibes with expertise in business analysis and agriculture or an essential network of farmers and business partners in potential target markets. The three institutions listed below have allocated candidates to help with the activities of qualitative and quantitative research, stakeholder and local partner identification, and analysis of the business model.

- Partner 1 - GISMA: Role of market research and survey creation.
- Partner 2 - Hungarian Research Institute of Organic Agriculture: Role of Local Business Development.
- Partner 3 - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca: Role of Conventional Agricultural Expertise, local operations, Stakeholder Involvement.

The master candidates of GISMA business school drafted a business model with the academic aim of inferring key insights on Solarvibes’ current business model and constructing structured suggestions to enhance the company’s business focus. The suggested contents applied to Solarvibes’s positioning strategy, the adaptation of its value chain to potential target markets and the drawing of foundations for a sustainable long-term strategy. This collaboration resulted in a market research providing a list of viable countries to enter, survey for our current/potential customers and partners, and an analysis of our current digital campaigns.

Hungarian Research Institute of Organic Agriculture and University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca have been crucial partnerships in the identification of key stakeholders such as seed manufacturers, fertilizer suppliers, pesticide suppliers, food processing companies, farm co-operatives and most importantly local on-ground partners to form an Agrimodule network. Both collaborations have also provided Solarvibes with a reliable list of associations and farmer networks, which Solarvibes can reach to conduct surveys and test products and business strategies with.
2.8.5.2. Horizontal activities for Solarvibes Sensor System

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.8.6. Cost structure & internal resources

2.8.6.1. Cost structure for Solarvibes Sensor System

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.8.6.2. Internal resources for Solarvibes Sensor System

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.9. UC1.9 – WITHIN-FIELD MANAGEMENT ZONING – BALTICS

“Within-field management zoning Baltics” is an IoF2020 trail that showcases the potential of hyperspectral imaging applications in precision agriculture. The technology for the analysis of crop field hyperspectral imaging data is being developed by ART21 Ltd. and its potential demonstrated in IoF2020 as a use-case.

The technology is at working prototype stage (TRL 6) with demonstrated functionality for winter wheat field analysis in a relevant (non-test crop field) environment. Additionally, during IoF2020 trials the solution is being calibrated for potato field analysis.

The service being developed is a SaaS platform for analysis of crop field hyperspectral image data, captured by Unmanned Aerial Vehicles (UAVs). The data analysis is able to identify plant stress and lack of major micro and macro nutritional elements in plants – Nitrogen, Phosphorus, Potassium, Sulphur, Manganese, Copper, Zinc and Iron.

During the IoF2020 trials the solution is being tested and demonstrated in operational environments. These trials will provide proof for potential investors and partners on the technological viability of the service, information for further service development needs and introduce new functionalities (potato field analysis). The trials are also expected to contribute to business development planning – gaining better international market awareness, experience sharing with other project participants, evaluate the feasibility of the commercialization plan, further detail the business model and value proposition for farmers.

2.9.1. Product description & value proposition

2.9.1.1. Description of Arial Crop Analysis

The product currently in development by ART21 is an innovative service for crop field analysis using remote hyperspectral imaging and data analytics based on Artificial Intelligence techniques. The service provides farmers with valuable information on crop plant nutritional state – which micro and macro nutritional elements are needed and in what amounts in order to achieve optimal plant growth conditions.

The service consists of:

- Data gathering – crop field spectral data collection using hyperspectral cameras mounted on Unmanned Aerial Vehicles (UAVs), provided directly by ART21 or its specialized local service distributors;
- Data analysis – applying advanced data analysis techniques based on Artificial Intelligence technologies and generating maps with nutrient distribution in plants in the field;
- Data delivery and utility – delivering analysis results to farmers in multi-layered, interactive and easy-to-use maps, using the data to generate efficient fertilization plans and integrating them with smart farming machinery.

Distinctive service features are:

- Use of non-invasive remote sensing technologies for data capture;
- Analysis of large amounts of spectral data for precise decision making;
- Fast and cost-efficient way to assess micro and macro nutritional element amounts in crop plants;
- Automatic recommendations for fertilizer and agrochemical use;
- Integration with smart farming machinery and in-field IoT systems.
**Technology.** At current stage, the technology is at working prototype stage (TRL 6) with demonstrated functionality for working in a relevant environment – non-test crop fields in operational medium-sized farms. The solution has been developed, tested and demonstrated for the analysis of winter wheat fields, with levels of all major nutritional elements (Nitrogen, Phosphorus, Potassium, Sulphur, Manganese, Copper, Zinc and Iron) being detected at over 92% accuracy. The current solution is being further optimized and – in the context of IoF2020 trials – additionally calibrated for potato field analysis.

**Infrastructure.** A SaaS platform is being developed for analysis process automation and optimisation, as well as a web service for data submission and result retrieval. The software for analysis result delivery to farmers and tools for its interpretation are being developed on AgroSmart Farms – a GIS-based farm management software product already developed by ART21. Additionally, service result data will be made available for integration with third-party software and smart farming machinery through APIs.

**Trials.** The technology, its capabilities and use case potential is being demonstrated as a use case trial in IoF2020. The trials will provide proof for potential investors and partners on the technological viability of the service, information for further service development and introduce new functionalities for potato field analysis. The trials are also valuable at gaining better international market awareness, experience sharing, evaluating the feasibility of the commercialization plan, further detailing the business model and value proposition for farmers.

### 2.9.1.2. Value proposition of Arial Crop Analysis

**Key service value proposition.** Advanced crop field remote sensing solution that enables arable agriculture farmers to more efficiently implement precision farming operations, save on fertilizers and increase yields.

**Target.** The target customers and main service beneficiaries are medium and large-sized arable agriculture farmers that pursue higher productivity and farm operational efficiencies through precision agriculture. The service is intended to enable this by providing an advanced crop remote sensing solution that is able to deliver accurate and detailed insights to farmers for smart decision making, planning and direct implementation.

**Distinctiveness.** Currently crop remote sensing is being mostly done by applying various indexes or using general reference models to data captured via multispectral remote imaging or specialized sensors mounted on agriculture machinery. These methods are limited in their application situations and can provide the farmer with a general understanding of crop plant stress factors. The data processing technology demonstrated in the IoF2020 use case trial is a significant improvement on existing methods. It can provide farmers with more detailed insights on plant stress factors, on exactly which micro or macro nutrient are missing and in which parts of the field.

**Value.** The farmer-oriented service that is in development using this technology will allow farmers to order services from specialized providers and receive insights on their field plant nutritional state with little direct effort. The insights will enable farmers to:

- Perform smart agrochemical planning and more efficiently use fertilizers – depending on crops, the service aims at helping farmers reduce expenses on fertilizers by 15% (for potato) and 20% (for wheat). This is to be achieved through precise calculations on what agrochemicals are required, as well as helping guide smart farming machinery to precise locations where the nutrients are needed;

- Increase productivity and crop yields – on average, farmers are expected to achieve higher yields, by an additional 5%. This is expected due to precise application of fertilizers that plants are lacking the most, increased operational efficiency and more effective early risk assessment;
• Facilitate farming sustainability – more efficient agrochemical use will contribute to maintaining crop field ecological sustainability. This will provide a long-term benefit to farmers by limiting soil degradation, fertility loss, water pollution and wildlife destruction.

In financial terms, the service impact and created value for farmers is expected to be a net gain of at least 30 eur/ha (decreased expenses and increased yields, minus estimate service price), or an estimate increase of 7% in farmer margin size at full-service implementation. Initial services will include analysis of wheat and potato fields, with additional services foreseen for rapeseed, corn and other major crop cultures.

**Trails.** Besides technology calibration for potato field analysis and technological potential demonstration in real-life operational conditions, the IoF2020 trials are aimed at providing information and experience for further elaboration of the service value for the target customer base.

### 2.9.2. Exploitation & monetization

#### 2.9.2.1. Revenue model for Arial Crop Analysis

The service revenue model is based on two scenarios:

• B2C service sales directly to farmers (in the domestic market);
• B2B service sales to distributors that provide end-customer (farmer) reach.

**B2C revenue model.** In the case of the B2C scenario a direct service sales business model is used in the domestic (Lithuanian) market. Following this model, all service sales, customer relations, data gathering, processing and interpretation activities will be performed by ART21, with the company receiving the entire revenue paid by farmers. This includes farmers that already are users of other existing company products (GIS-based farm management software), as well as acquisition of new customers through direct marketing.

The B2C service sales will be the main source of initial revenue, but is expected to become a secondary source once business operations are scaled and expanded to other markets through a network of local distribution partners.

**B2B revenue model.** In the case of the B2B scenario a channel sales business model is used, where specialized local companies (distributors) provide service sales, hyperspectral data gathering and customer relations directly to farmers in their local market. Local distributors are planned to receive between 70% and 80% of the revenue paid by farmers for provided services, while the remaining 20%-30% are to be received by ART21 Ltd. for solution licensing, data processing, interpretation and other business costs.

Similarly, other companies that wish to integrate the field hyperspectral imaging and analysis services with their own customer-facing products or services will be required to pay licensing fees to ART21 (with size to be determined on a case-by-case basis).

In total, B2B service sales are planned as the main revenue source and a solution for business operation scaling beyond the domestic market. Initial target markets for expansion include other Baltic states (Latvia and Estonia), Poland and the Nordic countries (Denmark, Sweden, Finland).

#### 2.9.2.2. Pricing of Arial Crop Analysis

At current project stage, the service price structure is envisaged and subject to later adjustment according to market situation, crop specifics and customer needs.
**Service price.** The retail price of the service for end-customers (farmers) is estimated at 15 €/ha for a single analysis of a field. This includes field hyperspectral data gathering using UAVs, data analysis, interpretation and result delivery in a customer-friendly software environment.

The main portion of the services are planned to be sold and delivered via seasonal analysis service packages, that include 3 separate crop field scans and analyses per crop season (usually done before pre-scheduled fertilization). The seasonal package of 3 service is estimated at around 40 €/ha.

In the case where services are being offered, managed and delivered by a service distribution partner, the retail service price is expected to remain similar. The gained revenue is to be split by the service distributor and ART21 at a ratio of between 70-80% to the distributor and 20-30% to the company.

**Price structure.** Around half of the service-related expenses will be associated with data gathering activities – transport, equipment, UAV flights, wages. In the case of service delivery via distributors, these expenses are expected to be covered by the distributors and compensated with a higher portion of the revenue. Other major expenses involve data processing, digital infrastructure maintenance and functionality improvement (up to 10% of the retail price), as well as other associated operational costs. Due to the digital nature of the service, the proportion of data analysis related expenses is expected to decrease in line with business operation scaling.

**Farmer gains.** The service is expected to generate around 70 €/ha of value to the farmer via decreased expenses and increased yields. After deduction of a seasonal service package price, the net gain for the farmer is projected to be at least 30 €/ha.

**Market potential.** The initial markets targeted for the crop field analysis services are the Baltic states (Lithuania, Latvia Estonia), Poland and the Nordic countries (Denmark, Sweden, Finland). These markets have been chosen due to environmental and agricultural similarities to the technology country of origin (Lithuania). Another factor is high levels of mechanisation of agriculture in the selected markets, thus enabling more effective implementation of the results provided by the service and increasing willingness-to-buy of potential customers.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total estimate field size (thousand ha)</td>
<td>54.2</td>
<td>86.4</td>
<td>337</td>
<td>1320</td>
<td>974</td>
<td>2400</td>
</tr>
<tr>
<td>Average yields (tons/ha)</td>
<td>12.5</td>
<td>35.6</td>
<td>18.2</td>
<td>3.94</td>
<td>4.79</td>
<td>4.09</td>
</tr>
<tr>
<td>Estimate farmer revenue (eur/ha per crop season)</td>
<td>1567€</td>
<td>8384€</td>
<td>2226€</td>
<td>709€</td>
<td>862€</td>
<td>736€</td>
</tr>
<tr>
<td>Target market penetration</td>
<td>9%</td>
<td>7%</td>
<td>10%</td>
<td>10%</td>
<td>5%</td>
<td>12%</td>
</tr>
<tr>
<td>Serviceable market size estimate</td>
<td>146.000€</td>
<td>207.000€</td>
<td>1.011.000€</td>
<td>3.960.000€</td>
<td>1.753.000€</td>
<td>8.640.000€</td>
</tr>
</tbody>
</table>
2.9.2.3. Additional data revenue models

Aggregated data brokerage – potential to broker aggregated and anonymized field hyperspectral data to institutional and business partners (subject to data sharing regulations or contractual agreements). The pricing strategy of this brokerage is not defined at this stage of the project and is to be explored further after commercial service launch.

Compatible equipment sales – potential additional revenue stream from reselling of ready-made, third-party hardware equipment that is configured to be fully compatible with the service technical requirements. At current project stage the hyperspectral data analysis system is being optimised with the aim of lowering the minimal technical requirements for equipment to be used in the commercial service. Discussions with potential equipment providers is currently ongoing and to be finalized before the commercial service launch.

2.9.3. Distribution & marketing strategy

2.9.3.1. Distribution and sales channels for Arial Crop Analysis

Main channel – B2B service sales and indirect end-customer reach:

- Local distributors – offer own hyperspectral imaging services to farmers in local markets while buying data analysis services from ART21;
- Integration partners – other companies integrate ART21 services with their own products or services and offer to own customers.

Limited channel – direct B2C service sales in the local market:

- Existing customer base – integration with existing products;
- New customers – direct marketing (dedicated website, promotional activities, cold calling).

At current project stage, discussion with potential service distributors in the Baltic region are ongoing. *Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.9.3.2. Marketing strategy for Arial Crop Analysis

Channel sales business model of a SaaS platform.

Service sales to B2B clients and indirect end-customer reach:

- Local distributors and integration partners – direct marketing (partnership outreach, promotional activities, cold calling).

Direct service sales in the local market to B2C clients:

- Existing customer base – new service integration with existing products (AgroSmart Farms software);
- New customer acquisition – direct marketing (dedicated website, promotional activities, cold calling).
At current project stage, discussion with potential service distributors in the Baltic region are ongoing. The data analysis system of the service is being integrated with existing products (AgroSmart Farms software) and is currently at beta stage.

2.9.4. Customer & end-user relations

2.9.4.1. End-customer relations & loyalty for Arial Crop Analysis

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.9.4.2. Product support services for Arial Crop Analysis

Most end-customer facing activities are expected to be directly performed by local service distribution partners. Product technical support and functionality expansion to be performed by ART21.

2.9.5. Partner network & horizontal activities

2.9.5.1. Partner network for Arial Crop Analysis

- The Chamber of Agriculture of the Republic of Lithuania provides support in testing and test site selection.
- Nature Research Centre (Lithuania) provides support and expertise in laboratory research, soil analysis and analytical model validation.
- Agrokoncernas Ltd. provides support in research and technology testing, potential local service distribution partner in local markets.
- Wageningen University & Research primary use case development and operational test trials.

2.9.5.2. Horizontal activities for Arial Crop Analysis

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.9.6. Cost structure & internal resources

2.9.6.1. Cost structure for Arial Crop Analysis

The costs structure of the service consists of 3 main parts – data acquisition, analysis and business operations.
1. **Data acquisition costs** (70-80% of total service cost) – crop field scanning service using UAVs and hyperspectral cameras. In the case of a B2B business model, the costs are by service distributors, and by ART21 in the case of a B2C model. Further breakdown of the costs consists of:

- Hardware initial costs (30,000-50,000 EUR at current setup, less once service is fully developed) and maintenance;
- Pilot staff wages;
- Marketing;
- Operating costs.

2. **Data analysis costs** (10-15% of total service cost) – receiving, processing and analysing the received data, delivering results. The costs are to be incurred by ART21. Further breakdown of the costs consists of:

- Data processing costs;
- Web infrastructure and maintenance;
- Service functionality expansion;
- Technical staff wages.

3. **Business operations costs** (10-15% of total service cost) – general costs associated with business operations and main activity support. The costs are to be incurred by ART21. Further breakdown of the costs consists of:

- Marketing expenses;
- Partnership management;
- B2B client support;
- Indirect business operating costs.

2.9.6.2. Internal resources for Arial Crop Analysis

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.10. UC2.1 – COW GRAZING MONITOR

This use-case changed its focus away from monitoring the time on pasture of milk cow towards a management tool for roaming herds in wide and remote areas. WP4 initiated this product focus change after poor results for the value proposition compared to the actual costs of the solutions. The proposed solution using costly Sensolus GPS trackers for the measurement of the time spent by each cow on pasture or in the barn could not be matched by the rather low benefits of a marginal higher milk price and regional subsidies.

New focus: Keeping track of large herds of animals in remote and wide areas is a big challenge for farmers all over Europe. The animals are vulnerable to predators, injuries, diseases and theft with only little protection and a labour-intensive monitoring. In these cases, the Sensolus GPS tracker with its low power consumption and long battery life-time is the perfect solution to keep track of animals, get warnings based an irregular movement patterns and analyse their grazing behavior. Further in this document this new focus and product will be referred to as “Grazing Cow Monitor”. There will no longer be reference to the old product and value propositions as there were tested and described in WP4 deliverable 4.9 and it was concluded the business opportunities were too low.

Original focus: One of the premium milk products in the dairy industry is pasture milk guaranteeing the consumer that cows spend at least 120 days on pasture throughout the milk production. This milk cost in average about 20-30 cents more in the supermarket and starts to bring also the farmer a premium of 3-4 cents.

However, the documentation of the time cows spend on a pasture are still recorded manually and proven by Excel-Sheets handed in by the farmer to dairy companies as well as governmental agencies.

This use-case develops a service that automatically tracks the time each cow spends on pasture and give the farmer the opportunity to file reports digitally to dairy companies and governmental agencies for regional subsidies.

Due to the fact that the Cow Grazing Monitor is going to use a cheaper hardware setup to enable the tracking of the cow’s time spend on pasture, the development of the solution is less attractive for current consortium partners. In final version the Cow Grazing Monitor might not use any Sensolus tracking modules due to the cost pressure and rely sole on RFID tracking in combination with collar similar to the one provided by Connecterra in UC2.1. It is currently under discussion if 365FarmNet take over the development of the service as their clients request a solution of the pasture time recording and reporting.

The final service is mainly for dairy farmers and exchanges information with the processing and governmental level of the value chain:
2.10.1. Product Description & Value Proposition

This use-cases developed a hardware and a software product to track cows and distinguish if a cow is grazing on a specific pasture and for how long.

2.10.1.1. Description of Cow Grazing Monitor

Hardware

The tracking collar is basically a Stickntrack sensor developed by Sensolus for the tracking of assets that are outside most of their time. This extremely battery-efficient GPS tracker is optimized for a long life in the field. The installation is “as easy as a sticker” and no maintenance or battery replacement is needed for 5 years.

For tracking inside the barn, the tracker detects beacons that are placed in any fixed indoor location and translates their signal into a GPS location.

Software

This manager is a service for farmers of large animal herds. It offers dashboards for the localization of animals, disease, injury & theft warnings based on movement behaviour for each single animal and an efficient grazing management. This management services builds on the insights already won with the original cow grazing monitor and on the same hardware setups with collars and beacons.
Figure 52: UC2.1 - Product Factsheet for Cow Grazing Monitor

Figure 53: UC2.1 - Product Factsheet for Roaming Herd Manager

Visual of Grazing Cow monitor Dashboard:
2.10.1.2. Value proposition of Cow Grazing Monitor

The major value of this service is the remote management of large roaming herds in wide areas. Currently the management of these herds requires a large stack of personnel for the protection and monitoring of the animals. The Grazing Cow Monitor delivers every important information in real-time to the farmers and automatically issues warnings and alerts if an animal behaves abnormal. This reduces the time for an animal to get proper treatment, to detect animals giving birth, to find an animal quickly in remote areas and to prevent animal theft.

With the Grazing Cow Monitor large herds can be easily managed by less staff and ensure even better conditions for the animals.

Furthermore, also meat processors, retailers and end-consumers profit from this transparent tracking system as it provides data on the precise location, activity and type of feed intake for every individual animal. This data can be used to ensure the origin of meat from typical, branded regions, show the wellbeing of the animals by its movement and even categorizes the meat by feed sources. With this data a retailer can prove to the consumer to quality of the meat and justify a higher price.

<table>
<thead>
<tr>
<th>Without our grazing monitor</th>
<th>With the grazing monitor</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual pen &amp; paper-based reporting</td>
<td>Digital reporting</td>
<td>Reduced labor time farmer</td>
</tr>
<tr>
<td>The farmer manually records pasturing times and nutrient balances and reports to dairy processor or government.</td>
<td>Easy digital reporting of pasturing times or nutrient balances to dairy processor or government using digital report template.</td>
<td></td>
</tr>
<tr>
<td>Manual counting total pasture times</td>
<td>Automatic graphic hour counters</td>
<td>Reduced labor time farmer</td>
</tr>
<tr>
<td>The farmer needs to count individual pasture times to keep informed on the pasturing progress of the herd to meet regulations.</td>
<td>The farmer can keep track of the total grazing time of the herd easily by looking at graphic hour counters in the cloud.</td>
<td></td>
</tr>
</tbody>
</table>
Figure 54: UC2.1 - Benefits for Dairy Farmers

The dairy processors as well as the government receives through the digital tracking and reporting way more precise values on actual time spent on pasture and saves a lot of work-time for on-farm audits.

2.10.2. Exploitation & Monetization

2.10.2.1. Revenue Model for Cow Grazing Monitor

The Grazing Cow Monitor is dedicated towards professional large-scale farmers with large herds in remote areas. The exploitation model foresees a monthly fee for the service and on-time instalment for the hardware required.
However, this current model still brings an initial cost barrier for farmers to actually try out the software solution and sign-up to a SaaS contract. Therefore, WP4 currently investigates the model of hardware-as-a-service or equipment-as-a-service where the hardware is initially pre-financed by the software provider through banks (e.g. leasing models). In this case, the farmer would solely pay an initial implementation fee and a higher monthly or yearly rate for the software service. In this model the farmer does not become the owner of the equipment and if the farmer decides after the end of the 12 months test period to terminate the contract the equipment is rebuild and collected by the service provider.

2.10.2.2. Pricing of Cow Grazing Monitor

The table below gives a detailed view on first year and recurrent pricing of different components (hardware / software and network connection fee):

<table>
<thead>
<tr>
<th>Component</th>
<th>1st year</th>
<th>Recurrent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Stickntrack sensor</td>
<td>75,00 €</td>
<td>-</td>
</tr>
<tr>
<td>Device activation one-off GOLD</td>
<td>6,00 €</td>
<td>-</td>
</tr>
<tr>
<td>Annual Sigfox service fee</td>
<td>7,00 €</td>
<td>7,00 €</td>
</tr>
<tr>
<td>Annual Professional Geolocation service fee</td>
<td>40,00 €</td>
<td>40,00 €</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>128,00 €</strong></td>
<td><strong>47,00 €</strong></td>
</tr>
</tbody>
</table>

In addition the end user (farmer) need to foresee neck collar to fix stickntrack sensor. This is not included in pricing structure.

Price implications for dairy farmers: The current milk price difference between pasture and conventional milk ranges somewhere from 0.02 – 0.10 Cents. This results in an additional revenue for a 6000l cow of 120-600€ per year. If we assume that the farmer is only ready to invest maximum 10% of this additional gain into a tracking and reporting solution of pasture milk then we arrive at a yearly price for the solution of 12-60€ per cow.

2.10.2.3. Additional data revenue model

The data of the Roaming Herd Manager on cow position and movement patterns is highly interesting as well for other applications like support tools for veterinarians, tools for modelling of air pollution by cow digestion gasses or tools on feed intake and conversion.

Therefore, WP4 evaluated the potential of a joint business model experiment with UC2.2. from Connecterra to test a data marketplace for cow or animal related data. Connecterra already offers a partnership interface which could be combined with the reusable component of WP3, the data exchange marketplace. Although different preliminary talks between both parties (Connecterra and Sensolus), it was decided not to move on this track.

With the permission of the farmer, the historical data or even the real-time data stream could be offered to third-party applications in return for an on-time fee or a regular subscription. In order to restrict the
usage of the data to specific fields and purposes, the license for the data usage that needs to be accepted by the buyer will be formulated accordingly.

### 2.10.3. Distribution & marketing strategy

#### 2.10.3.1. Distribution of Cow Grazing Monitor

Sensolus has a high reputation as asset tracker for industry companies, but according to its CEO Kristoff Van Rattinghe this reputation is hard to build in the agricultural sector. Therefore, the consortium initiated a possible collaboration and distribution with a multination player with a great network and reach in the agricultural sector and for which the grazing cow monitor might be a complement to their portfolio. As for now, the potential collaboration is in a preliminary phase and the business and distribution potential should be investigated further by the consortium.

The Grazing cow monitor operational performance is highly dependent on the Sigfox network and a total business potential was calculated for those regions with a high to medium network coverage. In an initial stage and parallel to what was previously mentioned, Sensolus is testing and evaluating the direct sales of the product in a reactive way to farmers that show proactive interest in the product. This interest is mainly generated by positive feedback, both through press and by informal reference / marketing by the test farm using the Grazing Cow Monitor for the season 2018 and 2019.

#### 2.10.3.2. Marketing strategy for Cow Grazing Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

### 2.10.1. Customers & End-user Relations

#### 2.10.1.1. End-consumer relation & loyalty for Cow Grazing Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

#### 2.10.1.2. Product support strategy for Cow Grazing Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

### 2.10.2. Partner Network & Horizontal Activities

#### 2.10.2.1. Partner network for Cow Grazing Monitor

A cooperation and testing has been set-up with Use Case 2.3 HERDSMAN + whereas UC2.3 is investigating and testing potential added value of the Grazing Cow monitor for its UC
2.10.2.2. Horizontal activities for Cow Grazing Monitor

No horizontal activities to mention.

2.10.3. Cost Structure & Internal Resources

2.10.3.1. Cost structure of Cow Grazing Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.10.3.2. Internal resources for Cow Grazing Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.11. UC2.2 – HAPPY COW

Due to the price pressure, increasing herd sizes and scarcity of (skilled) labour in the dairy sector it is getting harder for farmers to keep overview to track the health and behaviour of their cows in the best way. Any late diagnosis of a disease or health issue cuts the total milk production or affects the milk quality. Furthermore, it is often not feasible for humans to observe cows 24 hours a day 7 days per week and track behaviour objectively over time.

Therefore, this use-case develops an intelligent cow tracking system called Ida (Intelligent Dairy Assistant) that monitors the movement and eating behaviour of individual cows in a herd. It allows the early detection of oestrus for a cow in order to determine the right moment for the insemination. With this highly precise system it is possible to reduce the calving interval and increase the milk production.

UC 2.2 has involved several farms and technology providers. IDA operated in 3 deployment sites where API communication standard has been used. Milk yield, inseminations and antibiotics treatment were tracked and used to evaluate the health and production status of the herd. The herds are split in two groups of cows with and without Ida. Connecterra attributes differences between these groups to management changes based on the information that Ida presents to the farmer.

The three main features of Ida are

1. Estrus and Health,
2. Calving Detection and
3. Ask Ida & Cow Ranking.

This service focuses mainly on the dairy farm and exchanges data with feed producers and dairy companies:

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**Figure 56: UC2.2 - Value Chain Position**

Connecterra also chose to expand its offering beyond to create a service for enterprises.

https://www.ida.io/

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### 2.11.1. Product Description & Value Proposition

#### 2.11.1.1. Product description of IDA - The Intelligent Dairy Farmer’s Assistant

As of 2019, and while continuing to offer IDA for farmers, IDA also rolled out an enterprise offer.
Ida for farmers:

With Ida this use-case develops a full-featured advisory tool for dairy farmers to manage the calving and health of their animals. Its core feature is the heat detection to forecast the perfect timing for insemination. This way a dairy farmer can shorten the calving interval by some days, which make the cow more productive as reduces the off-times.

![Figure 57: UC2.2 - Overview of Product Features](image)

The service health insights was refined & updated with models that give more specific information on health issues, e.g. type of disease, severity of disease and intervention advice. Eating and ruminating behaviour are analysed to improve the health models and a ranking function has been introduced, along with a calving prediction model .

Here is what the solution offers:

- **Analytics**
  Farmers can perform their own internal benchmarking and analysis of the entire herd, as well as individual cows.
• **Calving Predictions (Under development)**
  IDA could predict when a cow is about to calve, providing farmers with a timely alert and advice when the time is right!

• **Health**
  IDA can help ½ your herds antibiotic usage and detects a variety of health issues such as mastitis or lameness, 24-48 hours before becoming apparent to a human. Health issues can also be narrowed down by using Ida’s diagnosis tool

• **Diagnosis tool**
  Through a short set of guided questions, successfully narrow down and diagnose ill cows with the assistance of IDA’s Diagnosis tools. For your temporary or new farm labour, the diagnosis tool helps them learn what to look out for!

• **Ask IDA**
  Formulate questions for measuring the impact of changes made to the farm. Use Ida to determine the impact of feed, bedding or operational changes.

• **Cow Ranking and Efficiency**
  Farmers can now identify top and bottom performers in the herd based on selected criteria. Make informed decisions about the best cows to breed, retire, inseminate, and plant with embryos.

• **Herd Insights**
  IDA also recognizes herd level behavior changes due to key factor changes, pushing valuable insights directly to the farmer, such as heat stress and its impact during hot summer months.

In addition, and to work for farmers, IDA also includes:

• **IDA Sensor (See description IDA Neck Collar below for more details)**
  Neck mounted sensor, provides the highest number of behaviour classifications of any system on the market and continuously learning more.

• **IDA Network**
  IDA uses a custom-built network consisting of distributed access points that enable IDA to communicate over long distances, up to several kilometers.

• **Pasture or Feed Lot (Under Development - not released)**
  IDA hardware will support pasture or feedlot systems with its easy to install and easy to manage infrastructure.

In a next step the service health insights will be refined. The service will be updated with models that give more specific information on health issues, e.g. type of disease, severity of disease and intervention advice. Especially eating and rumination behaviour will be analysed to improve the health models. Support would include tailored behaviour and detection models, and this is still under development.
Figure 58: UC2.2 - Product Factsheet for IDA

Additional features:2

- **Collaborate**
  - When you purchase Ida, you also gain valuable access to industry partners, suppliers and processors.

- **Integrations**
  - Ida integrates with most common dairy management software systems, we are building more integrations.

- **Automated Learning**
  - When Ida’s algorithms improve, these improvements are automatically rolled out without any additional costs.

**IDA for Enterprises**

IDA for Enterprises is a cloud-based solution that integrates real-time sensor data, integrates farm management data and also understands the farmers daily routine. Based on proprietary data and algorithms, IDA for Enterprises enables predictive insights on animal welfare, traceability and sustainability targets.

2.11.1.2. Product description of IDA neck collar

IDA worked with a product design consultancy to work on a collar-fitted sensor for the cows. The result is the sensor below.

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2 Source: https://www.connecterra.io/
2.11.1.3. Value Proposition of IDA - The Intelligent Dairy Farmer’s Assistant

The major value for the dairy farmer is the automatic monitoring of the animal’s health and calving cycle which saves a lot of work-time and increases the productivity of each cow. Furthermore, the system detects health issue earlier than a farmer could by visual checks, which results in cheaper therapies, lower use of antibiotics and lower production losses.

The data is also interesting for farm advisors. Advisors can track the success of their actions and to plan their countermeasures more in advance.

"Ida is a radical piece of AI and we have already seen impressing results in herd efficiency, calving time, health and a better understanding of cow behaviour.", Quote by a client
IDA for enterprises:

Ida promises to integrate real time farm data into a single platform and provide industry level insights. The offer to enterprises a solution that can:

- **Predict**
  - Feed and operational cost prediction, yield and component supply forecasting, and logistics scheduling.
  - Predictive forecasts powered by machine learning models.
- **Measure**
  - Keep track of on farm animal welfare, increase your sustainability footprint and overall farm performance.
  - Support consumer buying decisions with data.
- **Support**
  - Encourage the reduction of health incidents, support improved herd fertility and performance.
  - Strengthen farmer relationships.

<table>
<thead>
<tr>
<th>Dairy Processors</th>
<th>Feed Companies</th>
<th>Genetic Suppliers</th>
<th>Pharma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthen supplier relationships.</td>
<td>Empower advisors with data and reduce customer churn.</td>
<td>Access qualitative proofing through data.</td>
<td>Reduce antibiotic usage through preventive care.</td>
</tr>
<tr>
<td>Manage sustainability targets.</td>
<td>Measure the impact of feed changes in real-time.</td>
<td>Measure Genetic success and statistics.</td>
<td>Empower veterinarians with data.</td>
</tr>
<tr>
<td>Forecast milk supply.</td>
<td>Predict feed demand from customers.</td>
<td>Forecast your business outcomes.</td>
<td>Measure the impact of medical treatments in real time.</td>
</tr>
<tr>
<td>Measure consumer welfare expectations.</td>
<td>Value added services differentiate from competition.</td>
<td>Qualify and improve genetic products.</td>
<td>Proactive guidance on dosage.</td>
</tr>
</tbody>
</table>

*Figure 61: UC2.2 - Key values of IDA for enterprises*
2.11.2. Exploitation & Monetization

2.11.2.1. Revenue model for IDA - The Intelligent Dairy Farmer’s Assistant

Connecterra offers IDA to dairy farmers based on a monthly subscription model and charge for two of their subscription models an additional one-time setup fee of 65€/cow to finance the collar and its implementation. The farmer can choose between 3 different subscription plans.

2.11.2.2. Pricing for IDA - The Intelligent Dairy Farmer’s Assistant

The current pricing of IDA foresees rather low costs for the farmer to spread the service quickly on many farms. The more farms are connected to IDA, the more data the AI algorithms receive to be trained and sharpen their predictions. Therefore, the growth strategy is heavily subsidised by the equity of Connecterra to reach a critical mass in the market. Currently IDA is offered under the following payment plans:

**Plan Standard**

This subscription plans offers core feature of IDA like data insights and SMS alert, but comes without some extending analysis and convenience features. Additionally, the farmers pay a setup fee of 65€ per cow. For an average dairy farm of 100 cows this would result in the following costs for the first and the second year:

- 1st year: 3.000€ (Monthly fees) + 6.500€ (Setup fees) = 9.500€
- 2nd year: 3.000€ (Monthly fees) = 3.000€   TOTAL: 12.500€

**Plan Pro**

This plan gives the farmer access to all core and additional features, but still requires a 65€ setup fee per cow. For an average dairy farm of 100 cows this would result in the following costs for the first and the second year:

- 1st year: 4.800€ (Monthly fees) + 6.500€ (Setup fees) = 11.300€
- 2nd year: 4.800€ (Monthly fees) = 4.800€   TOTAL: 16.100€

**Plan Flex**

This plan is a pure as-you-go subscription with no initial setups fees that give the farmer access to all features of IDA and includes as well the collars as a service. For an average dairy farm of 100 cows this would result in the following costs for the first and the second year:

- 1st year: 9.000€ (Monthly fees) = 9.000€
- 2nd year: 9.000€ (Monthly fees) = 9.000€   TOTAL: 18.000€
The pricing structure for IDA for Enterprise is a case by case basis to be determined by the sales team.

2.11.2.3. Additional data revenue model

Connecterra is also developing a partnership platform that manages the exchange of data from their clients for third-party applications in the fields of veterinarians or feeding advisors. This data exchange happens only on prior permission by the farmer.

Usually the data is exchanged for other data from the third-party service so that there is no actual financial revenue stream created, but a barter agreement on additional data that can be transformed to higher added value for the farmer in terms of insights and knowledge.

2.11.3. Distribution & marketing strategy

2.11.3.1. Distribution of IDA - The Intelligent Dairy Farmer’s Assistant

Connecterra has a rather small distribution team of 3-4 people in-house while the major part of the international distribution network is composed of local resellers. Additional resellers can apply via an online form and after a successful assessment become a reseller for IDA in their region. Following this strategy, Connecterra could already build up sales presence in 10 countries (Netherlands, Belgium, Germany, Spain, USA, Canada, Mexico, UK, Ireland and Kenya) around the globe and is working hard to expand their distribution as well to New Zealand and Australia. See below a map of the current distribution network:
2.11.3.2. Marketing strategy for IDA - The Intelligent Dairy Farmer’s Assistant

Ida has been featured in Websummit, on various media (print & tv) such as MSNBC, FastCompany, BBC Studios, Trouw, Boerderij and also mentioned by the likes of Microsoft & Google.

2.11.4. Customers & End-user Relations

2.11.4.1. End-customer relations & loyalty for IDA - The Intelligent Dairy Farmer’s Assistant

The UC did meet with all three farmers face to face. Insights are that farmers want:

- A lower number of false positive insights,
- integration with their farm management system and
- milk yield data to be included in Ida.

They also indicated that they found the app user friendly, responses to questions quick and that they were concerned about battery life. Features they were eager for were calving prediction, group level monitoring of feeding behaviour and tools to gain insight in the feeding management.

For new customers, various touch points are possible - but for those who’s first interaction with IDA is through the website, the company has provided a questionnaire to help them with the sales process by asking the farmer where they are looking to add value through IDA:

https://ida.io/ida-for-farmers/value-selection/
2.11.4.2. Product support strategy for IDA - The Intelligent Dairy Farmer's Assistant

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.11.5. Partner Network & Horizontal Activities

2.11.5.1. Partner network for IDA - The Intelligent Dairy Farmer's Assistant

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.11.5.2. Horizontal activities for IDA - The Intelligent Dairy Farmer's Assistant

Three main activities were under consideration for UC2.2:

- **Expanding the Use Case from Dairy to Meat**
  UC2.2 considered expanding towards eastern Europe with Black Angus Beef farms, but for now they chose to stick with Dairy as beef has very different challenges and breeds.

- **Platform approach & FMIS integration or data exchange**
  UC2.2 is eying potential collaborations with FMIS providers for a platform approach as a growth avenue. For the moment, their solution uses *already available functionality in those systems. So, with the farmers agreement they have set up an integration for all 3 active farms.* The barrier for setting this up in a more modern way is that FMIS providers are hard to reach and the process takes long. We don’t want our customers to wait on this. They would have liked cooperating with a 3rd party like Farmnet 365, however the customers did not use their software.

2.11.6. Cost Structure & Internal Resources

2.11.6.1. Cost structure of IDA - The Intelligent Dairy Farmer’s Assistant

Ida’s cost structure can be divided into 3 main parts:

- **Product (software) development**

- **Hardware development & manufacturing**
  - Pre-financing was secured for the hardware prototyping but no data around this topic can be shared.

- **Marketing, distribution & sales – including aftersales & training**
  - While Ida (Connecterra) sells the service through their website and other channels, there is also the option of third-party sales through resellers. Future resellers need to provide field / farm technicians to ensure maintenance of the product, and Connecterra provides consistent support from a dedicated Account Manager and gives advice, training and materials from their Marketing and Sales team. The reseller also gains access to Connecterra’s local lead generation and campaigns.

It is worth mentioning that Connecterra has received external financing in addition to the financing coming from IoF2020.
<table>
<thead>
<tr>
<th>Announced Date</th>
<th>Transaction Name</th>
<th>Number of Investors</th>
<th>Money Raised</th>
<th>Lead Investors</th>
</tr>
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<tr>
<td>Jan 01, 2019</td>
<td>Grant</td>
<td>N/A</td>
<td>€2.4M</td>
<td>N/A</td>
</tr>
<tr>
<td>May 24, 2018</td>
<td>Series A</td>
<td>6</td>
<td>€4.2M</td>
<td>Sistema Venture Capital</td>
</tr>
<tr>
<td>May 19, 2016</td>
<td>Seed Round</td>
<td>4</td>
<td>$1.8M</td>
<td>Breed Reply</td>
</tr>
</tbody>
</table>

2.11.6.2. Internal resources for IDA - The Intelligent Dairy Farmer's Assistant

**Team at Connecterra**

31 employees, (5 Cust Success, 13 Engineering, 5 Finance/HR & Ops, 4 Sales, 2 Exec), across 3 countries (the Netherlands, USA and France)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yasir Khokhar</td>
<td>Founder &amp; CEO</td>
<td>Management</td>
</tr>
<tr>
<td>Saad Ansari</td>
<td>Founder &amp; CTO</td>
<td>Management</td>
</tr>
<tr>
<td>Marjolein van Hage</td>
<td>Finance Manager</td>
<td>Management</td>
</tr>
<tr>
<td>Stacey Hobson</td>
<td>Office Manager</td>
<td>Management</td>
</tr>
<tr>
<td>Sicco Pier van Gosliga</td>
<td>Director of R&amp;D</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Jorge Sáez Gómez</td>
<td>Director of Data Science</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Timo de Winter</td>
<td>UX, UI &amp; Product Design</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Sándor Kocsis</td>
<td>Front-end Developer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Mihai Coman</td>
<td>Full-Stack Engineer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Zhenyu Ye</td>
<td>Hardware &amp; Devices Engineer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Thijs Castelein</td>
<td>Hardware engineer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Zhenhao Li</td>
<td>Data Engineer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Nela Lekic</td>
<td>Data Scientist</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Arwin Stoop</td>
<td>Field engineer</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Niels Rutten</td>
<td>Industry Technology Specialist</td>
<td>R&amp;D + Product Development</td>
</tr>
<tr>
<td>Leonie ten Dam</td>
<td>Director of Sales</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Hailey Nelson</td>
<td>USA Account Manager</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Jan Jaap Kuipers</td>
<td>International Account Manager</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Robyn Bonnin</td>
<td>Marketing Lead</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Niels Molenaar</td>
<td>Customer success manager</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Monique Commandeur</td>
<td>Marketing and communication</td>
<td>Sales &amp; Marketing</td>
</tr>
<tr>
<td>Vaija Sekar</td>
<td>People Magnet</td>
<td>Sales &amp; Marketing</td>
</tr>
</tbody>
</table>
2.12. UC2.3 – HERDSMAN+

This Use-Case addresses the same challenges as in UC2.2, the objective being to shorten the calving cycle by better heat (oestrus) prediction and an advanced health monitoring with an alert functionality for mastitis. The Use-Cases are founded on highly advance algorithms driven by a profound understanding of the cow biology and the dairy sector. The product is based on a neck-collar system called Silent Herdsman that the developers successfully sold as spin-off to Afimilk³ in Israel.

Furthermore, the Use-Case is evolving to focus on the integration of additional pn-farm data sources generated by milking robots and feeding machines to provide a feed efficiency monitoring of the whole dairy farm in one integrated database/user interface. The integrated platform enables the enhancement of practices throughout the supply chain for farm consultants to farmers producing milk products with specific characteristics derived from specific feed mixes which at the same time limiting the impact on the environment.

The Use-C initial target market is dairy farmers as end-users/customers but with time the solution has an evolution path relevant to all of the key stakeholders within the supply chain and indeed can be important in terms of maintaining food safety, limiting the amount of drugs (antibiotics) in the food chain, limit the spread of diseases detrimental to the integrity of the food supply and inform regional and national Governments on the robustness of the food supply (Figure 3*)

![Figure 64: UC2.3 - Value Chain Position](http://www.afimilk.com/products/cow-monitoring)

2.12.1. Product Description & Value Proposition

2.12.1.1. Description of Herdsman+

The range of potential services (Herdsman+) are presently founded on integrating the data from a neck-mounted collar system milking robots and feeding machines to provide a full cycle monitoring of a cow’s health condition, oestrus (and hence pregnancy cycle), feed efficiency performance and milk product quality (Figure 39).
At this time, a central User Interface presents the real-time status of individual animals within the herd to the farmer, generating automatic alerts that trigger insemination tasks and on health issues. This service could be also integrated in an existing farm management system.

The final Herdsman+ Suite will consist of the fertility service, the health monitoring service and a nutrition service. These modules can be booked individually by the farmer based on the available sensing equipment and the needs of the farm.
2.12.1.2. Value proposition of Herdsman+

The major benefits owing to the platform is the lowering of the calving index (days between pregnancies), which results in enhanced milk yields and in turn increased revenues per animal. Concurrently, the service automatically monitors the health condition of each cow through the monitoring of the time spent eating and ruminating – a significant drop in these periods from the 7-day average provides real-time alerts to the farmer.

In addition to increased revenues, the platform brings social/operational benefits to the farmer through a major reduction of effort which traditionally was devoted to visually monitoring of the herd for signs of heat/illness in turn enabling the management of a larger number of animals (Figure 41).

2.12.2. Exploitation & Monetization

In February 2016, Israeli dairy farm management technology provider Afimilk acquired Silent Herdsman, a spin-out company from the University of Strathclyde which until then was the projected consortium partner for UC2.3. In March 2014, Silent Herdsman raised a $4.3 million venture funding round,
according to CrunchBase. Investors that participated include UK growth equity and venture capital partner Scottish Equity Partners, UK small company venture capital investors Albion, and the investment arm of The Scottish Investment Bank.

With this change in ownership, the current consortium lost its core product, the neck mounted collar to Afimilk and the focus of the Use Case aligned to the further development of services through the integration of data generated by other common dairy farm core equipment such as milking robots and feeding machines. However, the exploitation readiness of the Use-Case is still in its infancy as the Consortium is in the midst of establishing a proper distribution strategy and a framework to monetize service-based solutions.

2.12.2.1. Revenue Model for Herdsman+

In case of a standalone distribution, the Herdsman+ solution can potentially be offered as a software-as-a-service generating revenues through monthly or yearly subscription. A number of charging options are available but need to be tested with customers e.g. the farmer either subscribes just for the alerts service for (say) approximately £2 per month per cow which may/may not include the required hardware (collars) for about a further £0.50 more per month per cow.

If the distribution of the service takes place via a marketplace or in the form of a module integrated into a third-party application, the price would rise accordingly to the marketplace commission or license agreement with another service provider.

The value of reducing the calving index with the Herdsman+ service by for example 20-days for a 500-cow herd translates into £50k additional revenue per year. The costs for the service in return would only be £15k which results in a profit of £35k for the farmer within one calendar year. An additional revenue £175k results over the 5-year lifetime of a collar.

Calving Index (CI) is an industry accepted metric for herd fertility/pregnancy performance; if a heat event is missed and the cow does not become pregnant, then the CI increases.

2.12.2.2. Pricing of Herdsman+

For a 'hybrid' service-based model where the infrastructure enabling the service is at cost price and the service is at a reduced price per month, a representative price would be £2 per animal per month over 5-year lifetime of the collar.

For a fully priced per animal per-month service cost where the infrastructure enabling the service is deployed at zero cost to the customer, a representative price would translate into £2.50 per animal per month over 5-year lifetime of the collar.

2.12.2.3. Additional Data Business Model

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.12.3. Customers and End-user Relations

2.12.3.1. Distribution of Herdsman+

As the leaders of the use-case from the Strathclyde University have already over ten years of experience of developing new companies providing products to the dairy sector, the partners foresee the foundation of spin-off company for the exploitation of the Herdsman+. The distribution structure should focus on rural communities and the use-case is open for a collaboration with a partner that already has an established distribution network on this level.

Another interesting option to distribute the Herdsman+ service would via an existing FMIS marketplaces like 365FarmNet, which already offers solutions for dairy farmers and grants right away access to 5000+ dairy farmers.

However, due to the large similarities with UC2.2, WP4 initiated discussions between the partners from the University of Strathclyde and Connecterra. The proposition is to integrate the Herdsman+ algorithms for predicting the onset of a critical illness into the IDA solution, which is already on the market in 10 countries all over the world. With this commercial opportunity, the Herdsman+ solutions will either be offered as a full integration or a module distributed in the following countries: Netherlands, Belgium, Germany, Spain, USA, Mexico, Canada, UK, Ireland and Kenya.

2.12.3.2. End-customer Relations of Herdsman+

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.12.4. Partner Network and Horizontal Activities

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.12.5. Cost Structure & Internal Resources

2.12.5.1. Cost structure of Herdsman+

The hardware has a lifetime of greater than 5 years and costs of about £100 per collar. Therefore, the initial costs for an average herd of 500 cows would result in an investment of £50k.

The pricing for a service-based provision are currently under assessment.

2.12.5.2. Internal resources for Herdsman+

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.13. UC2.4 – REMOTE MILK QUALITY

During the production process, dairy companies are using instruments to analyze the various products, such as milk, cheese, milk and whey. In this way, they keep a grip on the production process and make adjustments where necessary. However, guaranteeing that the test results are correct is still an issue. Many factors can be of influence of the test results. This includes sampling, pre-treatment of the sample, correct calibration, maintenance of the instrument and influence of the person who performs the analysis.

The original plan for this Use Case was to develop a Remote Dairy Quality (RDQ) tool to help with guaranteeing the quality control for the analysis, as well as a Sample Pre-treatment Device. However, plans to develop the sample pretreatment device were abandoned early in 2019 as the business case for this product was found to be unjustifiable. Therefore, Qlip and the Remote Milk Quality use case decided to start developing a new product in 2019: Remote Milk Quality Testing on Truck.

For purposes of this description, the RDQ description as presented in deliverable 4.9 is considered to be the status quo and is in large omitted from this description given that there are no updates.
2.13.1. Product Description & Value Proposition

2.13.1.1. Product description of Remote Dairy Quality (RDQ) tool

In order to maintain reliable results from milk quality analyses the sensors need regular calibration, controls and harmonization by experts. As this is costly and specific competences are required, this use-cases develops an IoT solution for remote calibration and control services for dairy processors. Also, it is identifying the options to implement this approach on farm level.

The Remote Dairy Quality Tool monitors the sample handling and the execution of the calibration plan for a specific instrument. With RDQ, the method of pre-treatment of the control samples and whether the analysis results of the control samples fall within the set limits is all recorded. In cases of significant test deviations from the set limits the tool issues warnings to quality assurance / control manager and suggest actions for improvement. All this is presented graphically in digital control charts and deviations are reported to the responsible person by means of alerts. The RDQ tool is available online for the various employees, such as process operators, QC and QA managers, regardless of location. If more than one person carries out the analyses of the control samples, it is possible to follow the performance of each individual employee.
The RDQ tool is already being used successfully by customers in practice at multiple locations within the Netherlands. Several users analyse different types of dairy products, such as milk, skimmed milk, cream and various whey products. The RDQ tool hereby guarantees that the analysis results are accurate and guaranteed. These test results form a reliable basis for producing final-products that meet the specified specifications for fat, protein and lactose and improve efficiency of production.

2.13.1.2. Product description of Remote Milk Testing on Truck

This product consists of a miniaturized lab device which can be placed on a milk collection truck. The advantage is, that testing the milk samples is not dependent on being transported to a central lab location anymore.
The device that is being developed is capable of performing 2 kinds of measurements on milk:

- IR imaging
- Cell-counts

Certain types of tests (like butyric acid –tests) cannot be performed on the truck (yet). This leads to 2 important notions.

**Short term:** Because certain tests are only possible to perform in the central laboratory, it will still be necessary to preserve the current physical distribution of milk-samples: At this moment the milk-driver collects samples from every milk-tank, delivers these samples to the dairy plant and Qlip collects them twice a day from all dairy plants in Holland.

**Long term:** It would be wise to create a scalable platform: Future innovations will lead to new mobile-measurement-devices, with new possibilities when mounted on a milk collection truck. Therefore, it would be advisable to have the ability to add additional measurement devices to the platform in the future.

A first working prototype to be tested is expected by the end of 2019.

- Focus of our project will now move into creating an IoT-platform for such devices.
- Goal is to implement functionalities such as
- Communication of results, sample temperatures, Infrared models, choose between edge computing versus server based, hard- and software status, distribution of software updates, etc…
- Towards the end of 2020 we expect a 3rd prototype that we would really test in our laboratory.

One question to investigate is regarding the right amount of data points that the mobile solution should have, i.e. the resolution required. Currently, we have 1060 data points in the lab. At the moment for the
truck we are looking at a lower resolution but it has to focus on a special part of the spectrum so we think we will have enough information to get correct lab results.

The biggest question remains: How are we going to integrate this device in how we are working and our workflow and how to make use of this data?

The Use Case attempted to answer this question by investigating a specific user journey at this point: The Milk Truck driver.

The idea is that the logic for the interpretation of the lab results will not be present in the mobile device (not decided upon yet).

- This will make an update of interpretation logic much easier; you only have to update the central “Qlip Interpretation Service” (and not each device separately).
- Qlip-knowledge about interpretation of the raw data is unique in the world (for example Meadow Milk Indicator). It would provide an enormous security risk to distribute / scatter all this knowledge over 500+ devices for the Netherlands only.
- There is no need (in other words: there is no value), for functionality that the milk collection truck can leave a report about the intake and the lab results at the farm directly. Communication about the lab results will therefore be done by the current reporting systems like Melk-web and Z-Net. This saves a lot of complexity. There is no indication that Farmers want to have a “printed receipt” on the spot.

Figure 74: UC2.4 - Product process for Remote Milk Testing on Truck
It's also a possibility that this solution ends up also on the milk tank at the farmers. This disrupts the whole value chain for source planning.

An updated comprehensive product presentation of UC2.4 that focuses on the Milk Truck will be prepared for the final deliverable.

2.13.1.3. Value proposition of Remote Dairy Quality (RDQ) tool

The major advantage of the remote dairy quality tool is to standardize the required actions for a proper calibration control of the sensing devices in dairy company. This will improve the accuracy and reliability of milk quality testing.

With this system, high-precision sensing solutions can also be used and managed by user with lower experience in quality assurance and the calibration of measurement instruments. In general, the usage of this tool results will result in more precise quality measurement, fine-tuned dairy processing to final products with the required specs.

<table>
<thead>
<tr>
<th>Without Remote Dairy Quality</th>
<th>With Remote Dairy Quality</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>No standardized calibration plan available</td>
<td>Working following customized calibration plan</td>
<td>This approach will lead to increased efficiency and level of assured quality of production processed at dairy factories.</td>
</tr>
<tr>
<td>In many cases no calibration plan is available.</td>
<td>A specific plan per instrument per matrix</td>
<td>Efficiency + 5%</td>
</tr>
<tr>
<td>Manual recording of test results</td>
<td>Continuous monitoring of execution of calibration plan and quality of test results.</td>
<td>Assured Quality + 5%</td>
</tr>
<tr>
<td>In many situations test results are recorded within xls-files or on paper. Difficult to monitor and assure quality of information.</td>
<td>Result shown in control chart. Generates alerts based on plan to inform and take action</td>
<td>* These values are an estimation. Per dairy processor a zero measurement of testing performance will be done prior and after implementation of RDQ tool.</td>
</tr>
<tr>
<td>No SOPs available for sample handling</td>
<td>Organized, standardized and easy process</td>
<td>Easy to use for processors. Reliable decision making information available.</td>
</tr>
<tr>
<td>Standardized sample handling is key to assure quality of test result.</td>
<td>Provides standardized insights for QA manager. In control of process.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 75: UC2.4 - Benefits for Dairy Processors

2.13.1.4. Value proposition for Remote Milk Testing on Truck

With the Remote Testing on Milk Truck, milk quality can be determined before unloading at the dairy company which theoretically gives the dairy processor better control over the dairy production process while providing Qlip with cost saving on expensive equipment and extra value for the industry for direct results.

The samples can be analysed on farm-location; Saving time and transportation costs, reducing ecological footprint and also bringing new opportunities for logistical and supply chain innovation.

However, there is no value for the dairy company at this moment: In the current pilot Qlip is testing on fat, protein, lactose & ureum. The dairy companies will perform their own tests on the factory before processing the milk. They don’t need the results from Qlip for their production. These results are only needed for the payment of the farmers.

In the long run if Qlip is able to measure “ab-normal” milk on the truck, then dairy companies can prevent “mixing” this abnormal milk with “good” milk before loading it on the truck or before unloading it on the dairy plant (with an assumption of 200 trucks per Year). This will save a lot of time and money. Abnormal
milk is not very common where Qlip currently operates in the Netherlands, but it can cause a lot of trouble in the production chain.

There is value for farmers in knowing the results a day earlier, because some farmers are very keen on feed-management based on the % fat & protein: now they can react a day sooner with their food management.

- For Qlip, in the long run, when all the tests are done on the milk-truck, there is a possibility to close a large part of the stationary and expensive Qlip lab, and there won’t be a need to drive around with milk samples anymore, which would lead to lower production costs for Qlip resulting in a positive effect on the value chain.

- If the Milk testing on truck is successful, then Qlip can expand our business to other countries. We only need the raw-data to create a trustworthy lab result. This will help other countries in developing efficient and excellent dairy chains.

2.13.2. Exploitation & Monetization

2.13.2.1. Revenue model for Remote Dairy Quality (RDQ) tool

Qlip foresees the generation of revenue out of the following three main modules:

- **Subscription model for Remote Dairy Quality (RDQ) tool**
  Qlip intends to offer its remote calibration service based on an annual subscription fee. This contract would renew every 12 months and includes 10h support through a helpdesk.

- **Subscription model for Reference Samples**
  This subscription includes all needed reference samples to calibrate machines for a year. In a premium plan the samples could come with the sample pre-treatment device.

- **Subscription for training and workshops**
  Qlip offers a full training and workshop package for customer location to train local quality staff in the correct calibration of machines and the proper sample handling.

- **One-time fees for custom services**
  For specific customer requests, Qlip provides tailored proficiency tests, specific calibration, additional reference samples, workshops and training as well for one-time fee that depends on the effort for the individual service request.

The use-case is currently investigating opportunities and product features for farms and transport companies. WP4 is supporting this activity by its product development campaign and consulting on valuable feature sets. WP4 is together with the use-case still assessing the value created by the service for the dairy processor to compare price and value proposition. The business model will very likely be a SaaS model.

Furthermore, Qlip offers a variation of fee-based trainings and workshops. In addition, customized reference samples and calibration sets are being offered. Customers also receive remote online monitoring of calibration management, visualization and alerts as well as remote online and on-site maintenance services. Pricing for these services is equal for all customers (1st month for free). There is no pricing for data. In case of on-site expertise, a customer specific proposal will be made.
2.13.2.2. Pricing of Remote Dairy Quality (RDQ) tool

The pricing for the subscriptions of the Remote Dairy Quality Tool and the reference samples is currently not clear as this requires a better understanding of the cost structure behind the full service. This is currently under investigation and planned to find a price in 2019.

A subscription for a training package at a customer’s location (e.g. dairy plant) is currently priced at 2,400€ per location for a full year.

Additional revenues can come through

- Fees for training & workshops
- Fees for custom made proficiency tests, calibration & Reference samples
- Calibration & capacity building as a service or hardware sales

2.13.2.3. Revenue model for Remote Milk Testing on Truck

Some ideas from the former Sample Pre-treatment Device revenue model may be also taken into account for the new Remote Milk Testing on Truck. Here are two revenue streams possible:

- **Subscription model – Hardware-as-a-Service**
  The device could be part of a monthly subscription plan for the RDQ Tool or the reference sample package. The customer would pay a little top-up to the normal monthly or annual subscription fee. This would require a proper pre-financing plan for the devices as the initial manufacturing costs can only be recovered over a longer period.

- **Lump sum payment**
  Qlip offers the device at fixed price and the customers receives full ownership of the device and takes over responsibility for its maintenance.

2.13.2.4. Pricing of Sample Pre-treatment Device

Pricing of the Remote Milk Testing on Truck is to be developed, with the following ideas being discussed

- Price per sample
- Price per “delivery”
- Device price + installation + data

2.13.2.5. Additional data revenue model

Qlip will consider investigating potential advantage that “On Truck” testing bring in terms of immediate data generated that can be acted upon by other partners.

2.13.3. Distribution & Marketing Strategy

2.13.3.1. Distribution strategy for Remote Dairy Quality (RDQ) tool

Currently, the RDQ tool is promoted within Europe with distribution handled by Qlips’ own online platform: qcps.Qlip.nl & rdqtool.Qlip.nl. This platform will be connected to Qlips’ current customer platform (qcps.Qlip.nl) for Calibration & Proficiency Products & Services (e.g. ordering reference & calibration samples and reporting on proficiency testing), which is used by all customers globally. Main marketing communication platform is the website of Qlip – www.Qlip.nl and direct newsletters.
Qlip had 3 Dutch dairy processors in the project’s pilot phase that involved approximately 40 operators & 7 people on the QA/QC side of operations. The pilot phase and the commercial launch was a success - out of the pilots two have signed contracts for which deployment started and other contracts are in the pipeline.

2.13.3.2. Marketing strategy for Remote Dairy Quality (RDQ) tool

There have been special demonstrations about the RDQ tool in November 2019. Demonstration of the RDQ tool is also integrated in yearly Workshops/FTIR analyses: This training is conducted for Qlip clients (open registration) where clients get trained in FTIR technology. This training is provided 2 times a year and is not dairy company specific.

Demonstration of the RDQ tool is also integrated in Qlip’s yearly Cheese Analysis Workshops / training (also two times per year, open registration)

These trainings are also tailor made (dairy customer specific) available: (several times per year): The RDQ tool is always integrated in this training.

2.13.3.1. Distribution strategy for Remote Milk Testing on Truck

- Distribution & Sales Channels in the Netherlands: Existing customer networks and Qlip network
- Distribution & Sales Channels outside the Netherlands: To be investigated.

2.13.3.2. Marketing strategy for Remote Milk Testing on Truck

Existing relationships with customers is the basis of marketing the Remote Milk Testing on Truck for the moment - as our communication is more focused on the need to secure pilots and to test than to showcase the product. In 2020 it would make sense to explore the marketing strategy to reach customers outside the Netherlands.

2.13.4. Customers & End-user Relations

2.13.4.1. End-consumer relations & loyalty for Remote Dairy Quality (RDQ) tool

Customer relationship is maintained through:

- Subscription for delivery of samples
- Maintaining calibrations of IR instruments
- Maintaining competence & knowledge by training & workshops
- Organizing & reporting on Custom made Proficiency Tests
- Workshops

2.13.4.2. Product support strategy for Product Remote Dairy Quality (RDQ) tool

The newest version of Qlips’ RDQ-tool (Remote Dairy Quality) is continuously used by an internal customer: Qlip Department Wet Chemistry laboratory. Furthermore, the RDQ-tool is tested now in a real situation by the dairy-processors Rouveen CZ, Amalthea & Hyproca. Even though there is no technical maintenance needed, there is Online & On-site customer support provided by Qlip experts

2.13.4.3. End-consumer relations & loyalty for Remote Milk Testing on Truck

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.13.4.4. Product support strategy for Remote Milk Testing on Truck

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.5. Partner Network & Horizontal Activities

2.13.5.1. Partner network for Remote Dairy Quality (RDQ) tool

The plan is to exchange test data of reference samples directly out of IR-instrument. This will lead to a higher quality of data as no manual input of test results is foreseen.

2.13.5.2. Horizontal activities for Remote Dairy Quality (RDQ) tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.5.3. Partner network for Remote Milk Testing on Truck

The plan is to exchange test data of reference samples directly out of IR-instrument. This will lead to a higher quality of data as no manual input of test results is foreseen.

2.13.5.4. Horizontal activities for Remote Milk Testing on Truck

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.6. Cost Structure & Internal Resources

2.13.6.1. Cost structure for Remote Dairy Quality (RDQ) tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.6.2. Cost structure for Remote Milk Testing on Truck

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.6.3. Internal resources for Remote Dairy Quality (RDQ) tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.13.6.4. Internal Resources for Remote Milk Testing on Truck

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.14. UC2.5 – LAMENESS DETECTION THROUGH MACHINE LEARNING

Lameness is a substantial issue in the dairy industry – it entails pain and discomfort for the cow, and results in decreasing fertility and milk yield for the farmer. Current solutions are cost-intensive and involve complex equipment. Lameness can be addressed without having to spend a high amount of resources. By employing leg mounted sensors and machine learning algorithms lame cattle can be identified at an early stage, and the data acquired can be sent directly to the farmer so that treatment of lameness can start immediately.

The use case will build upon an existing trial for early lameness detection deployed on a farm in South East Ireland and extend as well as integrate this deployment into other IoF2020 use cases. The current deployment on a farm with 150 cattle utilizes leg mounted sensors and uses Machine Learning for early lameness detection. The team will attach sensors from two separate vendors on cattle in dairy and beef herds in three further countries. The approach will thus be validated in different environments and scenarios.

![Figure 76: UC2.5 - Value Chain Position](image)

Business analyses and development will be expanded through liaison with a consultant after October 2019.

23/08/2019: There have been a delay of 4 months because of the financial part with the involved partners.

2.14.1. Product description & value proposition

2.14.1.1. Description of Early Lameness Detection Service for Dairy and Beef Cattle

The dairy cows were each fitted with a long-range pedometer. The mobility data from the sensors attached to the front leg of each cow is aggregated at the fog node to form time series of behavioural activities (e.g. step count, lying time and swaps per hour).
These are analysed in the cloud and lameness anomalies are sent to farmer’s mobile device using push notifications. The application and model automatically measure and can gather data continuously such that cows can be monitored daily.

Furthermore, the clustering technique employed proposes a new approach of having a different model for subsets of animals with similar activity levels as opposed to a “one size fits all” approach. It also ensures that the custom models dynamically adjust as weather and farm condition change as the application scales.

Figure 77: UC2.5 - Product impressions for Lameness Detection Service

MELD will further validate this solution with expanded trials including a second vendor’s platform. Both of the sensor platform vendors are part of the MELD consortium, namely ENGS Dairy and IHerd (trading as Herdsy).

Figure 78: UC2.5 - Product functionality for Lameness Detection Service

SaaS based machine learning solution for early lameness detection

MELD will produce a SaaS based machine learning solution for early lameness detection in dairy and beef cattle validated on multiple trial sites in four different countries.

There is no apparent difference in this product between Beef or Dairy Cattle.
2.14.1.2. Value proposition of Lameness Detection Service for Dairy and Beef Cattle

The initial results indicate that we can predict lameness 3 days before it can be visually captured by the farmer with an overall accuracy of 87%. This means that the animal can either be isolated or treated immediately to avoid any further effects of lameness.

![Figure 79: UC2.5 - Value proposition of Lameness Detection Service](image)

2.14.2. Exploitation & monetization

2.14.2.1. Revenue model for Lameness Detection Service for Dairy and Beef Cattle

IP coming from the SFI-Connect SmartHerd project lies with the coordinator, Waterford Institute of Technology (WIT). The initial proposed business model is to licence this through IoT vendors operating in herd monitoring and provide the service as an add-on to current vendor offerings in a SaaS type offering.

Given the SaaS model sold as an add-on to current IoT vendor offerings we provide revenue projections as per Table 3 below.

![Table 1: Revenue projections 2020 - 2022](image)

<table>
<thead>
<tr>
<th>Vendor</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herdisy</td>
<td>50,000</td>
<td>85,000</td>
<td>125,000</td>
</tr>
<tr>
<td>Vendor 2</td>
<td>50,000</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Vendor 3</td>
<td>80,000</td>
<td>80,000</td>
<td>80,000</td>
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<tr>
<td>Vendor 4</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Total</td>
<td>210,000</td>
<td>245,000</td>
<td>285,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MELD Target</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle Monitored</td>
<td>42,000</td>
<td>61,250</td>
<td>85,500</td>
</tr>
<tr>
<td>Price per head</td>
<td>£5.00</td>
<td>£5.00</td>
<td>£5.00</td>
</tr>
<tr>
<td>Revenue</td>
<td>£210,000</td>
<td>£306,250</td>
<td>£427,500</td>
</tr>
</tbody>
</table>

![Figure 80: UC2.5 - Table with Revenue projections 2020 – 2022](image)
Herdsy have provided us with projection of the number of cattle they will monitor from 2020 to 2022. We have included three similar vendors with various example projections. MELD will seek to reach out to three similar vendors through Task 4 commercialisation activities. ENGS Dairy are already in negotiations for an evaluation licence of the current offering. Our project includes our target of the addressable market across four vendors of 25% in year 1, then 25% and 30% in the subsequent years. We provide a sample cost of €5 per head. Providing a final price will be part of the commercialisation activity in Task 4.

2.14.2.2. Pricing of Lameness Detection Service for Dairy and Beef Cattle

Base price is not yet established.

Points of attention that are now being considered are:
- Payment will be based on a pricing per animal per month
- Payment is made month in advance.
- Larger herds receive a better per animal price.
- An extra charge will in place for 24h telephone support
- Online support documentation (free)
- Support (telephone) – premium payment

2.14.2.3. Additional data revenue models

No additional royalty incomes has currently been identified.

2.14.3. Distribution & marketing strategy

2.14.3.1. Distribution and sales channels for Lameness Detection Service for Dairy and Beef Cattle

IP coming from the SFI-Connect SmartHerd project lies with the coordinator, Waterford Institute of Technology (WIT). The intended path to commercialisation is for WIT to create a spin-out company using the IP generated.

The direct sales could be via licensing to established livestock monitoring players and/or via integrated afri-services platform (e.g. 365FarmNet).

2.14.3.2. Marketing strategy for Lameness Detection Service for Dairy and Beef Cattle

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.14.4. Customer & end-user relations

2.14.4.1. End-customer relations & loyalty for Lameness Detection Service for Dairy and Beef Cattle

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.14.4.2. Product support services for Lameness Detection Service for Dairy and Beef Cattle

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.14.5. Partner network & horizontal activities

2.14.5.1. Partner network for Lameness Detection Service for Dairy and Beef Cattle

Our current partner network comprises our two trial partners:

- ENGS
- HERDSY

2.14.5.2. Horizontal activities for Lameness Detection Service for Dairy and Beef Cattle

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.14.6. Cost structure & internal resources

2.14.6.1. Cost structure for Lameness Detection Service for Dairy and Beef Cattle

- There is a cost to hosting the cloud based SaaS solution
- Resources required for integration with new livestock monitoring system as the partner network expands

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.14.6.2. Internal resources for Lameness Detection Service for Dairy and Beef Cattle

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.15. UC2.6 – PRECISION MINERAL SUPPLEMENTATION

This use-case is centred around the Pitstop+, which is being developed by MicroFeeder, a research and innovation-oriented SME with the mission to cover all market needs for mineral feeders for dairy production. To achieve this, MicroFeeder developed a set of new products for support of lactating dairy cows in the initial lactation phase. Especially during this period, dairy cows have an undersupply of minerals and vitamins compared to their need for milk production, which directly affects health and reproduction of the animals as well as the milk yield obtained. MicroFeeder aims to support exactly these animals by providing them with a dedicated supply of the minerals and vitamins they need in stage.

The MicroFeeder products consist of a technical part (the Pitstop+ Mineral Feeder and associated Pitstop+ Manager app) and a non-technical part, the supply of mineral concentrates. In this IoF2020-project they wish to validate both the technology and its application, such that subsequently it can be marketed to dairy farmers across Europe.

In an earlier feasibility study (https://microfeeder.com/docs/PitstopPLUS_Feasibility_Study.pdf), the potential of both hardware and market were investigated. Based on that, also a plan for product roll-out and organizational structuring was created. Within this use-case, the technology will be improved, followed by a validation and demonstration of technology and expected benefits on a larger scale, as a first step in rolling out this technology into Europe’s dairy production. An overview of the role of the Pitstop+ project in the dairy supply chain is given in Figure 75.

![Figure 81: UC2.6 – Value Chain Position](image)

**2.15.1. Product description & value proposition**

**2.15.1.1. Description of Pitstop+**

The technical basis of the Pitstop+ products is an RFID-based individual feeder to provide dairy cows access to additional mineral supplements in a restricted and targeted way, as a complement to their generalized feeding of roughage and other feedstuff in a Total Mixed Ration (shown in 76). Using the RFID-tag, the cow can be identified uniquely, and based on that the proper feed proportion can be distributed. This feeder unit comes with an integrated control for cow recognition and mineral dosing, that is also connected to an IoT network for storing and sharing the data acquired (as shown in Figure 3). For this, there is close collaboration with UC2.3 HERDSMAN+. Furthermore, there is an own app available for communicating settings and results to farmers, the Pitstop+ Manager.
For use with the Pitstop+ Mineral Feeder, a range of (mineral) feed additives are offered, such as:

- RumiStar as enzyme additive
- “MicroAid”, proven to reduce the ammonia emissions by 56% and reduce N excretion by 17.5 kg per cow per year;
- “Oceanfeed Bovine” with biocide effects on greenhouse gas emissions and dairy cow health

These are (together with the feeder itself) offered through a dealer network, such that they can be combined with proper advice on animal nutrition.

Figure 82: UC2.6 - Product impressions for Pitstop+

Figure 83: UC2.6 - Overview of product functionality

2.15.1.2. Value proposition of Pitstop+

The value proposition of the Pitstop+ is to have an easy, safe and efficient method to provide the cows with the necessary supply of minerals and vitamins. The Pitstop+ concepts costs €4 for the feeder + €27 for the minerals per cow per year. Using the Pitstop to supply dairy cows with additional minerals and vitamins to compensate for the undersupply in their standard feed ration is expected to produce 1.2kg milk extra per cow per day, having a value of €140 per cow per year. Furthermore, it will reduce health related losses with 10%, which equals to €37 per cow per year. As result, the total value of the Pitstop+ concept is €146 per cow per year. This information is also displayed in Figure 4, with some more detailed benefits of using the Pitstop+ concept in Figure 5.
2.15.2. Exploitation & monetization

2.15.2.1. Revenue model for Pitstop+

MicroFeeder envisions a revenue model for the Pitstop+ mineral feeder that consists out of 3 parts:

- Sales of Pitstop+ Feeders through Dealers, in which they consider:
  - 1 feeder for max 25 cows that are in the critical period where they make intensive use of the system
  - Which is equivalent to about 1 feeder on 50 cows in the herd
- Sales of mineral supplements, also by making use of dealers that frequently visit the farmers to aid them in their work
- A small subscription fee (1 euro/cow/year) for data usage after the first year, for software updates and data handling
Also, from the data being collected some revenues might be generated. However, this still needs to be investigated.

2.15.2.2. Pricing of Pitstop+

For the Pitstop+ Mineral feeder, the expected sales price is €1181, consisting of €405 production costs, €304 Microfeeder margin for development and sales and a dealer margin of €472. With that, the expected feeder lifetime is about 5 years, and sales are estimated to total 45000 within 9 years.

The farmer costs for mineral supplements are expected at €27.23 / cow /year. This is based on a relatively high price of €2.25 / kg, thus anticipating that the supplements are high-value supplements with a high content of a wide variety of feed additives. Cheaper supplements can of course be used with the PitstopPLUS feeder, and this would in return also reduce expectations to the effects on the cows’ productivity, health and reproduction performances.

2.15.2.3. Additional data revenue models

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.15.3. Distribution & marketing strategy

2.15.3.1. Distribution and sales channels for Pitstop+

Distribution of the Pitstop+ will be done using local dealers and re-sellers. To ensure this, MicroFeeder already obtained a number of Letters of Intent from large partners throughout Europe, which are willing to execute tests and sell the Pitstop+ to their customers, such as PanAgro (Benelux), Trouw Nutrition (Germany), and Vilomix (Denmark). Next to that, there is also interest from a dairy processor (Arla, Denmark) on the added value of this approach.

Furthermore, there already exists a MicroFeeder dealer network through Denmark, Norway, Sweden, Denmark, Switzerland, France, Belgium, United Kingdom, Finland, and the Baltic countries.

2.15.3.2. Marketing strategy for Pitstop+

The marketing approach for the Pitstop+ can be summarized as:

- Raising awareness and informing on bio-technical results of the Pitstop+ concept, which will be done through in-depth publications in both scientific and professional magazines and the like
- Generating project and product visibility, by having and sharing leaflets, webpages, social media posts (including video- and picture-sharing sites), newsletters etc.

In the first element, the focus is on informing farmers, dealers, nutrition advisors and researchers on the positive impact of the Pitstop+ and additional minerals on animal health and productivity. In the second element, the focus is more on generating sales prospects, by making farmers and dealers interested in the use of the Pitstop+. This not only involves information on the added value, but also regarding the practical usage of the system.
2.15.4. Customer & end-user relations

2.15.4.1. End-customer relations & loyalty for Pitstop+

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.15.4.2. Product support services for Pitstop+

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.15.5. Partner network & horizontal activities

2.15.5.1. Partner network for Pitstop+

In this use-case, a cooperation already exists with UC 2.3 HERDSMAN+, regarding the control algorithms and data usage. Furthermore, there is cooperation with various research institutes (Aarhus University, Lithuanian University of Health Sciences, German research farms) as well as potential resellers of this technology.

2.15.5.2. Horizontal activities for Pitstop+

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.15.6. Cost structure & internal resources

2.15.6.1. Cost structure for Pitstop+

The cost structure of the Pitstop+ concept is already detailed in the section explaining the product pricing. Regarding the company cost structure, more information is already provided in the MicroFeeder feasibility-study, sections 3.8 and Annex 8.

Costs can be divided over the following elements:
- Product development
- Production of feeders
- Research and communication
- Warehousing
- Staff for management, sales, warehousing and production/installation
- Housing and facilities

2.15.6.2. Internal resources for Pitstop+

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.16. UC2.7 – SMART PRECISION COW AND CATTLE MONITORING

Agriculture is a constantly developing industry as the global population has been growing rapidly for many years associated with the need for more food. Producing high-quality food with low ecological footprint and high animal well-being is one of the greatest challenges of the modern livestock production systems. In order to fulfill these requirements, farmers invest more and more to their properties which result in high value farms, animals, crop, which means highly growing interest of guarding, tracking, monitoring technologies which seamlessly and proactively help to turn the industry into smart and sustainable.

Our goal is to further develop and promulgate a high-tech, precise and reliable cattle monitoring ecosystem utilizing the needs from feedback of multi-country dairy and beef farmers, by harmonizing their different breeding methods and set novel and customized software features and functions accordingly, optimized for mobile devices (smartphone, tablet) being used in daily operation for all farm employee level.

We have detected that technology acceptance and utilization are sparser in the region of Eastern European countries in general. Lack of digital transformation mindset is also a challenge, how to inform, educate and stimulate farmers to recognize the long-term benefits of switching to digitization and automation. These limitations are the main obstacles in the way of precision livestock farming industry penetration. The technological challenge for providing one leap forward is to construct a small, lightweight, cheap, very long-life (up to 10 years) safe and smart cattle monitoring ecosystem that can provide clinical, physiological and location information to farmers about their livestock 24/7.

This challenge matched with cattle farmer needs, no matter having smaller or larger-scale herds. Although end user needs can tremendously vary due to different cattle breeds used, housing technology, trends and climate, with a long-life, smart rumen bolus monitor and intelligent cloud-based ecosystem we intend to open an entirely new and sustainable industry and facilitate user willingness to utilize such product and easy-shift to smart agriculture.

Figure 86: UC2.7 - Problem definition
Use case-specific challenges: Improve cattle farm productivity to TRL 8 level:

- accurate heat detection and calving alert
- indoor and outdoor positioning by using the newest technologies (NB-IoT or LoRa Geolocation)
- monitoring of drinking behaviour
- operation of up to thousands of devices at one place and time
- in the rumen, as harsh environment operation

2.16.1. Product description & value proposition

2.16.1.1. Description of Smart Rumen Bolus

Our goal is to further develop and promulgate a high-tech, precise and reliable cattle monitoring ecosystem utilizing the needs from feedback of multi-country dairy and beef farmers, by harmonizing their different breeding methods and set novel, customized software features and functions accordingly, optimized for mobile devices (smartphone, tablet) being used in daily operation.

We have reached TRL-6 level with the prototypes of Moonsyst Smart Rumen boluses with different communication systems (LoRa, NB-IoT). The system consists of a small-sized rumen bolus and a cloud-based server application system. The bolus is capable for multiple physiological data (temperature, rumen and body activity, pH level) monitoring and the used technology (NB-IoT or LoRa GeoLocation) will allow us location tracking which makes our product outstanding in the cattle monitoring market. The intelligent cloud-based system consists of a database and administration site, which is supported by Big Data service, machine learning technologies and later artificial intelligence (AI) solutions to provide accurate information and future data, predictions to the users (i.e. veterinarians, etc.).
During our user journey analysis, we identified the following user needs of dairy and beef farmers and opportunities as how to reach the main objectives and requirements as:

- increase production and quality
- increase reproduction rates
- decrease the occurrence of animal health problems (heat stress, rumen acidosis; milk fever, etc.)
- reduce the number of veterinary interventions
- reduce medication (i.e. less antibiotics, hormone treatments)
- improve the farmers’ work-life balance
- improve animal welfare
- improve our understanding of cattle behaviour
With the existing Smart Rumen Bolus we can detect and alert the farmer in a case of Estrus, abnormal water intake, fever alert and health alert. We can measure also the pH level in the rumen fluid. To have more information about the animal we are working on detecting abnormal rumen condition. On the right side you can see some features of our solution.

With the help of the NB-IoT network we will be able to give geolocation data from the animal. We believe this will be one of the most important features.

2.16.1.2. Value proposition of Smart Rumen Bolus

What benefits can Moonsyst offer to farmers?

- Help them to react more quickly to each cow’s individual needs and to prevent minor health issues escalating into serious problems.
- More accurate and less labour-intensive heat detection
- Time and stress around visual observation and other manual tasks will be significantly reduced
- The technology helps them identify which cows to look at and when to look at them, and then they do the diagnosis.
- Access to herd data on PC, tablet or mobile phone, for real-time insights and remote
2.16.2. Exploitation & monetization

2.16.2.1. Revenue model for Smart Rumen Bolus

Reseller Partner Concept

We’ve elaborated our Reseller Partner Concept. In this agreement the Reseller wishes to purchase the Smart Rumen Bolus from Moonsyst and resell these products to End Customers on his own account and in his own name, subject to the terms and conditions of the agreement. We can give them 30% discount from the list price.

Our cost of goods sold is 30% of the list price of the Smart Rumen Bolus, which is now 99€.

We’d taken into consideration our competitor’s pricing, when we determined the pricing model.

The end-user/farmer

We use 2 steps in the payment process:

1. One-time payment for system setup & configuration
2. And per device:
   a. One-time payment
   b. Subscription based for startup and monthly

2.16.2.2. Pricing of Smart Rumen Bolus

- One-time payment: 99€/device
- System setup and configuration: 1190€
- Annual fee from 2nd year/device: 6€ (max 799€/year)

2.16.2.3. Additional data revenue models

On long term maybe:

- Data development algorithm
- Data exchange brokerage
- Data Warehouse

2.16.3. Distribution & marketing strategy

2.16.3.1. Distribution and sales channels for Smart Rumen Bolus

- Own website
- Direct sales
- Platforms
- Reseller Partner concept.
- Data Exchange Partner Netwerks: LoRa, NB-IoT mobile network

2.16.3.2. Marketing strategy for Smart Rumen Bolus

Reseller Partner concept. There are positive reactions from potential resellers in 30% margin.
2.16.4. Customer & end-user relations

2.16.4.1. End-customer relations & loyalty for Smart Rumen Bolus

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.16.4.2. Product support services for Smart Rumen Bolus

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.16.5. Partner network & horizontal activities

2.16.5.1. Partner network for Smart Rumen Bolus

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.16.5.2. Horizontal activities for Smart Rumen Bolus

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.16.6. Cost structure & internal resources

2.16.6.1. Cost structure for Smart Rumen Bolus

Costs in our business model

- Personnel cost
- Travel Cost
- Equipment Cost
- Other goods and services
- Subcontracting - development, design

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.16.6.2. Internal resources for Smart Rumen Bolus

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.17. UC3.1 – FRESH TABLE GRAPES CHAIN

This use-case is working on solutions for smart farming in the table grapes value chain both in the production phase and in the post-harvest phase. On the production level an adaptive DSS using field sensors will be implemented on farms and an automated crop evaporation coefficient Kc is calculated to better manage the grapes production. In the post-harvest phase organic table grapes will be monitored using a breathing device to control gaseous exchanges of a food container. This will maintain and extend shelf-life of organic table grapes under modified atmosphere packaging.

The use-case offers therefore solutions for the farm production as well as the processing, transport and retailer part of the table grapes business:

![The Value Chain](image)

**Figure 93: UC3.1 - Value Chain Position**

2.17.1. Product Description & Value Proposition

2.17.1.1. Product description of Adaptive DSS & Kc Calculation

The Adaptive DSS is a new ‘integrated’ DSS for sustainable irrigation management at farm scale, based on modern ICT technologies with the goal to provide benefits for both the farmer (productivity) and the environment (sustainability). It integrates and processes data of four multi-sensor equipment for soil humidity, thermo-hygrometer and PAR measurement, weather data, Electromechanical valve actuator.

The aim is to reduce water usage by a precise scheduling of irrigation activities, and improve yield, crop value and product quality on the vineyard.

The Kc calculation utilises low cost sensors to auto estimate and auto-calibrate crop evapotranspiration Kc coefficient (ETc = ETo x Kc). It uses measurements coming from the crop data status: nutrients, gaseous exchanges, photosynthesis, leaf area, xylematic potential, etc. stem-psychrometers, sap-flow.
and dendrometers, to automatically evaluate and calculate Kc. It compares measures coming from IoT and non-IoT fields.

Adaptive DSS
Advanced support system for precision table grapes production

Customers & Provider
Producer association/farmer
Blue Leaf

Core Product Features
The aim of the product is to integrate hardware and software components with qualified agronomical support and services

Multi-sensor measurement – Four multi-sensor equipment for soil humidity, thermohygrometer and PAR measurement, weather data, Electromechanical valve actuator.

Production dashboard – Monitor all data of the farm on one digital platform to schedule and steer irrigation.

Major Challenge
Lack of aggregated farm information to manage precise asset application and to save water, pesticide and fertilizer for a better table grapes production.

Here is what we aim to improve (KPIs)
- Water usage
- Yield
- Crop value
- Quality

These values derive from comparison of a standard farm’s performance prior to the installation of our system and after.

Figure 94: UC3.1 - Product Factsheets for Kc Calculation and Adaptive DSS

Kc Calculation
Automatic estimation of Kc coefficient using meteorological & physiological data.

Customers & Provider
Producer association/farmer
Blue Leaf

Core Product Features
The aim of the product is to integrate hardware and software components with qualified agronomical support and services

Advanced crop data - nutrients, gaseous exchanges, photosynthesis, xylematic potential stem-psychrometers, sap-flow and dendrometers.

Automatic evaluation & calculation of Kc using Adaptive DSS data and comparing measurements coming from IoT and non-IoT fields.

Major Challenge
Implement low cost sensors to auto estimate and auto-calibrate crop evapotranspiration Kc coefficient (ETc = ETo x Kc).

Here is what we aim to improve (KPIs)
- Water productivity
- Yield
- Leaf area
- Water use efficiency

These values derive from comparison of a standard farm’s performance prior to the installation of our system and after.

Figure 95: UC3.1 - Product Factsheets for Kc Calculation and Adaptive DSS

2.17.1.2. Product description of Blow®

Blow® is a breathing device on packaging that allows bidirectional gas fluxes, avoiding carbon dioxide accumulation, select gas on their molecular weight, adapted for each kind of packaging.

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2.17.1.3. Value Proposition of Adaptive DSS & Kc Calculation

The core value for farmers of the Adaptive DSS is that its output allows for an improved planning of farm activities concerning irrigation, fertilization, pest management and harvesting.

The Kc calculation improves the Adapted DSS Blue Leaf tool with an automatic estimation and calibration of crop evaporation. By using this service farmers can significantly improve the water use efficiency by optimizing their irrigation.

2.17.1.4. Value proposition of Blow®

By allowing bidirectional gas fluxes in packages, Blow® avoids accumulation of carbon dioxide and can select gas on their molecular weight (depending on the requirements). Retailers and end-consumers...
benefit from a significantly increase in shelf-life of organic table grapes and from a reduction of the post-harvest rejection of organic table grapes.

2.17.2. Exploitation & Monetization

2.17.2.1. Revenue model for Adaptive DSS

Sysman is already selling the normal DSS. IAMB will be involved in selling the Adaptive DSS, which is an extension of the DSS that Sysman is already selling. So far no revenue model has been drafted for the things that other partners add to the DSS of Sysman. The idea is to first look at the performance improvement that can be realised and then discuss further on an acceptable price. The partners realise that not many farmers will pay 30,000 euros for the DSS. Yet, when the DSS can be upscaled costs will go down. Sysman’s DSS is also part of UC 1.3 (soy production). Tests are conducted to see if the DSS can also be used for other crops. Then prices could go down further.

Alternative revenue models are considered, e.g. selling versus renting out the required weather station to the farmers. Or maybe it can be part of the agronomic advice service.

The Kc calculation uses low costs sensors. The costs are less than 10 euro. The expectation is that these costs will not be a big obstacle for farmers to buy the sensors. But to have an automatic evaluation and calibration of Kc you need the Adaptive DSS as well and you also need to compare IoT (sensor) data and non-IoT field data. So the revenue model for the Kc calculation is linked to the revenue model of the Adaptive DSS. IAMB as partner has no plans to set up a sales organisation. Most likely extensions on the Blue Leaf DSS of Sysman will also be marketed by Sysman. In return partners as IAMB may be compensated for their work by getting paid to help Sysman, sustain the DSS and do other research for them.

2.17.2.2. Revenue model for Blow®

A post-harvest business model for Blow® still has to be developed. Modified Atmosphere Packaging costs around 40 euro cents and the Blow® device costs another 20 euro cents. The expectation is that in time the costs for Blow® will go down much further as you can 3D-print these devices. Most likely revenues will arise from licensing software to do this 3D printing and to apply it on the package.

2.17.2.3. Pricing for Adaptive DSS & Kc Calculation

IAMB is probably charging Sysman for the adaptation of their Blue Leaf DSS. No price is defined yet. Apofruit will sell the DSS to their member producers. No price is set for this either.

The Kc calculation uses low costs sensors. The costs are less than 10 euro. The expectation is that these costs will not be a big obstacle for farmers to buy the sensors. It will be included in the DSS package deal.

2.17.2.4. Pricing for Blow®

In the discussion on the revenue model, prices of 40 euro cents for modified atmosphere packaging and 20 euro cents for Blow® are given. It is expected that these prices are acceptable for post-harvest partners because the benefits of having an extended shelf-life and less rejected products outweigh these costs in the organic table grapes value chain. Blow® is developed and owned by professor Giovanni Carlo Di Renzo. At this moment IAMB has no brand to implement the device. And according to Vincenzo Verrastro, IAMB as a research institute cannot have revenues from selling the products. Next year (2020) a trial will be executed with partner Apofruit.
2.17.2.5. Additional data revenue model

No additional revenues are expected at this moment.

2.17.3. Distribution & Marketing Strategy

2.17.3.1. Distribution & sales channels for Adaptive DSS & Kc calculation

Sysman is now selling a ‘lighter’ version of the DSS. Add-ons on this DSS will most likely be sold through the same marketing and distribution channels. The same is true for the Kc calculation because to benefit from this you also need the Adaptive DSS.

2.17.3.2. Distribution & sales channels for Blow®

Blow® is applied when packaging products. Processing companies will buy machines to print the devices and to apply it on the packages. The required license to do this can be distributed through internet. It is not clear yet how the sales of the license will be organised.

2.17.3.3. Marketing strategy for Adaptive DSS & Kc calculation

Vincenzo Verrastro will bring Jos Verstegen in contact with Italian economists to collaborate on this. In his view the Blue Leaf system already has a business model, executed by the Sysman group, including three options:

1. Buy directly at Amazon; everywhere
2. Collaborative system: agreement with Sysman and assistance from the Sysman group to check the measurements and to adjust the notifications
3. Co-operative work / co-development: farmers works together not only to use it but also to further develop it. A farmers’ community already exists with Apofruit. This company informed the farmers about the possibilities of BlueLeaf. Acceptance testing is done already. Blue Leaf can be used in many crops. The farmer wants to test before buying. They already adopted it in kiwi (the basic dss, not the adaptive one). From now on Apofruit is informing all their members about the adaptive DSS for all fruits. Pegasus (Greece) is a little bit behind. Blue Leaf has an international patent.

The idea is to get solid scientific evidence through A-B-testing and then go to the market. There are many competitors on the market. Everyone knocks on the doors of farmers to sell their IoT solution. Therefore this evidence is crucial to make the difference in the market.

2.17.3.4. Distribution strategy for Blow®

First an experiment with Apofruit will be conducted in 2020. Then this will be discussed with prof. Giovanni Carlo Di Renzo of the University of Basilicata, who owns the patent on this.

2.17.4. Customer & end-user relations

2.17.4.1. End-customer relations & loyalty for Adaptive DSS and Kc calculation

The end-customer relations largely will be the same as what Sysman is doing now with their current DSS. Maybe when more agronomic expertise or sensor knowhow is needed, other parties need to be involved as well. This will be discussed in the next version of this evolutionary business model overview.
2.17.4.2. Product support services for Adaptive DSS and Kc calculation

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.17.4.1. End-customer relations & loyalty for Blow®

The device was already demonstrated at the Supermarket of the Future, Expo Milano 2015. Apofruit will bring the device to the retail. The retailers will be the ones who have contact with the end consumers. If the results of the experiments are satisfactory for both the retail and end consumers there will be a market for this device (because the costs are quite low).

2.17.4.2. Product support services for Blow®

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.17.5. Partner network & horizontal activities

2.17.5.1. Partner network for Adaptive DSS and Kc calculation

Sysman already involves the current clients of Blue Leaf and Apofruit has a farmers’ community who is informed about the possibilities of these new developments

2.17.5.2. Horizontal activities for Adaptive DSS and Kc calculation

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.17.5.1. Partner network for Blow®

The university of Bassilicata collaborates with the Apofruit cooperative to test the device in practice. Apofruit will start with an experiment with retailers in 2020.

2.17.5.2. Horizontal activities for Blow®

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.17.6. Cost structure & internal resources

2.17.6.1. Cost structure for Adaptive DSS and Kc calculation

Low cost (< 10 euro) sensors are used. It is not clear how many sensors you need per hectare. Also the costs of the software is unclear. It is clear however that for a good use of the sensors the farmer also needs the adaptive DSS. For this, a price of 30,000 euro was mentioned in a discussion but further research is needed to come up with a real sales price (or lease price).
2.17.6.2. Internal resources for Adaptive DSS and Kc calculation

Sysman already has a customer base of Blue Leaf users. They can be informed about the newest additions to the DSS and the Kc calculation. Apofruit is a fruit grower cooperative who has easy access to their members and who has already built a community structure to inform their members of the latest developments.

2.17.6.1. Cost structure for Blow®

Modified Atmosphere Packaging costs around 40 euro cents and the Blow® device costs another 20 euro cents. The expectation is that in time the costs for Blow® will go down much further as you can 3D-print these devices.

2.17.6.2. Internal resources for Blow®

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.18. UC3.2 – BIG WINE OPTIMIZATION

This use-case develops and implements services for the whole value chain of wine production from the vinery to the retailer or end-consumer. It tackles key issues like sustainability in wine production by providing wineries with a real-time supervision tool that presents all growth parameters in the vineyard and advises on the smart application of water, fertilizer and pesticides. The objective is to reduce the environmental footprint of each bottle and provide this information also to end-consumers for an informed and sustainable purchase decision. This is achieved by developing a solution called Process2Wine.

In a second solution the use-case tackles the expensive and time-intensive analyses throughout the wine production. Here it develops a user-friendly FT-IR spectrometer for the mobile analysis of wine directly in the cellar. A simple dashboard presents the results in nearly real-time and tracks the parameter for each wine lot.

The third solution makes the transport of wine more secure from high temperature events. The herein developed data logger (JODYN Modem) is monitoring temperature, shock and humidity during wine shipping, and GPS localization and modem connectivity provide real-time information on position and conditions of the wine pallet.

2.18.1. Product Description & Value Proposition

2.18.1.1. Description of Process2Wine

Process2Wine is already a fully featured suite of solutions for the winery reaching from production to purchase. In this use-case a component for sustainable wine production is added and an integration of the handy spectrometers is foreseen.
2.18.1.2. Description of Remote Spectrometer for Wineries

The solution around the **FT-IR Spectrometer** is composed of an infrared sensor and a mobile web application to show test results in real-time. The detection of chemicals in the wine will be done with infrared spectroscopy (FT-IR); the spectra are sent to the cloud where an hosted algorithm is transforming them in compositional data. This method is able to track most relevant components of wine
and calculate its concentration. Based on this real-time information, a winery can more precisely steer the production process and produce simply better wine and reduce risks.

![FT-IR Spectrometer](image1)

**Major Challenge**
- Frequent monitoring of wine composition in cellar
- Avoid insurgence of sensory defects
- Reduce cost of wine analysis ($ and time)

**Core Product Features**
Advanced dashboard for wine monitoring through the production process with highly precise, real-time data on the wine condition to optimize wine quality.

**Here is what we aim to improve (KPIs)**
- Rarification treatments: -10%
- Overall analysis cost: -30%
- Final wine quality: +5%
- Loss of product: -5%

These values derive from estimated comparison of a standard winery’s performance prior to the implementation of our system and after.

*Figure 101: UC3.2 - Product Factsheet for Remote Wine Spectrometer*

### 2.18.1.3. Description of Monitor of Wine Shipping Monitor

The solution for the **monitoring of wine shipping** consist of an initial chemical analysis (NET test) of the wine to determine the temperature threshold of a specific wine and the JODYN Modem, a worldwide operational temperature tracking device for the one-time usage. The transmission of data is based on NFC and GSM and is therefore extremely energy efficient.

It enables the winery to detect high temperature incidents, track problems, prove false behaviour by partners in the transport chain and to remove potentially damaged wine from retail to prevent brand erosion.

![JODYN Modem](image2)

**Major Challenge**
Wine is occasionally destroyed by exposition to high temperatures during shipping and wineries have nearly no opportunity to identify the perpetrator.

**Core Product Features**
Track the temperature of your wine shipment all over the world, get informed about events of high temperature exposure and identify the perpetrator.

Temperature sensitivity test - professional laboratory analysis to calculate the critical temperature point for the warming system

Temperature data logger - record temperature during shipping transmitting the data set to the cloud via modem

Winery dashboard - monitor the shipping process via an online tool.

**Here is what we aim to improve (KPIs)**
- Dispute reduction: -10%
- Ave. shipping cost: -5%
- Wine quality at consumer stop: +5%
- Stabilization treatments: -10%

These values derive from estimated comparison of a standard winery’s performance prior to the implementation of our system and after.

*Figure 102: UC3.2 - Product Factsheet for Wine Shipping Monitor*
2.18.1.4. Value Proposition of Process2Wine

The major advantage of the IoT component for the Process2Wine application is the ability to monitor and steer the wine production process in a more ecological and sustainable way and to prove this impact by measured values for each bottle to the end-consumer.

Furthermore, the smart vineyard management leads to a reduction of production assets like fertilizer, pesticides and water and of work-time to monitor the plant growth.

<table>
<thead>
<tr>
<th>Without our Product or Service</th>
<th>With our Product or Service</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen &amp; Paper-based monitoring</td>
<td>Automatic monitoring</td>
<td>The practices can be planned and efficient, so the viticulturist can focus on more valuable activities</td>
</tr>
<tr>
<td>Currently the viticulturist should visit the parcels. The winemaker should analyzed each tank.</td>
<td>The data is automatically uploaded in the software to be interpreted by the viticulturist or the decision making tool. No manual re-input is required.</td>
<td></td>
</tr>
<tr>
<td>No real-time measurement of water and electricity consumption</td>
<td>Smart metering for activity consumption</td>
<td>Reduction of the number of data inputs</td>
</tr>
<tr>
<td>In many cases the consumption tracking is only based on invoices.</td>
<td>A better tracking allows the reduction of energy and water resources (best practices).</td>
<td>-50%</td>
</tr>
<tr>
<td>Pesticide use on whole vineyard</td>
<td>Local pesticide application</td>
<td>Saving on energy consumption</td>
</tr>
<tr>
<td>Currently treatments are applied on the whole vineyard.</td>
<td>With the knowledge of local weather conditions, specific and localized spraying can be performed.</td>
<td>-25%</td>
</tr>
<tr>
<td></td>
<td>Reduction of pesticide use by treatments applied only in needed areas</td>
<td>-10%</td>
</tr>
</tbody>
</table>

**Figure 103: UC3.2 - Benefits of Process2Wine IoT for Wineries**

2.18.1.5. Value Proposition of Remote Spectrometer for Wineries

The core advantage of the on-site, spectroscopic wine analysis is the real-time and on-demand information on the current chemical composition throughout the wine production process. This significantly reduces production risks, enables quick recondition treatments and save costs for the analysis in internal and external labs.
2.18.1.6. Value proposition of Wine Monitor for Wineries

2.18.1.1. Value proposition of Wine Shipping Monitoring for wineries

An advanced NET test to determine the critical temperature for the wine quality is crucial for smart stabilization treatments that do not harm the wine quality. Furthermore, a temperature tracking throughout the wine shipping process makes sure that the winery has full insights in any overheating events and can coordinate countermeasures to protect the brand value.
2.18.2. Exploitation & Monetization

2.18.2.1. Revenue Model for Process2Wine

The software could be offered under a SaaS model with flexible monthly or yearly payments. The contract duration for an initial trial should be set to 24 months after this period the farmer can cancel at any time. Furthermore, the exploitation model foresees a fee for additional customization if needed by the farmer.

The product suite contains of one always required basic module on top of which customer can add optional components such as the Handy Spectrometer and the Wine Shipping Monitor.

2.18.2.2. Pricing of Process2Wine (Software)

Figure 106: UC3.2 - Pricing and feature sets for Process2Wine

Figure above is the actual price but from WP4 our proposal is to limit the options for the wineries, offering two different packages depending on the bottle production: small/medium wineries (less than 50K bottles) or above this.

2.18.2.3. Revenue Model of Remote Spectrometer for Wineries

FT-IR Spectrometer equipped for transmission to web of the spectra obtained on wines will be marketed by the manufacturer (TDI - Tecnologia Difusión Iberica) that also will provide services of assistance and maintenance.

The revenue for the partners is coming from the service offered to the wineries, that is the use of the cloud based algorithm transforming the spectra in compositional data – kept updated and increasingly precise thanks to the intense and ISVEA continuous calibration activity – through access to the web site and mobile app, which makes immediately available the data to all decision makers (winery owner, employee winemaker, external advisor).
2.18.2.4. Pricing of Remote Spectrometer for Wineries

The actual FT-IR instrument is proposed by the manufacturer at a selling price of €30,000.

Further R&D activity is ongoing – even beyond the project scope - to develop a lower price instrument with acceptable precision of results, to enlarge the potential market to the segment of small-medium size wineries.

The subscription fee to the service should range between €1,000 and 3,000 depending on the number of samples analysed, and the benchmarking availability. The service will be proposed by ISVEA to the domestic (Italian) market, by VINIDEA at international level.

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>Type</th>
<th>Indicative Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVATION</td>
<td>Calibration kit, technical assistance in deployment</td>
<td>One shot payment</td>
<td>€750</td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>Calibration kit, ring test</td>
<td>Yearly fixed fee</td>
<td>€500</td>
</tr>
<tr>
<td>ANALYSIS RESULTS</td>
<td>Access to compositional data of own samples</td>
<td>Yearly variable fee</td>
<td>€500 - 2,000 depending on the number of samples</td>
</tr>
<tr>
<td>BENCHMARK</td>
<td>Comparison own data with statistics of the whole database</td>
<td>Yearly fee</td>
<td>€500</td>
</tr>
</tbody>
</table>

Figure 107: UC3.2 - Price overview for Remote Spectrometer for Wineries

2.18.2.5. Revenue Model of Wine shipping monitor

The real-time single-use device JODYN Modem has been designed for monitoring environmental conditions of pallets of wine in all transportation and storage steps, from producer to distributor. In case of shipment to subsidiaries, the device can be reused several times thanks to the battery life period.

The source of revenues will be consisting of three components:

- **On time sale** of the device through direct sales. This will be done by the manufacturer WENDA. This price will include a commission to VINIDEA for the efforts developing the system.
- **Annual subscription fee** for the use of the web platform and download of shipment data.
- **Access fee to statistics** on wine transport conditions obtained from elaboration of the entire dataset.

2.18.2.6. Pricing of Wine Shipping Monitor

The initial selling price for the JODYN Modem will be around €250 per unit, with important discounts for quantity orders. The device price is set to decrease significantly as sales increase.

Annual fee for access to the web platform will be about €500/year. The same platform is also able to receive, elaborate and produce output from rough data coming from other data loggers, therefore, the platform service could be sold independently from JODYN Modem use.

The price of the information service on dataset statistic is still to be defined and the NET test to determine temperature sensitivity of wine lots will be proposed at starting price around €100.
2.18.3. Distribution & Marketing Strategy

2.18.3.1. Distribution & sales channels of Process2Wine

From WP4 we consider ATOS to be the distribution channel for the customer solution Process2Wine, having a country approach where ATOS presence has a strong presence. France and Italy for the launch and further developing and extending into Spain, Chile, South Africa, Australia and New Zealand. We also propose to collaborate with UC 3.2 E-wine making solution in order to explore synergies.

2.18.3.2. Distribution & sales channels of Remote Spectrometer for Wineries

Regarding the distribution of the Wine-Spectrometer, the priority role of the provider TDI (Tecnología Difusión Ibérica) and of its country representatives should be respected. Tecnología Difusión Ibérica, S.L. works closely with its European distributors and have at this moment five points of technical assistance, four of them in Spain (Madrid, Barcelona, Logroño (Rioja), Ciudad Real (Valdepeñas) and a fifth one in France (Paris).

The new analytical on-line service will be proposed worldwide to the wine industry by ISVEA in Italy, and in other countries by VINIDEA.

Although from WP4 we propose to have a larger worldwide distributor in order to be able to scale rapidly with the product.

2.18.3.3. Distribution & sales channels of Wine Shipping Monitoring

Wine shipping monitoring devices (JODYN Modem) and access to web platform will be marketed by WENDA on the basis of an agreement that recognize to VINIDEA a commission of this turnover. The statistic information is the core of the startup WENDA and will be proposed to go to market by VINIDEA.

The NET test will be proposed by ISVEA to domestic clients in Italy and still does not have a global distribution partner. The test procedure could be given to other laboratories under specific collaboration agreement, but this has not been further explored to date.

As previous products, from WP4 we suggest to start negotiations with a larger distribution manufacturer/integrator which may have a larger customer network.

2.18.3.1. Marketing strategy of Process2Wine

*Currently under development and will be discussed in the next version of this evolutionary business model overview*

2.18.3.2. Marketing strategy of Remote Spectrometer for Wineries

*Currently under development and will be discussed in the next version of this evolutionary business model overview*

2.18.3.3. Marketing strategy of Wine Shipping Monitoring

*Currently under development and will be discussed in the next version of this evolutionary business model overview*
2.18.4. Customers & End-user Relations

The three products of the UC will have complementary but separate strategies. Coordination and reciprocal exchange of information among the exploitation actors of UC 3.2 - and possibly of other UCs of IoF2020 -, may result in coincidence of the distribution network of the three products in some regions or countries. Similarly, promotion and advertisement activity will be jointly conducted wherever possible.

2.18.4.1. End-consumer relation for Process2Wine

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.18.4.2. End-consumer relation for Remote Spectrometer for Wineries

Relationship with end-consumer will continue for:

- Maintenance of instruments with periodical calibration against ISVEA algorithm
- Update of statistics for benchmarking

2.18.4.3. End-consumer relation for Wine Shipping Monitoring

Relationship with end-consumer will continue for:

- Continuous update of statistics

2.18.5. Partner Network & Horizontal Activities

2.18.5.1. Partner network for all products

For Process2Wine, the partnering network is currently under development and will be discussed in the next version of this evolutionary business model overview.

For the other two products coming from the Italian side, the consortia partners (VINIDEA and ISVEA) have recently defined an agreement with WENDA, creator and manager of the web platform for the reading of data from Remote Spectrometer and from Shipping Monitoring, where competences and rights of each company are detailed. The agreement foresees an exclusive collaboration in the wine sector, and the possibility to explore other markets.

Also, TDI (Tecnologia Difusion Iberica) will provide to the consortia with the remote spectrometer hardware and will also perform post sales services.

2.18.5.2. Horizontal activities for Process2Wine

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.5.3. Horizontal activities for Remote Spectrometer for Wineries

Currently under development and will be discussed in the next version of this evolutionary business model overview
2.18.5.4. Horizontal activities for Wine Shipping Monitoring

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.6. Cost Structure & Internal Resources

2.18.6.1. Cost structure of Process2Wine

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.6.2. Cost structure of Remote Spectrometer for Wineries

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.6.3. Cost structure of Wine Shipping Monitoring

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.6.4. Internal resources for Process2Wine

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.18.6.5. Internal resources for Remote Spectrometer for Wineries

Three companies will take tasks needed for delivering the system:

- Cloud, platform maintenance and customer assistance. This will be performed by WENDA.
- FT-IR algorithm kept updated. This will be performed by ISVEA.
- Elaboration of data statistics for benchmarking. This will be performed by ISVEA.
- Promotion of the innovation on the market by VINIDEA.

2.18.6.6. Internal resources for Wine Shipping Monitoring

The tasks and resources will only be developed by WENDA and VINIDEA. Those will include:

- Platform maintenance and customer assistance (WENDA as technical partner)
- Elaboration of data statistics to send to customer and will be performed by VINIDEA
- Hardware development and customer assistance by WENDA
- Promotion of the monitoring system by VINIDEA
2.19. UC3.3 – AUTOMATED OLIVE CHAIN

This use-case is working on solutions for smart farming in olive production and the traceability of olive oil quality throughout the value chain. On the production level a smart DSS concentrates all relevant farm data into a management dashboard in order to advise on a more sustainable production and to increase the quality (higher fat level) of harvested olives.

In the second solution the use-case develops a solution for the measurement and traceability of olive oil quality. This is very relevant for European olive farms and oil producers as the origin and specific regional taste of olive oil is of high value to the end-consumer. Being able to prove the origin and the outstanding quality by trustworthy data helps to justify a higher premium on these quality oils in the market.

The use-case offers therefore solutions for the farm production as well as the processing industry and the downstream levels of the olive oil business:

![Value Chain Position](image-url)

Figure 108: UC3.3 - Value Chain Position

2.19.1. Product Description & Value Proposition

2.19.1.1. Product description of Olive Production Manager

The **Olive Production Manager** is a decision support system (DSS) for the farm production level that integrates IoT data from several devices together with metrological data from a third-party provider. It measures the volumetric water content in 30-50cm depth directly in the soil and combines it with weather data on rainfall, wind speed and direction in order to calculate smart irrigation advice for olive farmers.

The aim is to reduce water usage by a precise scheduling of irrigation activities and to finally automate the irrigation process on the olive farm.
2.19.1.2. Product description of Olive Oil Quality Manager

The **Olive Oil Quality Manager** measures the fat content of olives in the milling process and reconnects this data with originating farm. The data is fed back into the Olive Production Manager to adjust production conditions and learn conditions lead to high fat values. The constant real-time measurement of the fat level and the temperature during the milling process increases the capability of an olive mill to increase the quality of its oil and to reduce the production time.

In a second component, the production and milling data that is relevant for partners downstream the value chain will be made available through a traceability manager.

2.19.1.3. Value Proposition of Olive Production Manager

The core value for **olive farmers** is to save significantly on production assets like water and fertilizer by at the same time using the quality data from olive oil mills to feed the machine learning improving the applications rates and the smart farming advice. For the farmer the production becomes more comfortable as many routine tasks are automated.
## 2.19.1.4. Value proposition of Olive Oil Quality Manager

**Olive oil mills** can significantly increase the oil quality and shorten the production time. Furthermore, the digital traceability gives opportunities to prove oil quality directly to end-consumers and gives the opportunity to diversify the portfolio of premium oils.

### Without our Product or Service

- **No Traceability in the whole value chain**
  All the activities done in the fields, crops and agriculture (oil) are not connected one another, so it is impossible to link the key data.

- **Labor without agronomic criteria.**
  Users do the labors without precision agronomic criteria, so it is difficult to assure quality.

- **No interoperability**
  No possibilities to connect with other systems, so it is difficult to integrate the data, therefore there are extra cost for data consolidation.

### With our Product or Service

- **Traceability in the whole value chain**
  All the activities done in the fields, crops and agriculture (oil) are thoroughly connected one another so all the data are linked.

- **Normalization of the agronomic criteria in labors.**
  IT system will normalize the way and the protocol to do the agronomic labors, so the quality is improved.

- **Interoperability**
  All the systems and other systems for 3rd parties will be able to connect one another.

### Here is the difference

- **Precision and integration**
  Here is how the activity is carried out under your product or service.

- **Scalability**
  +100%

- **Integration interoperability**
  +100%
2.19.2. Exploitation & Monetization

2.19.2.1. Revenue model for Olive Production Manager

The Olive Production Manager - Software - will be available in a yearly or monthly subscription that includes regular updates and maintenance services.

The Olive Production Manager - Hardware - consists of moisture and conductivity sensors as well as a weather station. This full hardware package is a technical requirement to run the service and is currently available for an initial setup fee.

However, this current model still brings an initial cost barrier for olive farmers to actually try out the software solution and sign-up to a SaaS contract. Therefore, WP4 currently investigates the model of hardware-as-a-service or equipment-as-a-service where the hardware is initially pre-financed by the software provider through banks (e.g. leasing models) or through private investors. In this case, the farmer would solely pay an initial implementation fee and a higher monthly or yearly rate for the software service. In this model the farmer does not become the owner of the equipment and if the farmer decides after the end of the 12 months test period to terminate the contract the equipment is rebuilt and collected by the service provider.

2.19.2.2. Revenue model for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.2.3. Pricing for Olive Production Manager

The price for a monthly subscription of the basic service will be around 100€, which adds up to 1.200€ per year. The price will also rely partly on the size of the olive farm or better the number of sensors connected. The service therefore could come in bundles of features and a number of sensors included.

2.19.2.4. Pricing for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.19.2.5. Additional data revenue model

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.3. Distribution & Marketing Strategy

2.19.3.1. Distribution & sales channels for Olive Production Manager & Olive Oil Quality Manager

HISPATEC is the major distributor of for both services in the area of Southern Spain. In the North of Spain are too few olive farms to justify a local distribution structure. Therefore, HISPATEC works here is with 2 smaller distribution partners.

For Italy, the use-case works on the selection and certification of distribution partners. Dissemination for partners in Italy already started. There is no distribution partner in Greece yet, but the use-case partner Synelix could become the major distribution partner in this country.

With these countries, the use-case covers already 93% of the European and 61,16% of the world olive oil production.

<table>
<thead>
<tr>
<th>Countries</th>
<th>2016/2017</th>
<th>Percentage</th>
<th>2017/2018 (prov)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyprus</td>
<td>6</td>
<td>0,2%</td>
<td>6</td>
<td>0,2%</td>
</tr>
<tr>
<td>Croatia</td>
<td>5</td>
<td>0,2%</td>
<td>2,6</td>
<td>0,1%</td>
</tr>
<tr>
<td>Spain</td>
<td>1290,6</td>
<td>49,9%</td>
<td>1251,3</td>
<td>37,8%</td>
</tr>
<tr>
<td>France</td>
<td>2,8</td>
<td>0,1%</td>
<td>5,9</td>
<td>0,2%</td>
</tr>
<tr>
<td>Greece</td>
<td>195</td>
<td>7,5%</td>
<td>346</td>
<td>10,4%</td>
</tr>
<tr>
<td>Italy</td>
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<td>7,0%</td>
<td>428,9</td>
<td>12,9%</td>
</tr>
<tr>
<td>Malta</td>
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<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>Portugal</td>
<td>69,4</td>
<td>2,7%</td>
<td>134,8</td>
<td>4,1%</td>
</tr>
<tr>
<td>Slovenia</td>
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<td>0,0%</td>
<td>0,4</td>
<td>0,0%</td>
</tr>
<tr>
<td>Total EU</td>
<td>1751,5</td>
<td>67,7%</td>
<td>2175,9</td>
<td>65,7%</td>
</tr>
</tbody>
</table>

Source: Internation Olive Oil Council (prod. In 1,000 t)

Figure 114: UC3.3 - Olive Oil Production in Europe 2016/2017 and 2017/2018

2.19.3.2. Marketing strategy for Olive Production Manager & Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.4. Customers & End-user Relations

2.19.4.1. End-customer relations for Olive Production Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.19.4.2. End-customer relations for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.4.1. Product support for Olive Production Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.4.2. Product support for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.5. Partner Network & Horizontal Activities

2.19.5.1. Partner network for Olive Production Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.5.2. Partner network for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.5.3. Horizontal activities for Olive Production Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.5.4. Horizontal activities for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.6. Cost Structure & Internal Resources

2.19.6.1. Cost structure of Olive Production Manager

The cost structure for the equipment looks the following:

- Sensors (conductivity, moisture)  €1.000 - €2.000 x 4
- Weather station  €2.000

Total hardware costs:  €6.000 - €10.000

2.19.6.2. Cost structure of Olive Oil Quality Manager

The cost structure for the equipment looks the following:

- NIR Fat Level sensor (real-time)  15.000€ - 20.000€
• Additional sensors 8.000€ - 9.000€

Total hardware costs: 23.000€ - 29.000€

2.19.6.3. Internal resources for Olive Production Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.19.6.4. Internal resources for Olive Oil Quality Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.20. UC3.4 – INTELLIGENT FRUIT LOGISTICS

Most of the agricultural products that are offered without further processing to the end-consumer in supermarkets are transported in standardized and returnable plastic boxes called trays. These trays contain products like fruits or vegetables and transport them from the harvest on the farm to the point of purchase of the end-consumer in the supermarket.

Therefore, trays are accompanying agricultural products basically throughout the whole value chain and are, due to the reusability of the trays, an excellent platform for IoT devices that track food conditions right through to the moment of purchase. With Euro Pool in this use-case one of Europe’s largest returnable tray and pallet providers experiments on IoT solutions for tracking of trays and sensing solutions for e.g. temperature tracking to offer on the one hand new services to its clients and on the other hand to improve its own services and the availability rate of trays.

The consortium aims at establishing an open platform for standardized and specialized IoT solutions within the Euro Pool ecosystem.

![Figure 115: UC3.4 - Value Chain Position](image)

2.20.1. Product Description & Value Proposition

In the last year, the Use Case team further sharpened the service model, which now enables two services that can be deployed directly on small scale (20-1000 IoT-trays) and can be scaled up to enable more users using the service or generate new service ideas.

2.20.1.1. Product description of Returnable Asset Investigation Service

In the last year, the internal use case “Tray radar” transformed into an investigation service concept, which allows customers to book IoT-trays for investigation purposes in their internal logistics network. This shift resulted from various pilots conducted in the last two years amongst others with Nestlé UK, the Spanish retail chain Ecomora and the German retailer EDEKA, and the conclusion that there is not only a need for EPS to improve pool efficiency but also a need for higher efficiency on the customer side which customers are actively seeking. This allows EPS to start using the developed technology on a small scale and learn more about the potential and not yet discovered values and downsides. Additionally, this model allows scaling up in numbers of IoT-trays on-demand to serve customers. For now the service is to a large extent co-financed by EPS to invest into the learning and evaluation with customers, which business model works best.
The product to be offered by Euro Pool System will, therefore, be a service that allows the investigation of internal flows of returnable packaging for bigger customers such as grower associations, FMCG producers and retail chains. With this service, we are addressing a range of efficiency issues in daily logistics operations and contribute to creating visibility for our customers on their product flows. Rented EPS IoT-trays will be inserted with the customer in strategic places where they can distribute through the customers’ network, comparable to a contrast agent in medical procedures. Based on the reporting Euro Pool System can support the customer in detecting inefficiencies such as e.g. bottlenecks in the logistics of returning the returnable assets (e.g. piles of unused trays) or even detect losses. Both categories are representing either a direct loss of deposit or binding capital for unused returnable assets, which is not only a financial topic but has also an environmental aspect.

The solution is based on a limited number of IoT-enabled returnable trays, a reporting tool based on LocMan (location management) and a cloud-based IoT platform called Vizix. Based on extremal calculation and location algorithms this tool makes the flows of returnable assets visible and measures e.g. temperatures along the way or the time per location on which the assets reside – the so-called dwell time, which is a major key performance indicator in the world of pooling returnable trays. A final report gives the customer insights and locations (e.g. stores or sites in general) as starting points for improvements. Removing these inefficiencies along the value chain will contribute to the P&L of the customer, circular economy of returnable assets in general and EPS in specific by a higher pool efficiency and better availability of trays during high season peaks, which is benefitting our customers again.

The potential of a platform for monitoring services of all kinds through the logistical chain fresh food is economically attractive and could create a lot of positive impacts. Currently, UC3.4 already looks into collaborations with startups and external service providers, but still needs to come up with a coherent platform strategy and an API for developers and will explore this.

The reach of Euro Pool throughout the logistical value chain makes it the perfect provider of monitoring services and data for certification, origin transparency and condition monitoring. Due to the higher demands for transparent data on the environmental footprint of food, there is a good market potential for RTI providers to become independent digital enabler platforms for monitoring services.

Currently, the use-case focuses very much on two specific services to prove the impact of the tracking internally. However, the value of the monitoring exists mainly for clients like:
• Farmers prove geographical origin of their products may be combined with a laser printer for fruits & vegetables
• Other ideas will be explored

So the platform business model should be pushed and maybe the data platform should be connected with competitors to cover the whole market.

2.20.1.2. Product description of EPS Temperature Monitor

In the past year, the use case further shaped the temperature monitoring scenario, which is now also resulting in another flavor of investigation service.

Building on the same technical foundation as the abovementioned service, Euro Pool intents to also test an investigation service, which gives customers the possibility to investigate isolated supply chains in regard to the performance of cold chain measures. Euro Pool is one of three pooling companies that are able to deliver an end-to-end supply chain temperature monitoring for fresh fruits and vegetables in Europe. This is due to the nature of the logistics chain – fresh products are packed post-harvest into EPS trays and then transported through the value chain down to retail stores – and the nature of the product and its freshness.

With this service, the customer can monitor if the cooling chain is intact and react if high-temperature events might have jeopardized the edibility of a food product. It consists of the same type of built-in sensor and a mobile dashboard for temperature monitoring. The service delivers the first starting points for improvements.

Every client that booked the service for his products can easily request temperature data via an API and feed the data into their own management system. This way a client can also make this data available to transport companies, for example, to give them an opportunity to react in case of an off-standard temperature event.

![Figure 117: UC3.4 - Product Factsheet for EPS Temperature Monitor](image-url)
2.20.1.3. Value proposition of EPS Tray Radar & Temperature Monitor

The advantage of the tracking service for retailers and larger organizations is the visibility that enables the reduction of bottlenecks. Especially looking at RTIs is supportive, because products are transported in the RTIs. Bottlenecks in relation to RTIs usually come along with bottlenecks in the product distribution or return of RTIs.

The temperature service offers the opportunity for farmers that deliver directly to retailers or end-consumers to track temperature breaches within the transport chain and to prove breaches to the transportation company.

**Figure 88: UC3.4 - Benefits for Farmers**

Without our Product or Service
- RTI supply could be problematic in high season
- During the harvest season, many farmers stock a lot of RTIs while others couldn’t order enough

With our Product or Service
- Better supply with RTI
- Due to better insights and data, value chain actors can organize their RTI stocks more efficient, which has a positive effect on availability.

Here is the difference
- Visibility of RTI Movements
  - Without: 30%
  - With: 80%
  +50%

Pull from Retail
- Retailers organize their weekly offers in a pull mechanism, which leads to a pull effect for the previous chain and RTIs.

Optimizing the delivery from farmers
- Using temperature data from the smart RTIs, retailers can optimize their cold chain to ensure freshness of products.

Insights in cold chain performance
- Farmers can control their own premises, but have no insights into the value chain behind the farm gate.

Clear temperature monitoring
- Right from the beginning, the product temperature can be recorded. A seamless value chain temperature monitoring is possible.

**Figure 89: UC3.4 - Benefits for Distribution Centers, Logistics Providers & Retailers**

Without our Product or Service
- Misuse and loosing deposit value
- Misuse of RTIs in organisation leads to losses in deposit value.

With our Product or Service
- Investigation of RTI utilisation
- Using smart RTIs the service can make misuse visible and help responsible persons to identify starting points.

Here is the difference
- Reduction of misuse
  - Without: 25%
  - With: 50%
  +25%

RTI movements are unknown
- Assets get lost in unknown places. Which requires reproduction of returnable assets.

Higher visibility on RTI movements
- Flows of smart RTIs can be documented and used to identify where RTIs are piling up.

Visibility of RTI Movements
- Without: 30%
- With: 80%
  +50%

Optimized RTI Flow
- Without: 25%
- With: 50%
  +25%

Temperature Data isn’t logged along the whole value chain
- No proof that the goods which they receive have been treated and cooled perfectly.

Clear temperature monitoring
- Right from the beginning, the product temperature can be recorded. A complete value chain temperature monitoring is possible.

Temperature Monitoring
- Without: 30%
- With: 80%
  +100%
2.20.2. Exploitation & Monetization

2.20.2.1. Revenue model for EPS Tray Radar

The major advantage of the EPS Investigation Service is a more efficient allocation of trays and the increase in efficiency of the pool for Euro Pool. This reduces internal costs and makes a single tray cycle more efficient. Therefore, the EPS Service will either lead to a more competitive service offer for the end-users or in a higher profitability of the asset pool for Euro Pool which would create additional revenue for core business model.

A major opportunity to generate further external revenue and further added-value for Euro Pool clients, is the opening and transformation of the EPS Investigation Service into a multi-purpose service platform for tracking solutions. Euro Pool would offer these services to their clients in addition to their basic tray service and share the revenue with the third-party service provider. If a Euro Pool client books an additional service the platform would provide position or sensor data of trays to third-party providers. The usual platform share of such a business model is about 15-20%. However, due to the fact that Euro Pool would also provide the sensing hardware and its maintenance on the trays to share could also reach up to 50% of the revenue.

Furthermore, the use-case and WP4 are assessing the possibilities of data brokerage, so the monetary exchange of tray data as a potential business model. A connection to a startup that might facilitate this has been initiated. WP4 also offers a platform economics expertise for a platform business model & concept development should the UC see fit.

To that purpose, WP4 has conducted a first market scan for startups that could provide business model inspiration by looking at agriculture but also other industries where supply chain management plays a big role, as well as looking at healthcare where temperature sensors and platform approaches have been adopted and Monitoring -as-Service business models are prevalent.

The full list of startups analyzed is available here.
2.20.2.2. Revenue model for EPS Temperature Monitor

The revenue model for this temperature monitoring service is either a per-use or in this case a pay-per-cycle model if the client just wants to test the service or has only a few temperature critical deliveries once in a while. For clients that would make more regular use of the service, they can book different subscription plans offering different numbers of trays or shipping per year included.

2.20.2.3. Pricing of EPS Tray Radar

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.20.2.4. Pricing of EPS Temperature Monitor

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.20.2.5. Additional data revenue model

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

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2.20.3. Distribution & Marketing Strategy

2.20.3.1. Distribution & sales channels of EPS Tray Radar

Euro Pool is the largest provider of reusable trays for fresh fruits and vegetables in Europe and commands 71 service centers in 15 countries offering services in 30 countries. The shareholders of EPS are the largest grower associations in the Netherlands, Belgium, and Germany; the main customers of EPS are the leading retail organizations all over Europe. This dominating market position enables the positioning of a service platform based on the EPS Asset Investigation Service. The service platform would be highly attractive for third-party service providers as they could reach right away a large group of customers all over Europe. Therefore, the major distribution role for the platform as well as for the services remains at Euro Pool and builds on existing infrastructure.

In order to attract the best added-value services for the platform marketplace, Euro Pool could take part in the IoF2020 innovation accelerating ecosystem and run a challenge or accelerator programme to identify interesting partners connected to retail or the food business in general.

2.20.3.2. Distribution of EPS Temperature Monitor

The temperature monitoring system is very likely to be the first at least third-party assisted solution on the marketplace. It will be fully distributed by Euro Pool as a service.

2.20.3.3. Marketing strategy for EPS Tray Radar

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.20.3.1. Marketing strategy for EPS Temperature Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.20.4. Customers & End-user Relations

2.20.4.1. End-consumer relation for EPS Tray Radar

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.20.4.2. End-consumer relation for EPS Temperature Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.20.4.3. Product support strategy for EPS Tray Radar

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.20.4.4. Product support strategy for EPS Temperature Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.20.5. Partner Network & Horizontal Activities

2.20.5.1. Partner network for EPS Tray Radar

Europool will provide same smart trays this year to the Table Grape Teams (For a farm located in Italy) He will use the smart trays to track his products on their way to the customer. Collaboration with a few startups has been suggested by Work Package 4’s ecosystem team.

Euro Pool System is partnering with La Pallet Rouge, Top 5 in the European pallet business, for the Asset Investigation Service.

2.20.5.2. Partner network for EPS Temperature Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.20.6. Cost Structure & Internal Resources

2.20.6.1. Cost structure for EPS Tray Radar

Work will continue to measure the costs of the IoT-enabled tray in the Asset Handling Processes including adding the chip to the tray and replace broken chips, but this has not happened so far.

Individual costs are related to:

1) The asset itself, that requires modification to allow retrofitting of the IoT device
2) The IoT device
3) The connectivity of the IoT device
4) Handling of the smart asset
5) Removal from the pool

Shared costs across all services:

a) IoT platform maintenance & hosting
b) LocMan maintenance & hosting
c) FTE that works on the investigation cases (% per case)
d) Marketing: Development of an animation video to transport the vision of the investigation service concept and development of marketing material
e) IT
f) Commercial Managers

2.20.6.2. Cost structure for EPS Temperature Monitor

Individual costs are related to:

1) The asset itself, that requires modification to allow retrofitting of the IoT device
2) The IoT device (Temperature Sensor edition)
3) The connectivity of the IoT device
4) Handling of the smart asset
5) Removal from the pool

Shared costs across all services:

a) IoT platform maintenance & hosting
b) LocMan maintenance & hosting
c) FTE that works on the investigation cases (% per case)

2.20.6.3. Internal resources for EPS Tray Radar & EPS Temperature Monitor

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.21. UC3.5 – SMART ORCHARD SPRAY APPLICATION

This use-case applies digitally interconnected sprayers and a smart software platform to reduce the usage of plant protection products in the field of speciality crops like cherries, apples and almonds. While cloud-connected sprayers are commercially already state-of-the-art for horizontal crops like wheat, corn, and vegetables, they are not wide spread in fruit crops (called specialty crops or 3D crops). One reason is that roughly 80% of world productions falls on horizontal crops, while only 20% is made up of speciality crops (fruits, vine, nuts, olives, etc.). Hence, the vertical crop market has traditionally been more attractive to the big industry players like John Deere, Jacto, CNH, and Kubota, while the speciality crop market has been served by many local niche players, with much less R&D money being spent. As a consequence, the digitalization of speciality crop agriculture is lagging behind and SMARTOMIZER, that optimizes the efficiency of spraying operations of specialty/3D crops dealing with parameters affecting disease management efficiency, has the potential to disrupts the current market of specialty farming, as it offers a holistic solution which combines exiting and complementing technological components to significantly reduce PPP usage, and tractor fuel consumption (and therewith greenhouse gas emissions), albeit, at higher quality yields.

2.21.1. Product description & value proposition

2.21.1.1. Description of Smartomizer

The Smartomizer is a smart turbine-driven sprayer system equipped with sensors for high growing fruits that connects via a digital gateway to a cloud service for scheduling spray jobs as well as visualizing the field data.

**Hardware**

The sprayer developed by FEDE Pulverizadores offers advanced control of each individual spray head to adjust the volume of plant protection product sprayed. A tractor power take-off drives the rotation of the sprayer. Furthermore, it is equipped with sensors for the monitoring of temperature and air humidity to assess and react to the climatic spray conditions. The farmer can control the sprayer directly from a tablet that runs on the sprayer control system (SCS).

**Gateway**

The tractor-mounted Specialty Crop Gateway (SCG) provides communications between the machines in the field as well as digital connectivity to the cloud system via a cellular modem.

**Software**

The software supports the farmer in planning spray jobs and to visualize the collected data in the field. On the software level, Smartomizer is open for sharing data via an API with other service for example disease detection, farm management information systems in general or weather services. The farm manager/agronomist in the back-office receives plant protection product treatment details (if the field has cellular coverage in real time) and can take corrective measures.

2.21.1.2. Value proposition of Smartomizer

**Hardware**

FEDE Pulverizadores is well-know in the market for its fuel-efficient turbine technology on its sprayers combine now a low CO2 footprint with a reduced volume of plant protection product (PPP) needed. The aim of Smartomizer is to reduce the output of PPP by up to 25%, which would result in a significant economic effect for the farmer as well as a great contribution towards the protection of biodiversity impacted by plant protection chemicals.
Software

The cloud service supports the farmer on the planning of spraying tasks, the transfer of all necessary data to the machine via WIFI or 4G and the visualization of the results of the spraying activity in the field. FEDE is working actively with its partners on open interfaces to other services and especially FMIS.
2.21.2. Exploitation & monetization

2.21.2.1. Revenue model for Smartomizer

Currently, FEDE favours a lump sum payment for the sprayer with a usual margin for the manufacturer and the reseller. WP4 supports FEDE currently on the development of an equipment-as-a-service business model that would offer the pure spraying service to the farmer with

For the data service, FEDE plans to charge an annual service fee that includes as well the exchange of the data with third-party services and FMIS.

2.21.2.2. Pricing of Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.2.3. Additional data revenue models

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.3. Distribution & marketing strategy

2.21.3.1. Distribution and sales channels for Smartomizer

Currently, FEDE is the 2nd largest sprayer manufacturer in Spain while 50% of the revenue is already realized internationally. The manufacturer aims actively for further international growth. The distribution in Spain is handled by FEDE directly, while the company works on the international level with a network of resellers in 22 countries.

FEDE: Margins on production and sale of SMARTOMIZER hardware and services.

Dealers LAKKOS, PROMO, SAMU: Margins on distributing/reselling of SMARTOMIZER hardware and services

2.21.3.2. Marketing strategy for Smartomizer

In order to come to an estimate of market demand, we rank all countries according to specialty crop land use statistics from FAOSTAT. In combination with our market type classification, i.e. Saturated, High growth, Growing, Basic, we are then able to estimate total market sizes per country. For example, 3 500 units per year in North America, 500 units in Australia, 7 000 units in South America. On a global scale we come to a specialty crop sprayer market of 26 350 units per year. Performing a similar analysis for the new regions we come to a yearly market demand of 1 155 sprayers in Portugal, 521 sprayers in Poland and 212 sprayers in Hungary as indicated in Table 5-1. Together with an attainable market share estimate, we come to a total FEDE sprayer sales forecast in 2021, where we distinguish between low end sprayers (70%) and the IoT enabled cloud connected high-end sprayers/SMARTOMIZERS (30%).

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This makes us believe that in 2021 we can realistically sell 35 SMARTOMIZERs in Portugal, 28 in Poland and 13 in Hungary.

2.21.4. Customer & end-user relations

2.21.4.1. End-customer relations & loyalty for Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.4.2. Product support services for Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.5. Partner network & horizontal activities

2.21.5.1. Partner network for Smartomizer

**Lakkos KFT, Hungary**

- Responsible for implementation and execution of Hungarian demo with technical and logistic support from FEDE and scientific support from UPC.
- Responsibility for the field days in Hungary with at least three field days organized during the UC lifetime.
- Work on increasing operating efficiency.
- Grow skilled human capital, through continuous capacitation of existing work force/farming community.
- Plus responsibilities of this partner for the “Use case envisaged outcomes” as well as assigned deliverables.

**Universitat Politècnica de Catalunya, Spain**

- Scientific support to the demo sites in Hungary, Poland and Portugal.
- Validation of plant protection product (PPP) savings.
• Monitoring over one growing season savings on plant protection product (PPP), tractor fuel, and labour costs, without jeopardizing crop quality nor quantity. As baseline reference serve results from previous years where framers were not using SMARTOMIZER IoT technology.
• Provisioning of didactic material as well as scientific support in the organization of field days.
• Grow skilled human capital, through continuous capacitation of existing work force/farming community.
• Plus responsibilities of this partner for the “Use case envisaged outcomes” as well as assigned deliverables

Societe Promodis oddzial w Polsce, Poland

• Responsible for implementation and execution of Polish demo with technical and logistic support from FEDE and scientific support from UPC.
• Responsibility for the field days in Poland with at least three field days organized during the UC lifetime.
• Work on increasing operating efficiency.
• Grow skilled human capital, through continuous capacitation of existing work force/farming community.
• Plus responsibilities of this partner for the “Use case envisaged outcomes” as well as assigned deliverables

Samuel Salgado Unipessoal LDA, Portugal

• Responsible for implementation and execution of Portugise demo with technical and logistic support from FEDE and scientific support from UPC.
• Responsibility for the field days in Portugal with at least three field days organized during the UC lifetime.
• Work on increasing operating efficiency.
• Grow skilled human capital, through continuous capacitation of existing work force/farming community.
• Plus responsibilities of this partner for the “Use case envisaged outcomes” as well as assigned deliverables

2.21.5.2. Horizontal activities for Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.6. Cost structure & internal resources

2.21.6.1. Cost structure for Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.21.6.2. Internal resources for Smartomizer

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.22. UC3.6 – BEVERAGE INTEGRITY TRACKING

This new Use Case aims to produce an integrated system that monitors the whole wine and beverage distribution channel from producer to consumer.

As it was introduced in another product in the Use Case 3.2, transport of wine is full of business opportunities. Wine integrity, traceability as well as insurance of precious goods new policies based on IoT are direct benefits of the solution i.e. a shared, affordable, ‘Plug and Play’ platform to indicate the best possible decisions for managing travelling product.

All data recorded during the shipment will be stored in the cloud and will be accessible to the delivering winery thereby allowing identification of the exact timing of any accidents and related responsibilities.

2.22.1. Product description & value proposition

2.22.1.1. Description of Beverage Integrity Tracking (BIT)

In order to bring the wine & beverage at its best qualitative expression to final consumers, an IoT, algorithm-based system tracks beverage integrity during distribution by monitoring how much and when it has been stressed and assessing its state-of-health through analytics. A reusable smart data logger is placed at the packaging level in every box of quality wine & beverage. It records - on an hourly basis - temperature, humidity and shock events during transportation and storage throughout the whole distribution chain to the final retailer (wine shop, wine bar, restaurant).

The retailer can access the wine IoT dataset associated with the device through her/his smartphone and obtain integrity alerts and consumer-oriented information on the wine contained in the box.
2.22.1.2. Value proposition of Beverage Integrity Tracking (BIT)

The major value of this service is that many actors could benefit in the value chain. Producers will be able to track if their product reaches the consumer spoiled, they have a big brand damage with consequent customer unloyalty. Importers/retailers they could know if they receive a not conform product or they have issues in managing the product. And finally, consumers will be able to assess if they pay for a product without knowing how it has been treated. They just know when they open it the bottle.

Without our Product or Service
- Beverage producers: "I don’t know how my product is treated in the distribution, if it is stressed or not."
- Retailers: "I don’t know the conditions of the product I receive, and I cannot show objective quality info to the consumer I sell to."
- Insurance companies: "We struggle to create policies to the sector based on means of transportation and quality because we don’t have enough statistics."

With our Product or Service
- Wineries and beverage producers will build up useful experience on transportation conditions by courier, country of destination and period of the year, to optimise future deliveries and market an almost perfect wine.
- Retailers can use the same system to report any non-compliance of the received good, and to send the producer first-hand feedbacks; they can also show consumers their care for the products they sell.
- The ensemble of data from all wineries that use the system will soon constitute a general database on issues frequency in wine shipping, open through license to insurance companies, that can hence propose IoT-based insurance policies to the wine sector.

Here is the difference
- More data on beverage integrity and more collaboration within supply chain stakeholders
- Increase the supply chain visibility +90%
- Enhance inbound goods control +50%
- Have real data on which building risk profile for logistics -50%

Target User:
- Medium winery (30 - 100 ha) and/or winemaking cooperatives
- Insurance company (Re-insurance mainly)
The ensemble of data from all wineries that use the system will soon constitute a general database on issues frequency in wine shipping, open through license to insurance companies, that can hence propose IoT-based insurance policies to the wine sector.

Moreover, a Blockchain environment will also be available to users to certify the data for legal use. The system will be fully developed to be adapted to the wine industry, but the similarities and potential transferability to other sectors such as liquor, craft beer, olive oil, etc, will be also explored.

2.22.2. Exploitation & monetization

2.22.2.1. Revenue model for Beverage Integrity Tracking (BIT)

Beverage Integrity Tracking could be offered under a SaaS model to producers, importers/distributors, retailers and insurance companies with flexible monthly or yearly payments. The data is the value, so the hardware modem could be embedded into the solution.

2.22.2.2. Pricing of Beverage Integrity Tracking (BIT)

The first proposed solution of the tracking device will be Bluetooth based, making the hardware very affordable for end user. Batteries will last years and the way to scan the pallet or bottle will be based in a mobile application.

The UC business model is based on a prudential market goal of 7.5 million shipped boxes per year with the aimed selling price of 20 €/unit for the Bluetooth data modem. However, the internal price analysis is currently under development and will be discussed in the next version of this evolutionary business model overview.

The software service (e.g. use of database, track&trace, etc) is offered jointly with the device per shipment, it means a pay-per-use pricing model is applied. So, wineries, importers, distributors and logistic companies will benefit of the system to optimize cost and condition of wine transportation, with a premium price on each shipped box and/or pallets. Prices for the service has not been disclosed so far by WENDA.
2.22.2.3. Additional data revenue models

Insurance companies could benefit from the technology due to the blockchain component. This opens a data exploitation universe.

2.22.3. Distribution & marketing strategy

2.22.3.1. Distribution and sales channels for Beverage Integrity Tracking (BIT)

First market introduction will be performed by WENDA and Vinidea, due to their local presence.

2.22.3.2. Marketing strategy for Beverage Integrity Tracking (BIT)

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.22.4. Customer & end-user relations

2.22.4.1. End-customer relations & loyalty for Beverage Integrity Tracking (BIT)

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.22.4.2. Product support services for Beverage Integrity Tracking (BIT)

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.22.5. Partner network & horizontal activities

2.22.5.1. Partner network for Beverage Integrity Tracking (BIT)

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.22.5.2. Horizontal activities for Beverage Integrity Tracking (BIT)

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.22.6. Cost structure & internal resources

2.22.6.1. Cost structure for Beverage Integrity Tracking (BIT)

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.22.6.2. Internal resources for Beverage Integrity Tracking (BIT)

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.23. UC4.1 – VERTICAL CITY FARMING

Facing the increased need of food for a growing pollution and limited availability of farm land, the concept of vertical farming can help to significantly increase the output per ha by at the same time reducing the usage of production assets like water, fertilizer and pesticides to an absolute minimum.

In verticals farms, plants are grown on artificial layers in closed buildings. Lighting is provided by led lamps all around the day what accelerates the growth time. Special light recipes further enhance the growth and the quality of the plant. The nutrition and water are provided on exact demand and there is no need for pesticides as there are neither insects nor weed inside the building. This concepts mainly suitable for leafy products like lettuce and herbs.

This use-case works on a fully automated vertical farm setup that is steered by a smart control system. The idea is to setup these vertical farms near cities to provide in a very predictable way high quality and even enhance fresh leafy products to supermarkets.

The use-case clearly targeting the farm production level, however the concept has effects on all parts of the value chain:

![Figure 126: UC4.1 - Value Chain Position](image)

2.23.1. Product Description & Value Proposition

2.23.1.1. Product description for GrowWise

The GrowWise Control System pools sensor data from weight scales, cameras, temperature and atmospheric sensors into a smart network to operate the vertical farm nearly automatically. The system steers the light application, nutrition and water supply, the seeding process and organizes the harvest.

An advance machine learning component use the big data pool of growth date to constantly improve the decision-making process of the control system.
This concept supports the demand driven production and it could be connected to supply management system of a supermarket to schedule the next growth cycles in synchronization with the predicted demand.

**Figure 127: UC4.1 - Product Factsheet for GrowWise Control System**

### 2.23.1.2. Value proposition of GrowWise

The core advantages of the GrowWise Control System for vertical farmers is the full automation and smart decision-making in real-time based accurate IoT sensor data. This way a farmer can produce a higher output with less production assets except electricity.

**Without our Product or Service**
- **Pen & Paper-based reporting**
  - Currently the achieved yield and performance is tracked manually.

**With our Product or Service**
- **Digital sensor based tracking**
  - Sensors (such VIS/IR cameras, in-line scales, nutrient composition) track growth and measure yield increase.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower analyses crops</td>
<td>Network of sensors to track and steer growth</td>
</tr>
</tbody>
</table>
- Currently a grower has to check for crop deficiencies and adjust settings manually.
- Review the crop growth by means of sensors and software analysis.

<table>
<thead>
<tr>
<th>Difference</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often too late to correct failures</td>
<td>Direct response to changes in growth</td>
</tr>
</tbody>
</table>
| If there are failures in the farm, or people ill, there is a lot of downtime and crops are wasted before harvest. | From training based on historical (trial) data, a machine learning algorithm can suggest improved growth parameters (i.e. fertilization) if needed.

**Target User – Mid/Large size farms**

(5000 – 100000 m² of growing space)

**Figure 128: UC4.1 - Benefits for Farmers**

The major advantage for supermarket and food processors is the all-season availability of certain food products and the risk-free on-demand production. The retailers can stronger differentiate leafy products...
by enhanced nutritions and its sterility and offer products to specific target groups like athletes or persons suffering from an allergy.

<table>
<thead>
<tr>
<th>Without our Product or Service</th>
<th>With our Product or Service</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of non delivery</strong></td>
<td><strong>Always in season</strong></td>
<td>Controlled production that is always in season will make planning and quality control much more efficient.</td>
</tr>
<tr>
<td>With weather changes, crops might be lost due to rain or storm. There will be no supply.</td>
<td>Never out of product, as everything is controlled and automated.</td>
<td></td>
</tr>
<tr>
<td><strong>Quality issues and foreign bodies</strong></td>
<td><strong>Nothing comes in, so guaranteed clean</strong></td>
<td>Waste reduction</td>
</tr>
<tr>
<td>Bugs, sand, soil may be on the product and could be in the package after processing.</td>
<td>With overpressure and correct hygiene protocols, no contaminants can enter the climate cell. The product will always be clean.</td>
<td>-15%</td>
</tr>
<tr>
<td><strong>Shelf life issues</strong></td>
<td><strong>Extended shelf life</strong></td>
<td>Nutritional value</td>
</tr>
<tr>
<td>Often, conditions during transport (e.g. temperature) are non-optimal, resulting in reduced shelf life and increased waste.</td>
<td>Based on customer specs, different growth recipes can be developed and optimized (through algorithms) to extend shelf life.</td>
<td>+15%</td>
</tr>
</tbody>
</table>

*Figure 129: UC4.1 - Benefits for Food Processors*

The major advantage of an automated vertical farm for supermarkets and end-consumers is the on-demand production of high-quality fresh leafy products with a minimal environmental impact if the electricity is sourced out of renewable power production. Furthermore, it is possible to produce plants with enhanced nutrition (e.g. higher vitamin level) and all products are completely free of pesticides and external allergens.

### 2.23.2. Exploitation & Monetization

#### 2.23.2.1. Revenue model for GrowWise

As the size of the potential market and costs for a single facility are quite significant, the use-case already starts, supported by WP4, to assess certain business models to lower the entry barriers for investments, but also fairly share the revenue among the developing partners.

In discussion are currently models like Pay-per-performance like Rolls Royce offers it for turbines. This means that the consortium behind the technical setup maintains and guarantees the technical functionality of the vertical farm and the operator pays a fee for its usage. This way the operator gets rid of the technical risks and can concentrate on the supply management.

Another opportunity could be the turnkey concept where the full vertical farm is paid in a lump and brought to the stage of full operation by the developers. After that point the operator is fully responsible for the management of the facility.

#### 2.23.2.2. Pricing for GrowWise

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.23.2.3. Additional data revenue model

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.23.3. Customers & End-user Relations

2.23.3.1. Distribution of GrowWise

The GrowWise Control System will be distributed by selected and value add partners. Philips does already performance-based – production-based sales. Although the payment plan has not yet been fully developed, some usage fees are foreseen for the GrowWise Control System. This includes: Implementation fee (initial purchase), User fee / licenses, Value add services (Pay per KG, Pay per recipe, Consultancy fee (growth advise, marketing etc.), Etc.

2.23.3.2. End-customer relation for GrowWise

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.23.4. Partner Network & Horizontal Activities

2.23.4.1. Partner network for GrowWise

The aim is to connect to partners in whole value chain. Partnerships currently exist with various value add technical partners (e.g. Certhon, Priva, Hortimax, Hoogendoorn) as well as different food processors and retail (e.g. Staay, Fresh Care Convenience, Aldi).

2.23.4.2. Horizontal activities for GrowWise

In order to ensure the functionality of their products, Philips Lighting will maintain a control center and use remote monitoring for maintenance. Furthermore, a partner service contract will be concluded (24/7). The system calibration incl. reports and certification is also conducted by Philips Lighting.

S/W – H/W providers and update / version, release and change management

2.23.5. Cost Structure & Internal Resources

2.23.5.1. Cost structure for IoField Gateway

A total of 17 FTE is needed, this results in a cost of 1.3 Mln Euro.

2m adjustment of GrowWise facility + extra 500k investment by – €10m indoor-farming

2.23.5.2. Internal resource for IoField Gateway

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.24. UC4.2 – DSS GREENHOUSE PRODUCTION

One major factor for the large-scale adoption of IoT solutions in agriculture is the availability of technical solutions that are also affordable for smaller farmers in more fragmented markets. The greenhouses for tomato production in Southern Europe, especially in Spain, are mainly operated by many smaller farmers with tight operating margins, sensitive cost structures, dynamic markets, and limited investment capacity. In addition, the greenhouses are semi-controlled systems, and thus they are also affected by volatile climate conditions. The solution presented in this use-case is a decision support system for fertigation and climate control that is based on data from climate forecast and climate and soil measurements. It is offered in components of low, mid and high tech.

The use-case aims to motivate the majority of the 15,000 tomato growers in the Almeria region, as a first target audience, and to make use of the agricultural cooperative network. The purpose of this use-case is to offer a smart management system based on prediction and IoT sensors that are affordable and to leverage data sharing, where possible, which may exist among farmers and their cooperatives. Based on such a crowd-sourced approach, the decision support could be improved through machine learning technologies.

Within the value chain, the solution is focused on the farm production, but the use-case intends to share and collect information across the value chain:

![Value Chain Position](image)

**Figure 130: UC4.2 - Value Chain Position**

### 2.24.1. Product Description & Value Proposition

#### 2.24.1.1. Description of DSS Greenhouse Production

The main objective of this UC is the development of an IoT web-based monitoring and DSS in the greenhouse tomato production involving large amount of data, physical and virtual sensors, models and optimization algorithms focusing on important aspects like water, nutrients and energy use efficiency, for tomato greenhouse productions. DSS and monitoring system for tomato crop will have two main separated components or features:
1. **DSS for tomato production**

The core of the system is a Decision Support Systems (DSS) to assist growers during the growing period, and which uses the publicly available data of climate forecast to help them in the day-to-day greenhouse climate and fertigation management. The DSS uses the sensor data from the soil and the climate control to improve farm management and to provide the farmer smart advice on fertigation and climate.

2. **Greenhouse monitoring integration**

The monitoring layer has as its main aim the integration of greenhouse climate and fertigation variables, field notebook, and lab analysis information into a FIWARE-based app, which is based on the open data architecture FIWARE. It implements its Context Broker to be compatible with other local data services. This approach has two different functions:

- Firstly, it is a data integrator and offers a dashboard for greenhouse monitoring to give the grower a quick view of all the processes, the climate and soil statement, the field notebook and lab analysis.
- Secondly, to use this data to improve the results of the core layer, the DSS. Using the data acquired, an automatic calibration of some of the model parameters in the DSS will be performed, ensuring the reliability of the model’s predictions by means of an automatic validation.

At the cooperative or producer organisation level, the tool could provide an overview of the productivity of each individual greenhouse, learn from successful farms, aid benchmarking, and identify problems. With this tool, the cooperative or producer organisation could actively manage farmers to get better output results, while at the same time producing in a more sustainable way.

![Figure 131: UC4.2 - Product Factsheet for Greenhouse DSS (incl. updated KPIs)](image)

**2.24.1.2. Value Proposition of DSS Greenhouse Production**

The major advantage of this approach is its contribution to the achieving a modern, sustainable and scalable agriculture. A tool based on the IoT (internet of things) has been developed to facilitate decision making and integration among different service providers. The tool gives the user the possibility of real-time visualizing the status of his/her crop, historical analysis and most relevant data from the field notebook or lab analysis. It has a “friendly” interface, in order to facilitate its use and has a series of references that recommend what would be the ideal state of the greenhouse in order to achieve a better
efficiency in the consumption of resources and an increase in production. This series of references is
generated through the development of DSS algorithms that, taking as reference the climate forecast,
makes a prediction of the future behaviour of the climate, growth and fertigation inside the greenhouse.
The IoT platform integrates heterogeneous data sources from different service providers at different
time scales from: sensors, actuators, predictive models, weather stations, etc. To address the
integration problem, it is based on the FIWARE Enable called ContextBroker, responsible for collecting
all the context information generated by the sensors and actuators.

Figure 132: UC4.2 - Benefits for Greenhouse Farmers

2.24.2. Exploitation & Monetization

2.24.2.1. Revenue Model for DSS Greenhouse Production

The solution that is being developed in UC4.2 is based on affordable hardware but with high amounts
of data sources and processing. The software is offered under a Models as a Service (MaaS) paradigm
with flexible monthly or yearly payments. The contract duration for an initial trial will be set to a minimum
number of months, and after this period the farmer can cancel at any time. Furthermore, the exploitation
model foresees a fee for additional customisation if needed by the farmer.

However, this current model still implies an initial cost for farmers to actually try out the software solution
and sign-up to a SaaS contract.

At this stage of the product development, revenue models have been studied and are under
consideration. A licensing agreement governed by the University is the preferred choice, with the
intention to find companies to licence it and to maintain the system (Model A in prior report). It is
important to consider that the business models in the prior report were to be seen as a progression
rather than an “either-or” scenario. The creation of a data cooperative has been considered (in prior
plan, Model B, as an extension of Model A), but economies of scale in terms of data and cost/benefit
were found to be not particularly viable at this point. There is some movement by a large multi-national
to partner with a Spanish entity to create a data cooperative, but its progress is unclear. We have
considered that a model based on a data cooperative will require much more coordination at the sector
level and may not be feasible in the life of IoF2020. While certain cooperatives have tried to create such
a data pool, they have realised that they need a much bigger data set then they can currently achieve
from their members. For this reason, the atomisation of the Almería sector and its many producer organisations presents significant challenges. As well, certain data is only allowed to be shared within members of the association of producers’ organisations (by virtue of F&V Operating Programs), which causes some barriers as well for data sharing. This option may be possible in the future given horizontal integration, merger trends and/or agreements, but it is off the table for the moment for this product development.

The chosen Business Plan is premised on a licensing agreement governed by the University of Almería, through its Office of Transfer of Research Results (OTRI – Oficina de Transferencia de los Resultados de Investigación) with the participation of third parties. Third parties would be responsible for the maintaining and commercialisation of the solution. This model is summarized in Figure 4 Below. In this model scenario, the University is responsible to maintain the core of the DSS, to update the models and the user access. However, the external support by another company will be required for maintenance, commercialisation and additional web-based solutions. Third party companies interested in including these services within their portfolio will be licenced to use DSS, allowing their users (farmers) the use of the services, DSSs and, if the case applies, the monitoring layer. These farmers who participate by providing data, would get certain basic services for free or a symbolic fee (monitoring layer, value exchange), and the core layer (DSS) products/services for established fees (usage fee/subscription fee). The final system will have a working business plan with and without monitoring layer (that is, the monitoring layer and the DSS are different products, depending on needs of farmers). The appropriate combination of products will be recommended to the growers based to two different advantages and their needs:

i. DSS + monitoring: The data acquisition helps to improve results of the DSS by auto-recalibration of the models.
ii. DSS: The data acquired can be used to improve the results in the greenhouse and others in the same cooperative.

Roles within the Business Plan:

- University of Almería: Development of the DSS and monitoring system for the working model 1 or working model 2 (see Figure 4 below). Also, implement the user’s management system, whose development will be done by an ICT company supervised by UAL.
- Licensing: License buyer, one or more ICTs companies which want to have this service within their portfolio, offering it to their Users (Growers).
However, in the future, a variation/extension of the previous business model could be considered with the set-up of a data cooperative or other data sharing arrangement. Creation of a cooperative data pool (creation of net value), with investment/operation (funding, setting up, servicing and data storage) shared along the value chain by payment for products/services (usage fee or subscription fee) by input providers, seed companies, growers, handling businesses, transport companies, wholesalers and retailers, etc. If the data cooperative or data sharing arrangement is ultimately established, the UAL would have access to the data pool in exchange for providing a basic service to contributing entities to the data pool and/or the association member producer organisation). Contributors/members would pay a usage fee or subscription fee for premium products. Third parties would pay a higher rate.

2.24.2.2. Pricing of DSS Greenhouse Production

Pricing models need to be refined. For example, farmers could pay based on a formula of combination of hectares, data input contributed, and DSS sophistication needed. Cooperatives or producer organisations could pay a subscription price with the option to pay fees for bespoke products or services.

From licence perspective cost per user is 350 so we suggested a retail price for a user: 700 € per year.

The next tables show the market competitors. In all of them the fixed prices are similar.
Figure 134: UC4.2 - Competitor’s Analysis

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unifarm</th>
<th>Limited (8)</th>
<th>Limited (6)</th>
<th>Limited (5)</th>
<th>Limited (4)</th>
<th>Unlimited</th>
<th>Unlimited</th>
<th>Unlimited</th>
<th>Unlimited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sensors</td>
<td>Unlimited</td>
<td>Limited (8)</td>
<td>Limited (6)</td>
<td>Limited (5)</td>
<td>Limited (4)</td>
<td>Unlimited</td>
<td>Unlimited</td>
<td>Unlimited</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Data exchange</td>
<td>Yes, in different formats</td>
<td>Only Yes</td>
<td>Only Yes</td>
<td>Yes, App-First service</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>App/Web-Platform</td>
<td>Yes/Yes</td>
<td>No/Yes</td>
<td>Yes/Yes</td>
<td>No/Yes</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes/Yes</td>
<td>No/Yes</td>
</tr>
<tr>
<td>DSS</td>
<td>Yes, advanced</td>
<td>No</td>
<td>No/Yes, very weak</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Interoperability/Integration with other systems</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Transmission Technology</td>
<td>Multiple protocols</td>
<td>4G/WiFi</td>
<td>Ethernet</td>
<td>4G/WiFi</td>
<td>4G/WiFi</td>
<td>4G/WiFi</td>
<td>4G/WiFi</td>
<td>4G/WiFi</td>
<td>4G/WiFi</td>
</tr>
<tr>
<td>Price</td>
<td>700 € / user year</td>
<td>5.500 € / user</td>
<td>4.800 € / user</td>
<td>4.500 € / user</td>
<td>300 € / user month</td>
<td>20.000 € / user</td>
<td>14.000 € / user</td>
<td>18.000 € / user</td>
<td>13.000 € / user</td>
</tr>
</tbody>
</table>

Figure 135: UC4.2 - Market Analysis

<table>
<thead>
<tr>
<th>Country</th>
<th>Spain (example)</th>
<th>Almeria</th>
<th>Rest of Spain</th>
<th>Netherlands</th>
<th>Italy</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of potential customers (fulfilling technical requirements)</td>
<td>235</td>
<td>600</td>
<td>900</td>
<td>700</td>
<td>400</td>
<td>2,500</td>
</tr>
<tr>
<td>Number of potential customers</td>
<td>23.500</td>
<td>15.000</td>
<td>45.000</td>
<td>6.000</td>
<td>2,500</td>
<td>12.000</td>
</tr>
<tr>
<td>Average size of customer (animals, turnover, yield)</td>
<td>1.100 pigs</td>
<td>30.000 ha</td>
<td>75.000 ha</td>
<td>9.000 ha</td>
<td>6,500 ha</td>
<td>25.000 ha</td>
</tr>
<tr>
<td>Average technological investment per year</td>
<td>15.000€</td>
<td>1000€</td>
<td>600€</td>
<td>2,000 €</td>
<td>250 €</td>
<td>200 €</td>
</tr>
<tr>
<td>Percentage of customers already using FIMS</td>
<td>2%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
2.24.3. Distribution & marketing strategy

2.24.3.1. Distribution and sales channels of DSS Greenhouse Production

In the event, the licensing arrangement included an exploitation partner, due to the consortia (UAL, third parties, farmers, etc.) nature, the ownership of the data and licence would require that a System Licence Exploitation Provider (SLEP) which will exploit under a data marketplace and get licence fees revenues from customers (Farmers, Cooperative of Farmers and Transport Companies). University of Almeria has extensive knowledge in how to licence through an OTRI to a third-party company and therefore it is advisable to look for a company which can fulfil this role.

2.24.3.2. Marketing strategy for DSS Greenhouse Production

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.24.4. Customers & End-user Relations

2.24.4.1. End-consumer relation for DSS Greenhouse Production

Customers/end-users of the DSS can be identified and organized in various levels, based on activities, which dictates the manner in which the product/services will be delivered:

- **Greenhouse activity**: (15,000 farmers, technicians and field supervisors) This is the main group of end-users. This group is interested in the DSS and the monitoring layer, they can use the full system to support their decisions during the production time.

- **Handling activity**: 83 producer organizations, 80 general managers; 500-800 line managers. Could use the production prediction to elaborate sales strategies. The main part of the system is the growth prediction, but they can use some parts such as information about the water consumption or CO2 management, to elaborate marketing strategies.

- **Third party users**: Almeria has over 250 auxiliary agri-related businesses, as well as countless national and international suppliers and service providers, and third-party analytics. They can use part of the DSS as sales strategy, including the DSS as an easy to use aid for the growers.

Solutions will be tailor made for each customer, depending on their information needs and decision-making requirements. For example, growers without climate control (very common in Almería, and perhaps in small farms in general) could use only the fertigation DSS.

2.24.4.1. Product support services for DSS Greenhouse Production

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.24.5. Partner Network & Horizontal Activities

2.24.5.1. Partner network for DSS Greenhouse Production

**University of Almería** – Research groups: develop DSS and Monitoring System, maintain the core of the DSS, update models and the user access.

**OTRI** (Office of Transfer of Research Results) to publicise product, find interested companies, and manage licencing arrangements with third parties. OTRI has experience in the exploitation and commercialisation of research results and handles patents, licensing, trademarks, etc. The OTRI has been recognized by the Ministry of Economy, Innovation, Science and Employment as an Agent of the Andalusian System of Knowledge to strengthen the relationship between Research, Innovation and Enterprise.

**COEXPHAL** and their members for access to farmers and their businesses, as well as feedback on product. COEXPHAL is the association of producer organisations with 83 members representing 15,000 farmers. The COEXPHAL group also includes project engineering, certification, services, etc. entities.

**ICT companies** who licence product and integrate it with their own range of products. (System Licence Exploitation Provider (SLEP) which will exploit under a data marketplace and get licence fees revenues from customers).

**External ICT support company** required for maintenance, commercialisation and additional web-based solutions. This may include a company related to financial and insurance services, which has a market share of over 60% of Almería agricultural activities. Hispatec, another IoF2020 partner, could also be a candidate for exploiting the service.

**Public Administrations** public data.

2.24.5.2. Horizontal activities for DSS Greenhouse Production

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.24.6. Cost Structure & Internal Resources

2.24.6.1. Cost structure of DSS Greenhouse Production

The first cost of the development is the implementation of user access, the UAL will contract a company to develop a user management tool to control the access to the DSS and monitoring system. Fixed costs are 30,000 €. This is one-time cost, then the company will do maintenance labours which will be included within the cost structure.

A first approximation of a service cost for 300 users is 90,000 € per year. This is the quantity that the ICTs company (license buyer) must pay to the University of Almería per year due to:

- Amortization of the User access implementation, every 300 licenses will include an added value for the system implementation of 4,000€
- Maintenance and management of the full system structure, DSS, monitoring and user access: 14,000 €
- DSS software licence: 7,000 €
- Development and maintenance of the DSS (prediction models) 65,000 €
2.24.6.2. Internal resources of DSS Greenhouse Production

With respect to the use of internal resources to develop the system, are mainly required to implement the user management layer. This component will be worked on by a ICT company contracted by the University of Almería for these labours and the maintenance. This development will require 30.000 € in a first payment and 14.000 €/year for each 300 users to maintain the system (monitoring and user layer) and data base (monitoring, DSS and user information), to register new users and the connections with the DSS. UAL will work introducing new features to the DSS and integrating them.
2.25. UC4.3 – ADDED VALUE WEEDING DATA

This use-case works on a smart weeding solution that consists of three sub-solutions being monitoring weed pressure (1), crop size (2) and harvest prediction (3). The first solution identifies weed pressure in the field based on analysis of camera images captured with a weeding machine. This data is used to subdivide the field into zones and apply the weeding in a smart way at specific field areas.

Furthermore, the use-case provides a high precision crop map with a resolution of a single plant. It provides detailed information on plant size and crop density (number of crops). This data can complement existing decision support systems and increase the decision-making processes.

The third solution is focused on the harvest prediction, calculating the optimum harvest date for lettuce heads in the field. The growth model is developed by WUR for greenhouse grown lettuce heads. In this use case the model is modified to predict crop growth for open field. Input for the model is crop sizes measured by the weeding machine. With the measured data the optimum harvest date is calculated which can be used by the farmer to plan the harvest.

The service aims mostly at the farm production level but the harvest prediction in date and number of crops is valuable information for selling the produce to retail.

![Value Chain Position](image)

Figure 136: UC4.3 - Value Chain Position

2.25.1. Product Description & Value Proposition

2.25.1.1. Product description of Crop Map

This service provides the farmer with a digital map on crop size, density and weed pressure created from visual images by the Steketee weeding machine. The core purpose of this data is to coordinate the weeding and treat only parts of the field that under high weed pressure based on a heat map of weed created with the data (1) and provide information on crop status to feed DSS on crop management (2).

Within IoF2020 the use-case explores further usage of the visual data to create disease forecasts, growth analytics and density overviews for third-party services and Field Management Information Systems (FMIS).
2.25.1.2. Value Proposition of Crop Map

The major advantage for farmers is the high resolution of individual plant information that enables highly targeted treatments and a precise management of different zones in the field. This accuracy improves the application of water and fertilizers and reduces even further the use of pesticides. It results in better yield produced in more sustainable way. The harvest prediction improves the harvest planning, giving the most production of the crops in the required size category.

<table>
<thead>
<tr>
<th>Without our Product or Service</th>
<th>With our Product or Service</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual crop observations</strong></td>
<td><strong>Generated heat maps of crop</strong></td>
<td>Increased precision and non-biased results</td>
</tr>
<tr>
<td>The crop status on the field is registered manually. This needs to be analyzed manually in the office.</td>
<td>The crop status is known on plant level by using image processing.Logging of the crops is done automatically.</td>
<td></td>
</tr>
<tr>
<td><strong>Yield prediction</strong></td>
<td><strong>Yield prediction improvement</strong></td>
<td><strong>Accuracy</strong></td>
</tr>
<tr>
<td>Yield prediction is based on manual observations during the growing season and experience from last years.</td>
<td>Combined crop growth and climate information will generate more accurate yield prediction</td>
<td></td>
</tr>
<tr>
<td><strong>Weeding activity</strong></td>
<td><strong>Weeding activity</strong></td>
<td><strong>Work required</strong></td>
</tr>
<tr>
<td>Moment for weeding is based on manual observations on some parts on the field</td>
<td>Improved weeding activity by using weed density maps.Fields can be weeded partially.</td>
<td></td>
</tr>
</tbody>
</table>

**Target User – Focused on, but not limited to, organic farmers**

Farm management system providers and other service providers benefit from the high-resolution data as it makes their decision support and forecasting services even more accurate.
2.25.2. Exploitation & Monetization

2.25.2.1. Revenue Model for Crop Map

Due to the nature of the business we are trying to exploit, we also consider to introduce a new company model provide which we can call Service Licence Exploitation Provider (SLEP). SLEP will act as Data Broker. Data and images will be processed on the weeding machine before sent to a data repository where the Service Licence Exploitation Provider could make the use of the processed data (intelligence based on the data) for a further selling or exploitations to other customers. These customers could be other Farmers or farm Cooperatives. The software could be offered under a SaaS model with flexible monthly or yearly payments. The contract duration for an initial trial should be set to a min of 12 months after this period the farmer can cancel at any time. Furthermore, the exploitation model foresees a fee for additional customization if needed by the farmer.

By processing on-site, traceability and integrity of the image data will be guaranteed. On the other hand, by processing the images on site before sending to the repository, will make this data unavailable for further use. First tests (20 acres producing 600 GB) show it’s impossible to upload such large amounts of data to the cloud in remote areas. Furthermore, refraining from uploading the RAW image data, might provoke a positive reaction from customers in terms of data privacy and data safety.

WP4 team proposed to have two different models for the Farm Management Information System, image model (fee per map) and data brokerage.

a) “Image Model”/ fee per map (proposed, but abandoned)

Previously WP4 team proposed that in the model, the weeding machine company (Steketee) could give the rights/licence to a SLEP exploiter who could sell the data, with optimization recommendations to farmers. Customization fees were foreseen in this data model, so a minimum lump of money such a setup fee will also be part of the revenue model. However, discussions within the consortia decided that selling of data is no-go, the farmer is the unique owner of the data. So, we will show the data (crop sizes/weed pressure) on the farmer’s account and he pays for the functionality.
**b) Data brokerage / data marketplace**

By uploading data to a database made by any of the current system providers (Akkerweb), and using a traditional Software as a Service (SaaS) model, farmers could make use of these services for producing a marketplace. In such marketplace SLEP could process the data and give recommendations in a SaaS model. Software is provided to the customer through the cloud. Farmers and Cooperative may buy the right to use the software on a subscription basis, on approval by the farmer.

### 2.25.2.2. Pricing of Crop Map

The pricing of the Crop Map is not finally decided upon but two options are considered, the functionality can be offered as addition to the machine or as stand-alone product on an online platform as Akkerweb. The first option can be implemented to add value to the existing product giving an advantage over the competitors without increasing the price, giving more product for the money. In this case the price will be included in the machine. The second option is to sell the product as an application on Akkerweb, in this case two apps being the data representation of crop size, crop density and weed pressure. The second app being the growth model giving the optimum harvest date. For both apps a combination of ‘subscription’ and ‘pay-per-use’ are considered (see also Figures UC4.3 - Product Factsheet for Crop Map and UC4.3 - Benefits for Organic Farmers). The subscription part of the app can be set at €30,- per year with a pay-per-use fee of €5,- per hectares.

![Figure 140: UC4.3 - Business model options for Crop Map](image)

#### 2.25.3. Distribution & marketing strategy

**2.25.3.1. Distribution and sales channels for Crop Map**

From WP4 we consider two options for exploiting the service to farmers:

a) Machine manufacturer, in this use case Steketee  
b) Data system provider such Akkerweb (or 365Farmnet)

The two distribution channels are being considered at the moment. The weeding machine is built by a machine building company, for which the data part is a new kind of business. It is being considered to include it in the company or being exploited by another ‘data’ company, therefore the Akkerweb may be the preferred option.

**2.25.3.2. Marketing strategy for Crop Map**

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.25.4. Customer & end-user relations

2.25.4.1. End-customer relations & loyalty for Crop Map

The decision on the distribution of the Crop Map will have impact on the relation from the company to the end-customer. Akkerweb distribution channel are preferred as there is an infrastructure present for the end-customer to contact the platform. The platform will then be responsible for the first line support to the end-customer. The second line support from will be done by Steketee solving the more complex issues which might occur.

2.25.4.2. Product support services for Crop Map

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.25.5. Partner Network & Horizontal Activities

2.25.5.1. Partner network for Crop Map

In this use case we make use of the services of Akkerweb. Although Akkerweb is closely related to WUR, it is not part of it. Though Akkerweb is not a partner in IoF and is one of the network partners we use. The app built in this use case will run on the Akkerweb servers. An agreement needs to be made between Akkerweb and Steketee on the financial part but also on service and support part, as discussed before. The agreement between these parties needs to be discussed on how this will be worked out.

2.25.5.2. Horizontal activities for Crop Map

Currently under development and will be discussed in the next version of this evolutionary business model overview

2.25.6. Cost Structure & Internal Resources

2.25.6.1. Cost structure of Crop Map

The costs for the product consist of software development and hardware required for the data connection. The required hardware for the data connection consists of a modem (€175,-) and a data subscription (€240,- yearly). Weather data for the crop growth model are based on a weather station (€2450,-) within the project. The weather data could be supplied by an online platform as Akkerweb, with a fee of €250,- yearly.

Additional internal cost of the products are related to human resources and IT development, those will be further explored in future discussions between partners in the consortia.

2.25.6.2. Internal resources for Crop Map

The development in the project is done by the use-case partners for the software on the machine part. The crop growth model development and implementation are done within the project as well. Some development on the project is outsourced to Akkerweb.
2.26. UC4.4 – ENHANCED QUALITY CERTIFICATION SYSTEM

This use-case boosts the current wine auditing, wine marketing and wine production with augmented and virtual reality to the next level of comfort and immersion. The future vine auditor will learn the profession with virtual reality audits and an advance e-learning tool. Augmented reality will be used on the tablets of auditors in the winery to quickly access sensor data by just pointing the camera to a barrel. The auditing tool projects the real-time measurements of the sensors in the barrel directly in the camera picture and presents comfortably to the auditor.

With the second service the use-case brings end-consumers virtually to far-away vineyards and offers virtual reality tours directly at the wine retailer.

With the last service, the use-case targets the wine production itself. It offers direct sensing within the vat throughout the fermentation process. The real-time data is accessible via augmented reality on the mobile and tablet.

With this suite of solutions, the use-case targets the full value chain from wine production to the retail level:

![Value Chain Position](image)

*Figure 141: UC4.4 - Value Chain Position*

The three products are now under different status at the moment. Valoritalia will be using E-audit as an internal tool for the auditing process for their clients. This fact will boost functionality, increase technical awareness but will be very customized to the Italian market needs.

The use-case is currently working on the interface for the augmented reality auditing and WP4 supports this development with its product development programme. The aim is to define a clear feature roadmap for the future MVPs of the three different products.

**2.26.1. Product Description & Value Proposition**

**2.26.1.1. Product Description for E-Audit**

The whole product suite is based on a set of IoT sensors in the fermentation vats and an augmented reality component that enriches live videos with virtual information. In the first service enables an Enhanced Audit with direct access to sensor data via virtual reality projections. The auditor just points with the tablet camera towards a barrel and receives right away information blended into the live camera picture.
picture. This way the auditor can quickly assess all areas in the winery and has always all information accessible.

Figure 142: UC4.4 - Product Factsheet for Enhanced AR Auditing Tool

2.26.1.2. Product Description for E-Wine making

As of Q3 2019 this product has been dismissed, so no further development.

The access to sensor data via augmented reality is of course also of interest for the winery itself to comfortably access the sensor data and get a quick overview on the current fermentation progress in a barrel. This reduces the need for manual reporting and gives a real-time monitoring opportunity.

Figure 143: UC4.4 - Product Factsheet for E-wine Making Tool
2.26.1.3. Product Description for E-loyalty

Furthermore, the footage can be used for end-consumers to get to know the winery through a virtual tour experience. The E-loyalty tool give wineries the opportunity to invite customers from all over the world directly into the vineyard and to transport the brand value in a more immersive and therefore more emotional way.

![Figure 144: UC4.4 - Product Factsheet for E-Loyalty Tool](image)

2.26.1.4. Value Proposition for E-Audit

The major advantage for the auditor is time reduction and high comfort of an audit supported by augmented reality. The auditor can focus more on a deeper quality analysis as the information is always available in real-time on-site. Furthermore, the training of auditors in virtual auditing situation is closer to the real-world situation and train the auditor important skills and observation techniques.
2.26.1.5. Value Proposition for E-wine making (Product discontinued)

The winery receives easy access to data by digital tags, saves time and can increase its production quality. Furthermore, the reporting of the fermentation process is fully transparent and digital.

2.26.1.6. Value Proposition for E-loyalty

The wine consumer gets a closer relation to the value of a wine by visiting virtually the winery and learn about the high-quality production, the region of the wine and brand values. This increase the brand value and facilitates a higher consumer loyalty.
2.26.2. Exploitation & Monetization

As one of WP4 proposal to UC 4.4 is further exploring synergies with other UCs. After studying deeply similitudes between UC 3.2 Big Wine Optimization and this use case suggest a cross selling exchange in Process2Wine offering and not focusing a brand-new solution as of E-winemaking.

Discussions with the consortia led to a product discontinuation for E-winemaking, because although the used sensors are in the industrialisation phase, they have to be considered as still "prototypes". Valoritalia believes the used technology is not mature enough for a product launch. The selected sensor provider (WATGRID) won a SME phase 2 founding scheme for developing the sensors. So, it may be considered later on in the medium term.

Valoritalia expertise in audits and the new E-audit product offering could be also sold as a solution to ATOS customers in UC 3.2 as a new add-on service. WP4 proposed this in last deliverable Q1 2019 but no further discussions have been taken of.

2.26.2.1. Revenue Model for E-audit

Due to the fact that all wineries need to go auditing, this is an excellent tool for an upselling new service to existing customers of ValorItalia. The use-case mainly plans to use the auditing tool within ValorItalia, that will lower the cost of the process of auditing as well as increase wineries satisfaction.

WP4 proposes to have a cross over as an annual fee, and price tag should be based on Valoritalia’s experience in auditing wineries. This service is intended mainly to medium and large wineries where the system provider has already an existing relationship.

WP4 proposes also Valoritalia to reuse E-audit knowledge and make it white label to other type of beverage industries, not only wine, but beer and spirits. This will also be a good way of further extending Valoritalia’s market segments. No further actions have been taken after this proposal.

Thinking even further, from the WP4 point of view, the reuse of E-audit in new other sectors would allow the creation of partnership with certification bodies.
2.26.2.2. Pricing of E-audit

The product will be sold to wineries by a subscription fee that covers use of the software and maintenance. Because of the fact that the main user is internal auditor, the subscription fee will cover initially the software adaption cost to new companies. Revenue flow to Valoritalia in terms of licencing will be transferred covered in a partnership agreement.

No prices have been disclosed as of Q3 2019.

2.26.2.3. Revenue Model for E-wine making (product discontinued)

E-winemaking could be seen as a marketing and sales tools to get into the wineries. There is a clear value proposition for the customer to get detailed online electronic data on the whole process. It could also save money and time for the auditors for data collection.

As stated in the beginning of the section WP4 proposes to be in synch and collaboration with UC 3.2 Big Wine Optimization and use Process2Wine know-how in order to avoid develop a full suite of products from scratch in an already very competitive market. Prices should also be in line with UC 3.2.

2.26.2.4. Pricing of E-wine making

This product has been discarded.

2.26.2.5. Revenue Model for E-loyalty

E-loyalty is a pure marketing tool aimed to boost loyalty to end users by bringing transparency and real user experience data. From WP4 perspective we don’t see this as a stand-alone product but as a add on to one of the previous ones, E-audit or E-winemaking licence

We propose to have a revenue price licence based on volume with a minimum fee covering the cost of producing the VR and AR, software and hardware, then we could introduce a variable revenue model based on use of the data retrieved by the end users.

2.26.2.1. Pricing of E-loyalty

Pricing is based on the experience software development cost that is outsourced. The quality of the experience influences strongly the software development cost. Margin for Valoritalia will also be added.

The final price of standard experience will be sold around 30k euros and will include 4 points of interest.

Due of the nature of these projects, prices of the solution could be integrated in rural development plans projects (or other project supported by contribution of EU). Usually EU covers 35-70% of the cost project making this very attractive for end customers.

2.26.3. Distribution & marketing strategy

The distribution strategy would be aiming to start a lobbing approach to propose to be the industry standard. In order to do this, Valoritalia’s knowledge of the auditing process of wineries and its extensive know how of the Italian market will put them in front of auditing in the sector.

As we also proposed in E-audit, Valoritalia could also offer a white label solution for Virtual Reality and Augmented Reality for wineries. In order to do this, we will suggest to collaborate with another third-
party company that could develop the content whereas Valoritalia don’t need to focus in developing and processing the data for VR and AR.

2.26.3.1. Distribution and sales channels for E-audit

Due to the fact that the number of certification bodies are limited (less than 20 of them for organic products and less than 50 for PDO wine). That leads to the reasoning that business development and the potential customer management will be led by the top management of the company distributing E-audit.

We from WP4 suggest to do a quick study market study to approach insurance companies as a potential distribution partner.

2.26.3.2. Marketing strategy for E-audit

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.26.3.1. Distribution and sales channels for E-loyalty

Due to the nature of marketing introduction company, the product is distributed as a highly customized product. Distribution will be done by a third-part company with the help of Valoritalia.

Valoritalia is the leading company in Italy authorized by MiPAAF, for the control and certification of wines with designation of origin, geographical indication and wines with indications of the grape variety and/or vintage. No further discussions as of Q3 2019 with regards of a potential distribution partner.

2.26.3.1. Marketing strategy for E-loyalty

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.26.4. Customers & End-user Relations

2.26.4.1. End-consumer relation for E-audit

Firstly, we should remind that the end-consumer of E-audit is the auditor of the process. So, the end-consumer relation is finally held by the certification body. Valoritalia will sell and distribute E-loyalty to certification body through a B2B contract with prices agreed depending on the opportunity.

2.26.4.2. End-consumer relation for E-loyalty

As on the previous product, we should remind the end-consumer of E-loyalty is the wine consumer. So, the final end user relation with the wine consumer is through the wine producer. Likewise, E-audit, Valoritalia sells E-loyalty to the wine producer through a B2B contract with prices agreed on a customized case, depending on the tailormade opportunity.

2.26.4.1. Product support services for E-audit

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.26.4.1. Product support services for E-loyalty

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.26.5. Partner Network & Horizontal Activities

2.26.5.1. Partner network of E-audit and E-loyalty

The needed partner network of the project is composed of the following companies:

- Hitachi. This company is the responsible for DIONISO, the core of Valoritalia’s management software. So, Hitachi provides the API for the DIONISO link.
- UQIDO: an Italian company specialised in mixed reality software development. UQIDO develops augmented reality, mixed reality and sensor interface software for the project.
- ABACO: an Italian company specialised in GIS. It provides the engine and data access for the vineyard audit.
- WATGRID: a Portuguese innovative start-up company that provides sensors for wine monitoring. As stated before, WATGRID is currently developing the sensors using SME instrument from EU.

2.26.5.2. Horizontal activities for E-audit and E-loyalty

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.26.6. Cost Structure & Internal Resources

2.26.6.1. Cost structure of E-audit

E-audit requires a number of components:

- software outsourced programming cost related to:
  - cellar audit
  - vineyard audit
  - interface with DIONISIO (Valoritalia management software)
- annual subscription fee for software maintenance and updates of the data cloud.
- annual subscription fee for data access (satellite images, weather databases, etc)
- internal staff for the activity’s coordination
- tablet
- auditor education

2.26.6.2. Cost structure of E-wine making (product discontinued)

E-wine making requires:

- software outsourced programming cost related to the cellar
- software outsourced programming cost related to the vineyard
- software outsourced programming cost related to the interface with Dioniso (Valoritalia management software)
• annual subscription fee for software maintenance and updates
• annual subscription fee for data access (satellite images, weather databases, etc)
• sensors
• sensor installation
• Annual fee for sensor update and maintenance
• sensor software outsourced programming cost related to the interface
• tablet

2.26.6.3. Cost structure of E-loyalty

E-loyalty cost structure will require:

• software outsourced programming cost related to the VR experience
• software outsourced programming cost related to the interface with third party software, databases and/or sensors
• VR devices

2.26.6.4. Internal resources for E-audit

In terms of human resources, Valoritalia IT unit will support software development and updating of the solution. This will require skills and month hours that they have not been quantified yet. DIONISIO software, in terms of subcontracting, is outsourced man hours power. Dioniso software is outsourced to Hitachi which is something that needs to be integrated in terms of resources too. And also, Valoritalia can coordinate data transfer between DIONISIO and E-Audit.

Man power audit work tasks will need to be carried out by internal personnel of Valoritalia. Although there are some professionals that annually are outsourced too.

2.26.6.5. Internal resources for E-loyalty

Valoritalia by its nature is a certification body therefore it has to be third part between the produced and the consumer. So, by Italian laws Valoritalia cannot sell or distribute the product. What Valoritalia can do us is manage and overlook the total business. And also, Valoritalia IT unit will support the software development and update.
2.27. UC4.5 – DIGITAL ECOSYSTEM UTILISATION

CYSLOP aims to create an Agrifood multi-stakeholder platform that optimises crop cultivation practices, nicely organises food supply value chain and offers farm2table data-story telling to consumers.

![Figure 148: UC4.5 - Value Chain Position](image)

2.27.1. Product description & value proposition

2.27.1.1. Description of CYSLOP

CYSLOP delivers tailored information to farmers based on data acquired by IoT devices (low-cost weather stations) regarding high farm input-costs (plant protection, irrigation water). As a result, IoT devices, Cloud Computing and Analytics technologies are translating data to services and increase Total Farm Productivity (TFP) factor which consequently assures food security for an increasingly populated world. In addition, CYSLOP will involve state of the art track and trace services and queries incorporating the good work done within IoFF and being the first solution that delivers on- and postfarm traceability features. Last, an innovative marketplace where on- and post-farm data services can be published along with external business entities’ food content.

Cyslop provides IoT-powered soil and air sensors, actuators (electrovalves) and connected devices (nodes and gateways) to farmers and in the chain; IoT powered devices are built inhouse and enable remote monitoring of the farm and timely risk management by the farmer. On and post-farm self imported data to provide product traceability story.

Plant protection and irrigation scheduling services are tested to be available on demand through a yearly subscription with an annual subscription to sensor services (analytics) offered on a pay-per use basis.
Sensors and associated services will provide:

- Reduced farm input costs (water, energy, pesticides)
- Increased farm's Total Factor Productivity since less resources will preserve or optimize farm yields
- Increased farm sustainability in respect to environmental footprint
- Optimized food value in the business process by
- Increased consumer trust in CYSLOP-enabled food products
- Waste reduction
- Increased profit margins for high quality CYSLOP products
- 8h Hotline – free
- Physical support in two layers- 1st level local support actions undertaken by local partners; 2nd backend support by FINT

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**Figure 150: UC4.5 - Product Functionality**

- **FIWARE microclimate station**
  - Air Humidity
  - Air Temperature
  - Soil Moisture

- **User Inserted Data**
  - Irrigation relevant

- **Irrigation Optimizations**
  - Capable of irrigation optimizations

- **Plant Protection Notifications**
2.27.1.2. Value proposition of CYSLOP

**Value proposition of CYSLOP**

**Figure 151: UC4.5 - Value Proposition of CYSLOP**

**Core Product Features**
- **Irrigation Service**: Enables the development of multiple profiles per irrigation valve by time, sensor, and weather-based scheduling.
- **Plant Protection Service**: Provides real-time risk assessment for certain crop diseases based on microclimate and seasonal data.

**Payment Plan**
- Once-off HW payment (IoT gateway, sensors) with subscription scheme for devices monitoring and light analytics and subscription Services for plant protection and irrigation.
- We may provide a on month free trial for the irrigation/plant protection service.

**Customers & Provider**
- Business retail partners will initially get for free the possibility to be presented online as food producers partners where consumers can find these products with a small subscription fee to remain in the catalogue and update their content.

**Major Challenge**
- Agricultural global total factor productivity (TFP) shall be increased by at least 70% pressing climate-change conditions call for rational use of fresh water and chemicals use; fierce competition in the global food value chain lowers profit margins.

**Here is what we aim to improve (KPIs)**

- **Water usage**: -5%
- **Plant Protection applications**: -10%
- **Farm managers' efficiency**: +20%

These values derive from comparison of a standard farm's performance prior to the installation of our system and after.

---

2.27.2. Exploitation & monetization

2.27.2.1. Revenue model for CYSLOP

The CYSLOP IoT platform will be sold as a combination of once-off hardware costs and subscription-based services with break-even point at 200 IoT devices sold.

A suite of gateway, air and soil sensor would approximately cost 900 euros, with a plant protection notification service 200 euro/year and the Irrigation scheduling service 150 euro/year.

Combination sales with hardware sales and after sale services on advisory for specific crops based on sensor data and existing customers (food producers) are paying for real-time farm-monitoring and data availability capabilities.

Payment Plan: Once-off HW payment (IoT gateway, sensors) with subscription scheme for devices monitoring and light analytics and subscription Services for plant protection and irrigation. We may provide a one month free trial for the irrigation/plant protection service.

The average percentage that the services adds on top of the current costs of your customer is 15%

CYSLOP will also offer them tailored services for plant protection and irrigation management; Business retail partners will initially get for free the possibility to be presented online as food producers partners where consumers can find these products with a small subscription fee to remain in the catalogue and update their content.
2.27.2.2. Pricing of CYSLOP

EXAMPLE: We intend to calculate part of the subscription fee by the amount of soya produced complemented by basic price based on the number of sensors installed. For an average farm of 10 hectares we would install 100 sensors, accounting for monthly basis price of 200€. Additional we charge 50€ per Mt of soy produced in a year, which would be in average 20 Mt for an 10 ha farm, so 1000€.

2.27.2.3. Additional data revenue models

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.3. Distribution & marketing strategy

2.27.3.1. Distribution and sales channels for CYSLOP

The ITC Cluster (as a founder of DIH AGRIFOOD) will offer information materials based on CYSLOP demo implementations to Smart Farming Erasmus+, the Project Danube S3 Cluster members and other farmers of their network.

Additional sales are expected through external Irrigation experts / agronomists involved in the advisory activities, to promote the product and its services.

FINT will scale CYSLOP services in a privately funded programme with the Olenaia cooperative who own their own sensor equipment. FINT is exploring the potential of establishing an affiliate presence in Canada (distribution agreement or physical presence) UNRF will exploit the middleware mobile application development platform (D3.5) and the devices’ management integration. CYSLOP’s apps technical approach will be the basis for the mobile app development in GEOSTARS INTERREG GRCY programme.

CYSLOP’s idea is to incentivise data sharing of the data holders so that they get a competitive advantage (needs to be validated). By opening cultivation data and practices’ details to consumers, retail partners, local food businesses or else, trust, loyalty and perceived quality of their products may be increased.

Of course, this data-sharing is not solely an issue of providing the appropriate technical tools to do so but it also requires a certain change of business as usual that it will be even more impactful when shared across their stakeholders.

From FINT’s experience distribution is one of the trickiest part of our IoT solution commercialisation. Awareness should be created by our website, media channels and external platforms (FIWARE marketplace, IoT catalogues etc.) but it would be critical to build a network of professionals close to the agrifood market to promote our products.

2.27.3.2. Marketing strategy for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.27.4. Customer & end-user relations

2.27.4.1. End-customer relations & loyalty for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.4.2. Product support services for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.5. Partner network & horizontal activities

2.27.5.1. Partner network for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.5.2. Horizontal activities for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.6. Cost structure & internal resources

2.27.6.1. Cost structure for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.27.6.2. Internal resources for CYSLOP

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.28. UC5.1 – PIG FARM MANAGEMENT

The pig meat production sector is currently under a lot of public pressure to improve its animal health & welfare standards while production cost needs to be lowered. Especially pig farms that are investing in a better animal welfare need transparent ways to inform the end-consumer to justify the premium price and to stay competitive with conventional low standard pig farms.

This use-case develops a Pig Farming Business Intelligence tool that integrates the core information for slaughter pig production, both on farm and over the chain, including early warning, for improved management (reduce health problems, increase productivity, reduce boar taint) & efficiency.

A user-friendly dashboard presents real-time data from weighing scales, feed sensors, RFID tags and climate control sensors. This way the farmer can monitor the animal health as well as the technical performance (feed conversion) for a group of pigs in the barn.

An additional objective of the use-case is to reduce boar taint on the farm and processing level.

In a later stage the use-case will provide the pig monitoring even on an individual level and gives further opportunities of automation and individual treatments. This would further increase the animal welfare in pig production.

The monitoring solution clearly targets the pig farm level while the boar taint management also involves the processing industry level.

![Figure 152: UC5.1 - Value Chain Position](image)

2.28.1. Product Description & Value Proposition

2.28.1.1. Description of Smart Pig Production Tool

The use-case develops in the first instance a monitoring dashboard for a group of pigs that combines and integrates data from weighting scales, feeding systems, water systems and climate control. This allows a better adaptation of the feed mix and lower feed conversion rate.

The farmer receives warnings on animal welfare incidents that are spotted by reduced feed intake or an increased feed conversion ratio of a group of pigs.
In a second step the monitoring dashboard also supports the individual tracking of pigs via RFID tags. This allows the individual follow-up of eating and drinking behaviour and individual weight. This concept requires step-by-step a more advanced IoT equipment on the farm with feeding robots and individual medicine application. With data on an individual pig level the feeding can be automated and tailored to the demand of each individual pig. This would further increase the feed conversion and lead to fast and larger growth.

2.28.1.2. Value Proposition of Smart Pig Production Tool

The major advantage for the pig farmer is the early detection of problems, which offers the chance to resolve abnormalities and treat individual or groups of pigs timely. This will improve the feed conversion
2.28.2. Exploitation & Monetization

The first product release for the Smart Pig Production Tool is planned by mid-2019 and Evonik Porphyrio as a poultry service provider is entering with this product launch a completely new market. This is the reason why the company is very sensitive on giving too detailed information on their business model strategies even to the WP4 team. The general situation got even more clear as Evonik Porphyrio just recently announced its acquisition by Evonik in Germany in October 2018.

Furthermore, the use-case team was very busy with finding properly equipped test farm to validate and develop the solution further. Therefore, most part of the business model development for this use-case will fall into 2019.

2.28.2.1. Revenue Model of Smart Pig Production Tool

The envisioned revenue model is a yearly licence fee for farmers based on the activated modules and farm devices connected to the system. The system consists of one basic module on which all additional modules build up.

As the current situation on the farm is very diverse in terms of sensing equipment installed, it is very likely that in the first years of introducing the system the farmer will also be able to buy in customization and integration services.

However, the largest challenges are the following:

- Very low number of fully equipped pig farms that could make full use of the service right away
- Tendencies towards a vendor-lock-in by hardware manufacturers – Companies like Big Dutchman are developing own support services like the BigFarmNet

Therefore, WP4 tries to initiate a dialogue with the largest equipment manufacturer to pursue the same strategy as the farm machine manufacturers in UC1.4. The goal would be to implement a data exchange platform to transfer data from various machines to third-party services and return safely execute
commands by external services on the machines. The service providers would pay a fee for each data transfer which would equally be shared between the platform provider and the equipment manufacturers. This way the equipment manufacturers would profit from the digitization of pig farms and can still concentrate on their core competence of designing industry machines.

In order to meet the second challenge and to lower the barrier for pig farmers to install necessary IoT hardware like feeding intake sensors, weighing scales, ventilation systems and other sensors, WP4 plans to develop a pre-financing plan for different equipment modules. The goal is to offer the required hardware as a service together with the Smart Pig Production Tool in return for a higher monthly rate. This way the farmer could validate the system over a test period of 12 month and give back the hardware in case the software subscription is cancelled afterwards. This reduces the risk and barrier for the farmer to invest in equipment without knowing the actual effect of the software.

Figure 156: UC5.1 - Overview of equipment manufacturers and their digital services

2.28.2.2. Pricing of Smart Pig Production Tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.28.2.3. Additional data revenue model

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.28.3. Customers & End-user Relations

2.28.3.1. Distribution of Smart Pig Production Tool

Evonik Porphyrio is foreseen as the major distributor of the system. As Evonik Porphyrio is now part of the Evonik Group as part of the animal nutrition department. This takeover gives Evonik Porphyrio right away a global market reach through the Evonik distribution network.
Thanks to offices in more than 60 countries, Evonik ensures maximum responsiveness and service quality to potential customers and guarantees availability of their products and service to customers in over 100 countries.

A more detailed distribution plan for the Smart Pig Production Manager does not yet exist as the product itself is still under development. Currently, the product is developed for testing in five pig farmers in the Netherlands.

2.28.3.2. End-customer Relation of Smart Pig Production Tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.28.4. Partner Network & Horizontal Activities

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.28.5. Cost Structure & Internal Resources

2.28.5.1. Cost Structure of Smart Pig Production Tool

The major costs occur for the farmer mainly in the need for proper sensing equipment to make full use of service. The current price of a full hardware setup for a barn with 500 – 1000 pigs is estimated at 15.000€ – 25.000€. It consists of:

- Automatic feeding system
- Water system
- Ventilation system
- Scale 3-5k

The initial costs for the development of the service and the running costs for maintaining it are currently unclear and impossible to assess for WP4. However, the development of a similar system for poultry (with data integration, early warning, health etc.) took Porphyrio about 3 years. The pig system benefits partly from this existing system and the experience in its development, but the integration and algorithms are rather unique to pig farming and need developed from scratch.

2.28.5.2. Internal Resources for Smart Pig Production Tool

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.29. UC5.2 – POULTRY CHAIN MANAGEMENT

This use-case develops a set of smart monitoring solution for the poultry production. The development aim for the following 3 areas:

- Farm level – efficient growth, welfare
- Logistics – increase welfare and decrease loss of chickens
- Processing – Optimize process and better market value with traceability

The use-case develops solutions for the farm production, transport and the processing industry:

Figure 157: UC5.2 - Value Chain Position

2.29.1. Product Description & Value Proposition

2.29.1.1. Description of Poultry Growth & Health Manager

The Poultry Growth & Health Manager unites all data of weighting scales, climate control, feed and water consumption to present the farmer a full picture of the current growth stage and the health conditions of the poultry.

One component of this solution is sole dedicated towards the control of environmental conditions to assure the over animal welfare in the barn. It warns the farmer if conditions are out of the approved corridor and initiates if possible automatic countermeasures.
2.29.1.2. Description of Transport & Logistics Monitor

The Transport & Logistics Monitor tracks the loading process of the poultry by smart bands worn by the loaders. The system indicates inappropriate treatment and physical impact on the birds to the integrator, so that the procedure can be improved.

Furthermore, the transport monitor measures the temperature, humidity, acceleration and condition of the breathing air to issue alerts if the conditions get out of the acceptable corridor.
2.29.1.3. Description of Poultry Chain Manager

The last solution is a traceability tool that correlates data from different stages showing relevant influences among the production chain and presents a graphical interface showing the value chain data as well the correlation analytic results.

![Poultry Chain Manager Diagram]

**Poultry Chain Manager**
Value chain data aggregation

**Clients & Provider**
Integrators
Monthly Service Fee

**Major Challenge**
No opportunity to get all the data from the different stages of the value chain together to generate new knowledge.

**Core Product Modules**
- Production Management DSS – Considers all the data gathered through the whole poultry chain and extract their relation regarding to the impact in the final product.
- Data Visualization – Presents a graphical interface showing the value chain data as well the correlation analytic results.

**Here is what we aim to improve:**
- Reduce waste: $-10\%$
- Productivity increase: $+10\%$

These values derive from comparison of a standard farm's performance prior to the installation of our system and after.

**Figure 160: UC5.2 - Product Factsheet for Poultry Chain Manager**

2.29.1.4. Value proposition of all 3 services

The major benefit of all three solutions together is the clear increase animal welfare in each part of the value chain as well as the improved feed conversion leading to higher growth rates and a better flock uniformity. The uniformity is dependant of the environmental conditions. Different values of environmental conditions among the different zones of the farm can imply that the poultries eat more or less or “better”...

Now the feed control is made at whole farm level, but not zone by zone.

Farmers and integrators will experience a significant reduction in worktime, a better use of the feed and water resources, a more comfortable workflow and better predictability of the final weight results.
### 2.29.2. Exploitation & Monetization

#### 2.29.2.1. Revenue model for Poultry Growth & Health Manager

The Poultry Growth & Health Manager targets mainly the farmer as an end-customer improving the feed conversion and health situation. Therefore, the favoured revenue model is a software-as-a-service offer with regular payments and an initial setup fee to connect all relevant farm equipment.
However, the largest challenges are the following:

- Tendencies towards a vendor-lock-in by hardware manufacturers – Companies like Fancom are developing own support services like the FarmManager for Broilers

Therefore, WP4 tries to initiate a dialogue with the largest equipment manufacturer to pursue the same strategy as the farm machine manufacturers in UC1.4. The goal would be to implement a data exchange platform to transfer data from various machines to third-party services and return safely execute commands by external services on the machines. The service providers would pay a fee for each data transfer which would equally be share between the platform provider and the equipment manufacturers. This way the equipment manufacturers would profit from the digitization of poultry farms and can still concentrate on their core competence of designing industry machines.

In order to meet the second challenge and to lower the barrier for poultry farmers to install necessary IoT hardware like feeding machines, scales, ventilation systems and other sensors, WP4 plans to develop a pre-financing plan for different equipment modules. The goal is to offer the required hardware as a service together with the Poultry Growth & Health Manager in return for a higher monthly rate. This way the farmer could validate the system over a test period of 12 month and give back the hardware in case the software subscription is cancelled afterwards. This reduces the risk and barrier for the farmer to invest in equipment without knowing the actual effect of the software.

Figure 163: UC5.2 - Overview of equipment manufacturers and their digital services

2.29.2.2. Revenue model for Transport & Logistics Monitor + Poultry Chain Manager

On a meeting in July 2019, all companies in the consortia agreed in the business model. They were represented by Kristof Mertens, Toon Leroy (Evonik Porphyrio), Jesús Haro (Exafan), Robert De Dios (Grupo SADA), Elena Garcia, Izaskun Fernandez (Tekniker).

The business roles of the different companies represented in the telco were described as follows:

- Exafan: turnkey projects on farms, following a CAPEX business model with support services
- Evonik Porphyrio: software-as-a-service, following a OPEX business model
- Tekniker: IP generator, following a licensing business model
Two scenarios were identified & discussed, based on the type of customer that is considered:

1. **Customer is an integrator.** SADA would prefer 1 partner providing the complete service, with a monthly license fee (OPEX) instead of heavy investments (CAPEX). This means that Evonik Porphyrio or Exafan would be the prime partner for the complete service, since Tekniker is not a commercial entity. For both Evonik/Porphyrio and Exafan this role would be OK. The prime partner will then arrange collaborations with the other supplier(s). The IP transfer from Tekniker to the other supplier(s) will also be a bilateral discussion that will be transparent to the final customer.

2. **Customer is a farmer.** In this case, the current individual business models can be kept, with direct sales to the farmer. A similar collaboration between partners as for an integrator is still possible, but in the discussion, this was considered less likely.

The major end-customer of these 2 services is integrated poultry producers. On the second level, also food companies and supermarket chains can be a customer. They are interested to achieve a high level of transparency regarding quality and animal health towards the end-consumer and trustfully justify higher prices for quality meat.

Considering the industry characteristics of these customers and their need for a predictable cost development, UC5.2 favours a staggered yearly subscription agreement with certain numbers of loaders or transactions included. The integrator would pay a basic subscription fee plus a batch fee plus a one-time installation fee.

**2.29.2.3. Pricing for Poultry Growth & Health Manager**

After long discussions with the CEO of the companies in the consortia (Evonik/Porphyrio and IK4 Tekniker), due to confidentiality we cannot disclose any prices for the solution.

**2.29.2.4. Pricing for Transport & Logistics Monitor**

We are not allowed to disclose due to confidentiality.

**2.29.2.5. Pricing for Poultry Chain Manager**

We are not allowed to disclose due to confidentiality.

**2.29.2.6. Additional data revenue model**

No other data revenue model has been discussed or proposed for the solution.

**2.29.1. Distribution & marketing strategy**

**2.29.1.1. Distribution of all three services**

Evonik Porphyrio is foreseen as the major distributor of the system, with possible royalty payments to IK4-TEKNIKER. As Evonik Porphyrio is now part of the Evonik Group as part of the animal nutrition department. This takeover gives Evonik Porphyrio right away a global market reach through the Evonik distribution network. EXAFAN and SADA may also distribute the products but from IK4 Tekniker we should distinguish between the product offering.
2.29.1.2. End-customer relation for Poultry Growth & Health Manager

For the first product Evonik Porphyrio is the ideal distributor of the system, paying royalties to IK4-TEKNIKER and EXAFAN, because both of the companies provide information to Evonik/Porphyrio platform. IK4-TEKNIKER offers information coming from the wireless environment and climate control sensors and EXAFAN through the wired sensors (water, food, animal weight).

IK4-TEKNIKER, besides the sensor network offers a dashboard and a predictor of temperature, which could also be an extra module or add on component within Porphyrio.

Similarly, EXAFAN could also be a distributor of the solution by acquiring HW and SW from IK4-TEKNIKER, and Porphyrio’s platform. Though this model is a bit more difficult and requires a separate reseller agreement contract with Porphyrio.

EXAFAN has developed the capacity of offering the implementation of integral animal production projects. Projects including all the cycles requested by the client, from the fodder production point till the animal slaughterhouse.

2.29.1.3. Marketing strategy for all three services

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.29.2. Customer & end-user relations

2.29.2.1. End-customer relations & loyalty for Poultry Growth & Health Manager

For the first product Evonik Porphyrio is the ideal distributor of the system, paying royalties to IK4-TEKNIKER and EXAFAN, because both of the companies provide information to Evonik/Porphyrio platform. IK4-TEKNIKER offers information coming from the wireless environment and climate control sensors and EXAFAN through the wired sensors (water, food, animal weight).

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Similarly, EXAFAN could also be a distributor of the solution by acquiring HW and SW from IK4-TEKNIKER, and Porphyrio’s platform. Though this model is a bit more difficult and requires a separate reseller agreement contract with Porphyrio.

EXAFAN has developed the capacity of offering the implementation of integral animal production projects. Projects including all the cycles requested by the client, from the fodder production point till the animal slaughterhouse.

2.29.2.2. Product support services for Poultry Growth & Health Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.29.2.3. End-customer relation for Transport/Logistics Monitor + Poultry Chain Manager

For the two other solutions, and taking into consideration that IK4-TEKNIKER is the development provider, we need to find another distribution way due to the nature of the business. From WP4 we foresee EXAFAN would be the ideal distribution company. Sensors are coming from a HW provider therefore, EXAFAN could acquire HW and SW from IK4-TEKNIKER and offer it in its own company catalogue because Porphyrio is only a SW provider but not a HW one.
2.29.2.1. Product support services for Transport/Logistics Monitor + Poultry Chain Manager

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.29.3. Partner Network & Horizontal Activities

2.29.3.1. Partner network for all three services

In this use case the partner network refers to an integrator that will be able to offer the solution to the farmer. This case is still under discussion and will be explored in a near future.

Other partner networks include Feed mills, veterinarians, genetic companies, insurance companies, hardware companies, ERP providers and greenfield project consultancy services

2.29.3.2. Horizontal activities for all three services

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.29.4. Cost Structure & Internal Resources

2.29.4.1. Cost structure for all three services

I. Hardware
   a. Production of the hardware
   b. Including all facilities

II. Software
   a. Cloud infrastructure (AWS, Azure, Google etc.)
   b. Website hosting, Virtual Machines, Analytics services, tooling for data pipeline etc.

III. Internal
   a. Hardware
      i. Electrical engineers, designers, workers, software developers (embedded software)
   b. Software
      i. Bioscience engineers, data scientist, software developers (cloud software)

From the sensor’s perspective, IK4 Tekniker will charge a cost of development to the distribution/reseller of the final solution. Then HW development companies will pay a royalty/fee to IK4-Tekniker depicted in the following table. Final customer prices could not be disclosed.

Costs in the table below are referred to the sensor network as a kind of development platform in order that a third party could use it and provide with a monitoring dashboard of his will. This includes HW, driver and APIs.
<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost Detail</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>Hardware (license)</td>
<td>Hardware licensing per unit sold</td>
<td>10€/unit</td>
</tr>
<tr>
<td>Software</td>
<td>Optional platform libraries and communication stack</td>
<td>3.000 €</td>
</tr>
<tr>
<td>Software Maintenance license</td>
<td>Optional software libraries maintenance licensing per year</td>
<td>300 €/year</td>
</tr>
<tr>
<td>Technical services - Consultancy</td>
<td>Hardware reviews or software functionalities</td>
<td>€500/day</td>
</tr>
</tbody>
</table>

For the complete monitoring solution, we don’t need a third party, therefore internal costs for IP4-TEKNIKER are higher and also shown in the following table.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost Detail</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>Hardware (license)</td>
<td>Hardware licensing per unit sold</td>
<td>10€/unit</td>
</tr>
<tr>
<td>Software</td>
<td>Complete Monitoring Solution with Optional platform libraries and communication stack</td>
<td>10.000 €</td>
</tr>
<tr>
<td>Software Maintenance license</td>
<td>Monitoring Solution maintenance licensing per year with optional software libraries maintenance licensing per year</td>
<td>1.000 €/year</td>
</tr>
<tr>
<td>Technical services - Consultancy</td>
<td>Hardware reviews or software functionalities</td>
<td>€500/day</td>
</tr>
</tbody>
</table>

2.29.4.2. Internal resources for all three services

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.30. UC5.3 – EPCIS-BASED TRANSPARENCY SYSTEM

Despite all food crises in the last 25 years, eating food is safer than ever. Many of the crises were not only on food products that were ‘wrong’ in some sense, but also on inadequate communication. This is the case if you want to explain to your customer – a food consumer as all of us – that one of your food items is below your standard, but even more if you want to tell them that it is top quality. Today food is communication. Consumers want to know what they are eating. Is it healthy, safe, fresh, local? Is it produced at an organic farm in an animal friendly and sustainable way?

This use case aims at enabling to share information along the supply chain. A substantial part of transparency related data will be collected in the use case Optimise pig production management. EMTT will develop a connector that will store a part of the quality related data that is relevant for other supply chain partners in an EPCIS repository with the permission of the farmer where the data come from. These data include also data from sensors, gathered in the use case Optimise pig production management.

Further events i.e. slaughtering, processing, distributing and retailing, are captured along the supply chain. These include but are not restricted to monitored temperatures of meat products and traceability data, both at the various business steps, including transport.

Figure 164: UC5.3 - Value Chain Position

2.30.1. Product Description & Value Proposition

2.30.1.1. Description of Meat Information Transparency System

EPCIS is a well adopted standard to exchange traceability data between multiple partners in complex value chains worldwide. EECC’s EPCIS implementation EPCAT is one of the first solutions certified as EPCIS 1.1 compliant. EPCIS on the other hand is a generic traceability standard without domain specific functionality and business logic.

On top of the EPCIS repository, MITS is a traceability solution for the meat supply chain, which is expendable to other farming sectors. It contains several modules to support the domain specific business needs of livestock farming and meat production. Core functionalities are:
• Support to capture traceability and quality (sensor) information from different source systems to ease integration into existing IT infrastructure
• Combine and aggregate raw data into standardized and business relevant life cycle events
• Store and provide the event data with standardized interfaces and vocabulary
• Support business process monitoring and alerting to enable near-time quality control and management
• Dashboard to monitor business relevant KPIs derived from event data
• Evidence of origin and quality of products
• Enable data exchange between supply chain partners

The MITS solution represents a layer on top of existing farm management systems and sensor installations. It provides high-level management and quality information derived from low-level process events and sensor data, respectively. This enables farmers, slaughterhouses and cooperatives to actively manage quality and processes in near real time.

Figure 165: UC5.3 - Product Factsheet for Meat Information Transparency System

Figure 166: UC5.3 - Product Functionality of Meat Information Transparency System
The first implementation will provide a transparency and quality tool for the auditing at KDV of antibiotic-free meat. The system will connect to several pig farms of De Hoeve and a slaughterhouse from Westfort all near Utrecht and compile this data into KDV’s inhouse LeeO database system. The tool will have a dashboard to show auditors right away all information about the origin of the meat as well as quality KPIs (e.g. health and medication).

2.30.1.2. Value Proposition of Meat Information Transparency System

The major advantage for the production value chain is that the time for certification and verification procedures is significantly shortened. This results in less costs for all partners while gaining a more trustful and transparent dataset that proves to the end-consumer the premium value of a product.

<table>
<thead>
<tr>
<th>Without our Product or Service</th>
<th>With our Product or Service</th>
<th>Here is the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-time feedback on certification</td>
<td>Continuous feedback on certification</td>
<td>Timely feedback on certification status</td>
</tr>
<tr>
<td>farmers get feedback after an inspection</td>
<td>farmers get feedback regularly based on real-time data gathered</td>
<td></td>
</tr>
<tr>
<td>One-time extensive inspection</td>
<td>Surgical on-demand inspection</td>
<td>Reduce inspection cost</td>
</tr>
<tr>
<td>Coops inspect farmers extensively once or a few times a year</td>
<td>Real-time insight enables better planning of inspections; less inspection required</td>
<td></td>
</tr>
<tr>
<td>Proprietary transparency IT</td>
<td>Standard (EPCIS) transparency IT</td>
<td>Improve marketing (increase revenue)</td>
</tr>
<tr>
<td>Slaughterhouses implement proprietary transparency systems that are costly and difficult to extend</td>
<td>Farmers and slaughterhouses use standards- and cloud-based transparency system that is affordable and easy to incorporate new actors</td>
<td></td>
</tr>
</tbody>
</table>

Figure 167: UC5.3 - Benefits for Farmers, Slaughterhouses & COOPs

The end-consumer benefits from trustful and understandable quality labels that are backed with individual data of the food production and transport. The information is easily accessible for apps and consumer information systems so that the consumer can make more informed purchase decisions.

As the actual EPCIS system is running as an independent entity on top of the internal process and traceability systems of the integrator, the event information cannot be manipulated. This independence and trust level is the highest value for the end-consumer.
2.30.2. Exploitation & Monetization

2.30.2.1. Revenue model for Meat Information Transparency System

The current transparency and auditing service is planned as a white-label solution for meat integrators that are interested to prove the higher quality of specific meat products like antibiotic-free meat to retailers and end-consumers. Even so it is planned to position EECC as the main exploitation partner of the solution, it is more reasonable to create an independent maybe even non-profit body to ensure independence and objectivity in handling the sensitive data.

Every label or transparency system that is mainly reliable on payments by the objects of their monitoring are easily subject to fraud and mistrust. Therefore, it must be a system that is acting in major interest of the end-consumer and the local, national and regional societies. The funding should be balanced between the food industry reaching from farmer to processor and the end-consumer and retailer level that is interested to have full information about a food product at the point of purchase.

The business model needs to be based on equal revenue streams from consumer and production side. While at the industry payments for labels and monitoring institutions are already common, on the consumer level the involvement is not yet implemented.

One possible solution could be to implement together with leading supermarket chains and high-quality food processors a marginal price premium clearly communicated to the end-consumer for independent and objective food quality transparency. This premium would be collected by retailers and forwarded to the MITS platform. Furthermore, part of this money could back governmental subsidies for investments by farmers or processors in sensing technology. In order to push such an initiative into the market it would be a benefit to secure official support by national animal welfare and environmental protection programmes, however they are not crucial as the political influence is anyway limited and, in many cases, driven by certain agricultural and industry lobbies.
2.30.2.2. Pricing for Meat Information Transparency System

The system scales with the amount of process steps captured as EPCIS events. Pricing depends on the amount of EPCIS events stored for each customer or white label licensee. Prices for the different event volume packages apply every year. In addition, a one-time integration fee will be charged to cover the initial setup efforts. Consulting for e.g. system integration will be provided by EECC and can be charged separately. Customizations of the solution can be provided by EECC and will be charged with one-time costs for development and an additional annual fee for support & maintenance.

Yearly event package prices are currently under development and will be discussed in the next version of this evolutionary business model overview.

2.30.2.3. Additional data revenue model

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.30.3. Customers & End-user Relations

2.30.3.1. Distribution of Meat Information Transparency System

The consortium currently plans to exploit the solution through EECC and GS1 Germany. Customer target groups are cooperatives, brand owners and retailers.

2.30.3.2. End-customer relation for Meat Information Transparency System

2.30.4. Partner Network & Horizontal Activities

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.30.5. Cost Structure & Internal Resources

2.30.5.1. Cost structure for Meat Information Transparency System

Costs apply for hosting the PaaS solution, maintenance and support.

Specific costs are currently under investigation and will be discussed in the next version of this evolutionary business model overview.

2.30.5.2. Internal resources for Meat Information Transparency System

Resources for operation & maintenance (developers) and consulting & support (project managers) are necessary to provide and operate the solution.

The number of FTEs needed is currently under evaluation and will be discussed in the next version of this evolutionary business model overview.
2.31. UC5.4 – DECISION MAKING OPTIMIZATION IN BEEF SUPPLY CHAIN

The use case brings cooperation in beef supply chain to the next level. The beef supply chain is a very complex system, involving crops farms, livestock farms, feedlots, transporters, slaughterhouses, retailers, consumers, etc. Events occurring at farms have huge effects on industries, consumers (who demand more information) and other stakeholders.

Nowadays, traceability systems collect some data (normally by hand) from every segment of the supply chain, mainly to assure food safety to consumers. ShareBeef allow every segment of the supply chain to improve production efficiency, to make better market decisions, to be more informed about product quality due to data sharing.

This use case combines existing IoT solutions in the beef supply chain with new data collection and uses all this information and know-how to create new services both on the level of individual farms as well as on the level of supply chain information exchange. The use of low-cost sensors enables farmers to equip all animals with a sensor and carry out farm management on individual level, instead of on herd level.

First focus of product development will be on farm level, developing sensor-based services for crop farmers, who provide animal feed, cattle breeders and cattle fatteners. In a second stage, focus will be widened to include data exchange along the supply chain to improve decision-making, and certification of production conditions to consumers.

The following products will be developed on the farm level:

- Crop Monitoring Service for Crop Farmers.
- Animal Location and Monitoring Service for Cattle Breeders.
- Animal Weighing and Monitoring Service for Cattle Fatteners.

Regarding supply chain, the following products will be developed during the second stage of the project:

- Data Exchange for Decision-Making Service for Beef Supply Chain Stakeholders.
- Grazing and Welfare Certification Service for Retailers and Consumers.
2.31.1. Product description & value proposition

2.31.1.1. Description of Crop Monitoring Service

This product is based on the integration of data coming from weather stations and soil stations (at least one per farm) with data from satellite imagery (Sentinel 2). These data include temperature, humidity, rain, wind speed and direction, normalised difference vegetation index (NDVI), etc. The information is accessed by farmers through a user app, allowing them crop growth monitoring and the improvement of decision-making regarding irrigation, fertilization and optimum harvest time.

Figure 171: UC5.4 - Product Factsheet for Crop Monitoring Service

2.31.1.1. Description of Animal Location and Monitoring Service

The Animal Location and Monitoring Service enables cattle breeders having cows on grazing systems to be at the right place in the right time. It is especially suited for farmers with cattle in remote areas. The product is based on smart collars for cows (GPS + accelerometer + temperature probe) and Bluetooth tags for their calves. Smart collars allow farmers to easily locate animals and to detect key events such as calving and oestrus. Bluetooth tags are connected to smart collars, allowing farmers to know the location of the calf. The service reduces animal losses and can optimise reproductive performance (reduction of calving interval) by the early identification of non-pregnant cows.
2.31.1.1. Description of Animal Weighing and Monitoring Service

This product enables cattle fatteners to monitor animal growth as well as to early detect animal health and welfare problems. It is based on automatic scales placed at watering troughs, which electronically identifies (RFID) and weights animals every time they drink. The service provides decision support for sorting calves at the feedlot and for determining the optimal slaughter weight per animal. Moreover, drinking behaviour is used to automatically detect health and welfare problems. The service increases profit by detecting health issues on time and by avoiding non-productive animals to stay longer at the feedlot.
2.31.1.1. Description of Data Exchange for Decision-Making Service

This product will be developed during the second stage of the project. It consists of a data platform where different stakeholders (crop farmers, cattle breeders and fatteners, and slaughterhouses) can share their data in order to improve decision-making of every step of the supply chain. These data can be gathered by sensors (those described above and others) or manually recorded. Platform design is flexible, allowing the establishment of bilateral or multilateral agreements among stakeholders. They can decide which data they want to share and which data they ask for in return. For example, cattle breeders can share calf birth dates with feedlots, which can use these data to optimise animal entry calendars. In return, feedlots can provide individual growth rates to farmers, who can use these data to make genetic selection decisions on their farms. The service optimises production efficiency and increases profit, allowing stakeholders to make more informed decisions by considering the whole supply chain.

2.31.1.2. Description of Grazing and Welfare Certification Service

The Grazing and Welfare Certification Service will be developed during the second stage of the project. It enables retailers and consumers to have access to key information about beef production processes. It consists of a mobile app where data about grass-fed production and animal welfare along the whole supply chain (farm, feedlot, transportation and slaughterhouse) are available. These data are objective, as they are gathered by sensors, and secured by blockchain technology. The overall goal behind this product is to have better informed consumers, who value high-quality beef products and make more informed purchase decisions.

2.31.1.1. Value proposition of Crop Monitoring Service

The major benefit of this service for crop farmers is remote and real-time monitoring of crop growth and status, as well as environmental conditions. That enables farmers to make adequate decisions in order to maximise resource efficiency, e.g. fertiliser and water, reducing costs and environmental footprint. The information provided by the product can also be used to identify optimum harvest time, which can positively affect crop feeding value.

![Figure 174: UC5.4 - Benefits for Crop Farmers](image-url)

<table>
<thead>
<tr>
<th>Without ShareBeef</th>
<th>With ShareBeef</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limited knowledge of crop status and growth</strong>&lt;br&gt;Crop status is determined visually (only as far as the eye can see)</td>
<td><strong>Real-time information about crop status, including</strong>&lt;br&gt;Heterogeneity inside every parcel&lt;br&gt;Remote imagery allows having data of crop status every 5-10 days for each plot of 10 m x 10 m</td>
</tr>
<tr>
<td><strong>Fertiliser and water usage based on previous experience</strong>&lt;br&gt;No information about crop needs</td>
<td><strong>Fertiliser and water usage depending on current crop status and environmental conditions</strong>&lt;br&gt;Optimisation of production resources, reducing cost and environmental impact</td>
</tr>
<tr>
<td><strong>Harvest time based on previous experience and visual inspection</strong></td>
<td><strong>Harvest time optimised</strong>&lt;br&gt;Based on current crop status and available biomass determined from remote imagery</td>
</tr>
</tbody>
</table>

*Target User – All size of crop farms*
2.31.1.1. Value proposition of Animal Location and Monitoring Service

The major benefit of this product for cattle farmers is the time reduction and improved accurateness of monitoring animal location and status. Thanks to the alert system, the farmer is enabled to intervene when needed, e.g. if an animal has crossed farm borders or if a cow is calving. That is important in order to avoid animal losses. Moreover, the product provides information about cow oestrus, which allow the farmer to early identify non-pregnant cows, taking corrective actions when necessary and ultimately optimising calving intervals. This service is especially suitable for large cattle farms in mountainous or remote areas.

![Figure 175: UC5.4 - Benefits for Cattle Breeders](image)

2.31.1.1. Value proposition of Animal Weighing and Monitoring Service

The major benefit of this product for cattle fatteners is the real-time monitoring of individual calf weight during the fattening process, which enables them to improve decision-making in order to reduce costs. For example, the identification of those animals with the lowest growth rates can lead to new feeding strategies, to the modification of slaughtering weights, etc. Additionally, this service includes the early identification of some health and welfare problems, enabling the farmer to take corrective actions, which can lead to a reduction of animal losses.
2.31.1.2. Value proposition of Data Exchange for Decision-Making Service

This product will be developed in the second stage. It enables the different stakeholders participating in the beef supply chain to access production data of other stakeholders in order to improve their decision-making. Having a real-time insight of the supply chain can be especially useful to forecast resource availability (feed, calves, etc) and to adjust supply and demand, optimising costs and revenues.

2.31.1.1. Value proposition of Grazing and Welfare Certification Service

This product will be developed in the second stage. Its major benefit for retailers and end-consumers is to have access to detailed data about beef production, enabling them to make informed purchasing decisions. The Grazing and Welfare Certification Service goes beyond current traceability systems, offering consumers precise and individualised information about two of their major concerns: type of feeding system (grass-fed meat) and animal welfare conditions. In order to ensure the truthfulness of this sensitive information, data are gathered mainly by sensors (objective measurements) and blockchain technology is used.

2.31.2. Exploitation & monetization

2.31.2.1. Revenue model for Crop Monitoring Service

The revenue model for the Crop Monitoring Service will be based on the current revenue model of Agricolus, which is a subscription-based model. The amount depends on the number of hectares, the level of subscription and the optional features selected by the customer. Payment is annual and upfront. Hardware components (weather and soil stations) are paid once, at the time of purchase. It is also possible to rent these components. In that case, the upfront payment of an annual fee is required. Weather and soil stations can also be pre-existing, and therefore owned by the farmer.
2.31.2.2. Pricing of Crop Monitoring Service

Prices will not be differentiated by geographical area. As a preliminary idea, the cost for the different service packages will be:

- Agricolus Free, the basic version, is free up to ten hectares.
- Agricolus Essential costs 249 €.
- Agricolus Plus costs 645 €, plus an additional fee per hectare.

Additionally, it is possible to add optional features like mobile apps, modules for specific crops, etc.

2.31.2.1. Revenue model for Animal Location and Monitoring Service

For the Animal Location and Monitoring Service, ShareBeef has planned the combination of a one-time payment for the IoT devices and a subscription fee. Depending on the number and type of IoT devices (collars and/or tags) the price will be different. ShareBeef will also explore the option of offering the solution as a service, either as renting or leasing. As an additional service, ShareBeef has planned to offer its customers an app for the technical-economic management of livestock farms for free.

2.31.2.1. Pricing of Animal Location and Monitoring Service

This service is based on smart collars and Bluetooth tags. The price for smart collars ranges from 36€ to 150 €, depending on the number of units and the subscription model. In the case of eartags, prices range from 5€ to 20€. The subscription fee per animal per year may range from 15 € to 50 € depending on the number and type of IoT sensors. Special pricing packages will be developed for different geographical markets (Europe, LATAM, etc).

2.31.2.1. Revenue model for Animal Weighing and Monitoring Service

In the case of the customer owning the weighing system, there is an initial payment of around (3000-4000€) and a fee of 0.49 €/animal/month. On the other hand, for the all-included service, the price ranges from 1 € to 4 € per animal per month depending on the number of animals and the type of service. ShareBeef plans to offer different payment methods depending on the type of market.

2.31.2.1. Pricing of Animal Weighing and Monitoring Service

In the case of the customer owning the weighing system, there is an initial payment of around (3000-4000€) and a fee of 0.49 €/animal/month. On the other hand, for the all-included service, the price ranges from 1 € to 4 € per animal per month depending on the number of animals and the type of service. ShareBeef plans to offer different payment methods depending on the type of market.

2.31.2.1. Revenue model for Data Exchange for Decision-Making Service

By the moment, there is no revenue model defined for data brokering. This will be defined in the coming year. In general, users shall define the type of data they want to share and the stakeholders that will have access to those data. They will also define the type of data they want in return by establishing bilateral or multilateral agreements. All users will pay a fee for using the data sharing platform. ShareBeef will explore the possibilities of allowing data users that do not share their own data. In that case, data producers could establish a payment for their data, which will be managed through the platform.

2.31.2.1. Pricing of Data Exchange for Decision-Making Service

Initially, to use it as a marketing channel, we do not charge any fee to the users of the data exchange service. For the future, the stakeholders will pay an annual fee to be determined in the coming year (depending on the data usage) to be able to use the data sharing platform.
2.31.2.1. Revenue model for Grazing and Welfare Certification Service

This product will be offered as a premium service to farmer associations, cooperatives, slaughterhouses, etc, in the case they comprise several stakeholders using ShareBeef IoT solutions. Through this service, they can provide their customers improved traceability data in order to increased consumer satisfaction, to obtain a better price for their products, etc. As a first idea, there will be two service levels:

- Complete: data available in the platform allow the certification of grazing and animal welfare along the whole supply chain.
- Partial: data availability allows the certification of only grazing or welfare, and/or only certain steps of the supply chain.

2.31.2.2. Pricing of Grazing and Welfare Certification Service

The customers of this service (cooperatives, farmer associations, etc) will pay an annual fee of depending on the number of access from the customers to the data stored in the platform. Free plans will be also defined to promote the use of the service.

2.31.2.3. Additional data revenue models

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.31.3. Distribution & marketing strategy

2.31.3.1. Distribution and sales channels for all products

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.31.3.2. Marketing strategy for all products

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.31.4. Customer & end-user relations

2.31.4.1. End-customer relations & loyalty for all products

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*

2.31.4.2. Product support services for all products

*Currently under development and will be discussed in the next version of this evolutionary business model overview.*
2.31.5. Partner network & horizontal activities

2.31.5.1. Partner network for all products

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.31.5.2. Horizontal activities for all products

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.31.6. Cost structure & internal resources

2.31.6.1. Cost structure for all products

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.31.6.2. Internal resources for all products

Currently under development and will be discussed in the next version of this evolutionary business model overview.
2.32. UC5.5 – FEED SUPPLY CHAIN MANAGEMENT

The IOFeed project aims at optimize the animal feed supply chain for global leaders and farmers by developing a cutting-edge integral feedstock management system. It entails the implementation of a ground-breaking 3D camera technology to monitor the stock levels in the farms' silos, integrated with a Smart Feed Logistics Platform (SFLP) that will make use of leveraging IoT technologies as, Big Data, Artificial Intelligence (AI), and Cloud Storage to optimise the animal feed supply chain, benefiting both farmers and suppliers.

2.32.1. Product description & value proposition

2.32.1.1. Description of Silo Remote Monitoring Device

The **Silo remote monitoring device** is an easy-to-install, solar-power-driven device to accurately measure the feedstock in silos at a farm. By making a three-dimensional depth map of the silo content it can measure volumes even when the feed is not equally distributed in the silo.

2.32.1.2. Value proposition of Silo Remote Monitoring Device

The core value for **farmers** and **feed suppliers** is:
- Much more stable device / hardware; survives the Northern European winters
- Density value of feed can be determined.
- Is needed to calculate the kg once you have the volume.
- Farmers want the kg
- Logistic system is based on kg.
- Truck transporters are also interested in volume but now they work mostly with kg

2.32.1.3. Value proposition of Smart Feed Logistics Platform

The **smart feed logistics platform** can optimise the animal feed supply chain in a way that farmers will not be out of feed stock, trucks can always unload the feed when they arrive at the farm. Raw feed purchased, mixed feed production and feed delivery routes can be optimised. Furthermore, farmers can get accurate information about the feed consumption of their animals.

2.32.2. Exploitation & monetization

2.32.2.1. Revenue model for Silo Remote Monitoring Device + Platform

The Silo remote monitoring device and the smart feed logistics platform are sold in one package. There are many revenues as is described at the "value proposition sections“ above. More optimal procurement, mixed feed production, less wasted truck kilometers and wasted feed (when trucks
cannot unload).

A few feed suppliers have agreed to the pricing.
20% higher price possible in UK (they have better margins)
One example in the UK of a farmer living more than 400 km away

Not a good model to sell directly to farmers; too complex

The actual revenues from sales are described in the next paragraph

2.32.2.2. Pricing of Silo Remote Monitoring Device

Two purchasing modes for the package of monitoring and services exist:
   1. Purchase mode: 380-450 euro / device + 6-9 euro / month / silo for the service

Renting mode: 15-20 euro / month / silo

2.32.2.1. Pricing of Smart Feed Logistics Platform

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.32.2.2. Additional data revenue models

Data is gather after informed consent from farmers. The ownership of data stays with the feed company. Insylo has access rights, but no right to resell data.

2.32.3. Distribution & marketing strategy

2.32.3.1. Distribution and sales channels for Silo Remote Monitoring Device + Platform

The company tries to become more known at potential customers by:
   • Visiting trade shows
   • Advertising in magazines
   • Participating in startup promotion activities (recently elected in: InvestHorizon Accelerator LoS
   • Approaching the big feed companies in Europe
   • Involving private investors that have an interesting network (e.g. in South America)

Company approaches directly the big feed companies in Europe, to do a pilot.
To establish the return on investment in a pilot
Some basic payment asked for the pilot
Now 7 large pilots with in total 1000 silos
Pilots in spain are advanced; started earlier
In the Uk more recently

Own team installs the devices now. They think about how to upscale.

Three options:
   • First option: an own team in house for Europe region (next 6 months)
   • Second option: installation of devices through dealers
   • Third option: instruct people at feed supplier companies in a way that they can install the
2.32.3.2. Marketing strategy for Silo Remote Monitoring Device + Platform

Insylo is lucky that the potential competitors did not scale up. They face a lack of reliability and low accuracy. High deployment.

2.32.4. Customer & end-user relations

2.32.4.1. End-customer relations & loyalty for Silo Remote Monitoring Device

Farmers:
- Trying before buying (pilots)
- Sensors maintenance
- Information provider

2.32.4.1. End-customer relations & loyalty for Smart Feed Logistics Platform

Feed supplier:
- Trying before buying (pilots)
- Smart Logistics Platform Integration
- Silos connectivity

2.32.4.2. Product support services for Silo Remote Monitoring Device

Currently under development and will be discussed in the next version of this evolutionary business model overview.

2.32.5. Partner network & horizontal activities

2.32.5.1. Partner network for Silo Remote Monitoring Device + Platform

We produce devices ourselves (few hundreds we can do now); we have to scale up to 500 units. That’s where we need the extra money for. Working manufacturing and pilot costs. Manage the cash flow.

Already found some investors. But are looking for a few more. We can connect to Pymwymi

Renting model □ capex investment needed

One or two experienced funders needed. Preferrably with a network in agriculture, and interested in scaling

Person interested is Canadian who lived most of his life in Brasil. Helps now to contact the big companies in South America.
2.32.5.2. Horizontal activities for Silo Remote Monitoring Device + Platform

Besides extending the partner network as mentioned in 7.1 this use case also managed to get in the InvestHorizon Accelerator LoS programme. In this programme they will learn from other companies and will be coached on how to scale up the company in the right way.

2.32.6. Cost structure & internal resources

2.32.6.1. Cost structure for Silo Remote Monitoring Device

The costs of the device includes the manufacturing and installation. IPR protection, marketing.

2.32.6.2. Internal resources for Silo Remote Monitoring Device

There is no urgent issue with respect to the human resources. Many things (such as installing devices) can be executed through the partners.

There is however a need for fast upscaling in the market (before competitors enter the market) and there is a lot of financial resources needed for this. Therefore, additional investors are sought for this.

2.32.6.1. Cost structure for Smart Feed Logistics Platform

- Development of new features for logistics
- Validation of IoT supply

2.32.6.1. Internal resources for Silo Remote Monitoring Device

This part is executed by Insylo in collaboration with the Universitat Oberta de Catalunya.
2.33. UC5.6 – INTEROPERABLE PIG TRACKING

This use case works on solutions to put more attention to individual animal that is now possible by the use of IoT sensors, sending online information to farmers. Pig production has gained a substantial efficiency over the last couple of decades. Technological development and genetic progress have resulted in more piglets produced per sow and year than ever. Efficiency of production flows in buildings by structered and planned operation has increased. This has resulted in considerable improvements in work efficiency, allowing farms to be operated at larger scale without losing efficiency. However, there is a public and societal concern on animal welfare in large scale operations due to the perceived lack of attention of the individual animal. For the producer, in this competitive branch of agriculture, unnecessary losses can be the difference between profit and financial losses and thus the risk of being forced out of production. With automated alerts, farmers can respond quicker to events that require action. The advantage of the use of sensors, is that the animals are monitored around the clock and not only during short sessions during mainly daytime. Further information from such systems can be used to assess production management in the short and long term. Such approach is suggested to improve animal welfare and reduce the use of antibiotics together with improving efficiency.

2.33.1. Product description & value proposition

2.33.1.1. Description of Ear Tag Sensor

The **Ear Tag Sensor** aims at monitoring heart rate with a sensor located on the ear. This technology has already been validated on humans. In this use case the photoplethysmographic (PPG) sensor will be adapted to use as an ear tag for pigs to monitor physiological parameters and detect abnormal activity and health issues.

2.33.1.1. Description of Smart Spot

The **Smart Spot** entails a gateway platform allowing LoRa, WiFi and GPRS communication as well as the Interoperability & Data Management layer. It offers an integral solution for the management of pigs on the farm, farmer interaction, scalable maintenance and sustainable sensing & monitoring capabilities.

2.33.1.2. Value proposition of Ear Tag Sensor

The core value for **pig farmers** is to improve sow farrowing results, reduce sickness detection time and improve health and well-being of the animals.

2.33.1.1. Value proposition of Smart Spot

The core value of the **smart spot** has to be considered in combination with the Ear Tag Sensor. The smart spot combines the ear tag information with context information to detect farrowing and health problems with accuracy. Context-based decision making results in alarms, farrowing prediction figures, and improved illness detection times resulting in improved health and well-being of the animals.

2.33.2. Exploitation & monetization

2.33.2.1. Revenue model for Ear Tag Sensor

The Ear Tag Sensors - will probably be sold per unit. DigitAnimal will be responsible for the business
2.33.2.2. Pricing of Ear Tag Sensor

Now they are testing the robustness of the ear tags with pigs. They don’t want the pigs to die from eating batteries. The test is done with empty ear tags (without batteries)

- The starting price is 48 € (applying 20% to the price of manufacturing costs). The devices have a battery that IoT devices delivery. Pay per unit and its corresponding maintenance
- The devices have no maintenance and are sold in batches.
- The price per unit is 20 €. The cost price would be drastically reduced scalable to 10000 ear tags.

2.33.2.1. Revenue model for Smart Spot

The Smart Spot Gateway is sold in units along with a batch of ear tags. Pay per unit and its corresponding maintenance

2.33.2.2. Pricing of Smart Spot

- The price per unit is 500€ (applying 20%)
- But there is an annual maintenance fee which includes support such as: Software/Firmware Updates, Protocol versions upgrades, Security Update, includes support for the installation (not person/physical installation)
- The price of the app is 1 euro per tag per year

2.33.2.3. Additional data revenue models

- From our clients to part of the economic resources, we (DigitAnimal) extract the advantage of advertising. These resources give us great value in terms of notoriety, contact with new customers, new market segments, etc..
- Other additional or alternative that we receive are: access to features, services, new data to analyses, etc.

2.33.3. Distribution & marketing strategy

2.33.3.1. Distribution and sales channels for Ear Tag Sensor + Smart Spot

The distribution and commercialisation will be done by DigitAnimal.

The principal goal is to find large farmers distributors which offer technological solution to farms

Several methods have been planned to distribute the product:

- Partnerships to reach a large market and distribution such as El Pozo or Cefu, S.A.
- Direct sales
- Partnership with large distributors of Smart solution in farmers such as Exafan or Eurogan
- Visibility and dissemination
- Dissemination in events such as Sol & Agrifood Italy (April 2019) and FIWARE Global Summit (2019)
2.33.3.2. Marketing strategy for Ear Tag Sensor + Smart Spot

In this case, there are many alternatives, being three potential alternatives:

- Divide the price for the whole solution per month in order to avoid that the farmer disburses the total annual costs. For instance, if there are a farm with 10 rooms and 200 pigs and it is needed 10 gateways, 200 ear tags and a platform subscription to manage the information provided by sensors, and the price (if not real) is 6,000 €. Although it is the same to pay 6,000 € in one time as 500€ month by month for a year. The fact is that farmer will have the feeling that is cheaper (it is a marketing strategy). Also, it is better because of if there are potential farmer who can afford to pay 6,000 € at the beginning but are interested in this solution, there will be a bigger client portfolio.

- The other strategy might be sold the whole solution and the client have to pay before to use the solution.

- For big farms the strategy of charging an annual fee per animal per year can be followed (To be determined from what volume of animals is profitable, offering a rate between 20-30 €.

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2.33.4. Customer & end-user relations

2.33.4.1. End-customer relations & loyalty for Ear Tag Sensor + Smart Spot

Apart from offering a product to the client, we also offer a personalized treatment depending on the needs of each client. It is offered to them:

- Physical support
- Phone and mail support will be available to any organization which deploy this solution
- Physical support
- Bag of hours

It is necessary to inform farmers and veterinarians of the advantages of using this product, as well as to participate in an educational process to learn to use and manage by themselves this solution. As we have planned a pilot test in Sweden, with these results we will be able to draw conclusions and show them to future customers to exhibit the product.

2.33.4.2. Product support services for Ear Tag Sensor + Smart Spot

Currently under development and will be discussed in the next version of this evolutionary business model overview.

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2.33.5. Partner network & horizontal activities

2.33.5.1. Partner network for Ear Tag Sensor + Smart Spot

Distribution and marketing partners:

- EXAFAN is a world leading firm in the development of automated systems for the poultry sector with presence in more than 72 countries. This enterprises has more than 10,000 customer. Also, EXAFAN has a proper market position with present all over the world, capable of providing consulting services and give the most convenient solution for each requirement.
• EUROGAN S.L. founded in 1964, is an entirely Spanish company, which with more than 50 years of experience has established itself as a benchmark of quality in the sector of equipment for livestock facilities. EUROGAN is the leading company in turnkey solutions. EUROGAN carry out all types of livestock projects: updating, transformation, renovation, etc, in all types of poultry and pig farms.

Technology partners:
The key technological partners in the use case are HOP Ubiquitous and Swiss Centre for Electronics and Microtechnology.
• HOPU: provides the gateway platform as well as the Interoperability and Data Management layer.
• CSEM: designs the ear tag to take the data from the pigs.

Data exchange partners:
HOPU: is being the company in charge of collecting and processing the data. It is in charge of the exchange of data. The platform use for this is FIWARE, is an open-source standard. This platform provides a fairly simple and powerful set of APIs. Standard APIs for data management and exchange, as well as harmonised data models.

Other partners:
SLU: The partner will carry out studies on the farm test bed and collect data on animal and farm activities. It will coordinate actions between the partners and the farmer hosting the test bed. It will provide the information needed to the other partners to develop algorithms by on farm recordings of animal activities, health and performance.

2.33.5.2. Horizontal activities for Ear Tag Sensor + Smart Spot

Farmers
• Participation in events to publicize the product
• Get to know the first impressions of the farmers

Planning
• Pig producers day – poster at exhibition possible
• Alnarp Conference – short presentation or poster “Sensors and digitalization of pig production – FitPig - a new system”
• Alnarp Pig production day (academic-industry outreach day) – oral presentation, panel discussion (Preiliminary date)
• Also possible to invite to an event for pig farmers where technology is presented and discussed (any time from February 2020) – we need about 2 months of data collection and processing in order to prepare material for such event

Veterinarians
• Meeting with the veterinarian to define the process of placing the ear tags to baby pigs and pregnant mothers

Planning
• Own activity – oral presentation for invited veterinarians, “Use case of Fitpig sensor and data flow – possibilities and future), presentation with farmer and researchers)
• Own activity oral presentation for invited veterinarians, “follow up on the use of the Fitpig sensor – detection of health issues and effects on herd and workflow”
• (likely dates) Swedish Veterinary congress – exhibition – poster, suggesting oral presentation “Benefits of early detection of peri-partial syndrome in sows”
2.33.6. Cost structure & internal resources

2.33.6.1. Cost structure for Ear Tag Sensor + Smart Spot

The ear tag is still under development. The sales price is now estimated to be 20 euro, but large-scale advantages are expected that can drastically reduce the price.

2.33.6.2. Internal resources for Ear Tag Sensor + Smart Spot

The skills & profiles needed:

- Someone focused on the design of the software architecture for constrained devices security and backend integration
- How many of these resources do you need? One or two software developers
- How much does it cost to employ those resources (3,000 euros/months for a software developer)
3. CONCLUSIONS

3.1. LESSONS LEARNT

3.1.1. Use case support lessons learnt

3.1.1.1. Limited business model validation and economic ambition from research cases

The IoF2020 business model experts experienced quite some difficulties to develop use cases like UC4.2 and UC2.3 that are dominated by a university or research institute as key exploitation partner. Here the progress classification shows that these use-cases show a clear limitation in the business structures and revenue models for the exploitation of their services. For any further open calls that aim for use cases with a clear go-to-market ambition, we suggest to select consortia with a private company in the lead that will exploit the final results and that has a clear business model for it.

Nonetheless, research institutes and universities are crucial hubs for knowledge exchange and matchmaking of innovation sources that provide great inputs for the product development. Furthermore, the market insights and stakeholder knowledge help to validate the value proposition of smart services in the first place before entering the product development.

3.1.1.2. Use cases create significant synergetic effects in product development & market entry

The matchmaking and exchange of IoF2020 partners within the scope of the project created tangible collaborations in the fields of joint product development and go-to-market activities like farm demonstration and presence at industry fairs. Now that most use cases have presentable products or services, the product support intensifies now the matchmaking activities also outside of IoF2020.

Concrete actions are matchmaking with companies outside of IoF2020 to complement the offers of our use-cases. One first initiative here was the matching of the trailer Belgian manufacturer Lambrecht and the Spanish silo sensor system provider Insylo with the US startup Indigo. The connection of a digital platform with a digital supply management and decentralized transportation services has disruptive potentials.

Furthermore, the business support defined the market entry as key support objective for 2020. Therefore, our team creates now a list of potential synergetic distribution partners and plans to invite use-cases to matchmaking events.

3.1.1.3. Business support misses clear economic objectives and consequences

Other than the description in the project proposal, the IoF2020 project steering group decided to apply a rather pulling then pushing support approach towards the business model development of the use-cases. Therefore, the business support has only very limited impact on the business orientation of some use-cases. If the achievement of clear business model milestones would be connected to interim payments, the project would have a more active role in steering the use cases to economic exploitation.

Furthermore, it was quite a challenge to build up trust with use-cases to share knowledge and insights with new business model experts who joined for the improved support of 33 use-cases. As a first step it helped to arrange intensive one-on-one calls with new business models experts accompanied by already known experts in order to do a proper introduction and assure the use-cases of confidentiality agreements und which all partners of IoF2020 fall to not disclose any sensitive information classified by the use-case as such. Furthermore, the excellent support by the highly qualified experts of the IoF2020 business support team that delivered practical and innovative ideas for commercialization, product design or got market planning convinced the use-cases of the relevance of the support.
3.1.2. Ecosystem lessons learnt

3.1.2.1. Limited availability of professional product validation through test farms

The IoF2020 use cases invested a significant amount of time and effort on the identification and securing of test farms in different locations to receive proper product development feedback. While most test farms were only bound by in-kind benefits or the pure pioneering interest, the feedback on the product usability and features was specifically in times of harvest slower than expected by the service provider.

Furthermore, the professional measurement of KPIs was in many cases impossible as test farms did not have historical baseline data available or simply lacked necessary equipment. IoF2020 tackled many on these issues by equipment implementations and the creation first data pools on test farms. The network of IoF2020 test sites grew over the past 3 years to now 140+ farms, which is an excellent infrastructure that should be sustained for further generations of smart services.

Therefore, the business support team worked out a business model for a self-sustainable European Digital Test Farm Network that unites different test farm infrastructures from IoF2020 with test farms of corporates, universities and other projects like NEFERTITI or the test farm project of EIT Food in Poland.

3.1.2.2. Lack of engagement of larger and medium-sized corporates in innovation services for startups

The business support team identified an underrepresentation of corporates active in IoF2020 in the innovation acceleration ecosystem. At the same time many corporates indicated interest in sourcing innovative complementary products or services for their own product portfolio or to identify services that can help to transform their own business models.

In order to support this ambition to invest capital in the innovation sourcing and acceleration, the business support started monitoring the existing ecosystem in order to identify active partners in Europe and underserved topics. The market analysis was performed by using a machine-learning driven data platform called DataScouts. The aim is to motivate at least 2 acceleration or innovation initiatives set up by IoF2020 partners in 2020.

3.2. NEXT STEPS IN 2020

The focus for the last year of IoF2020 is for the business support on bringing as many services and products out to the market as possible. Second objective is to further work on the validation of key performance indicators of the use cases and to arrive at a proper overview of the actual IoT impact. Third objective is to turn part of the IoF2020 infrastructure into a sustainable test farm network and to ignite the establishment of further corporate innovation programmes based on an acceleration of a service approach. Next to these core objectives, our team will work on the preparation of a proper knowledge transfer to other stakeholders like digital innovation hubs and accelerators.

The business support will also further elaborate in the final version of this evolutionary document on the business models development of the 14 open call use-cases and complement some missing details for the old IoF2020 use cases.
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