# Smart Farming

A special about Dutch initiatives & innovations

From agriculture to livestock and aquaculture:

## Smart Farming holds the key to a sustainable and future proof sector

Netherlands

‘Smart Farming made me become a farmer again’

# Floating Farm

One of the best-known and most eye-catching Dutch initiatives in Smart Farming is the Floating Farm in Rotterdam. Here, in the heart of the city, healthy food is produced close to the consumer. Important goals of the Floating Farm are reducing food waste and food transportation, improving food quality, animal welfare, circularity, sustainability and innovation. The farm is maintained by two farmers and three types of robots: milkers, feeders, and poop scoopers.

A large part of the cows' diet consists of organic waste streams from the city. For example, the cows are fed brewers' grains from a number of Rotterdam breweries, bran from Schiedam mills, grass from sports fields in the neighborhood and potato peels from a local processor.

# In this issue


## Farming even smarter

**How can technologies change the way we farm? And what is the role of farmers?**


## The Dutch Diamond

**The Netherlands is gearing up to take the lead in the formation of international partnerships.**


## The farmer's view

**"Every day I enjoy the opportunities Smart Farming offers."**



# Accelerating Smart Farming together

The recent COVID pandemic has stressed the need for food security and nutritious foods. At the same time we need to look for ways to make farming both more climate-resilient and climate-friendly, while achieving sufficient yields.

Smart Farming addresses precisely this - reducing the environmental and climate impact of agricultural activity on the one hand and enable farmers to give crops, livestock and the agro-ecological environment the right treatment at the right time using the latest technology.

By working together and investing in knowledge development and innovation, a major contribution can be made to solve societal issues related to the Agri & Food sector both in the Netherlands and abroad. This Topsector approach allows the Netherlands to remain a global leader in the development of smart and efficient solutions.

I am thrilled to join forces with FME, the association of the technology industry in the Netherlands, on this Smart Farming special, including an annex with technology providers. It gives an impression HOW we stimulate and operate the transition to smart agriculture in open field agriculture, livestock and aquaculture in the Netherlands.

This special aims to give more insight from a farmer, technology provider and Dutch Diamond perspective. It is clear that this is often not a case of 'plug and play'. Initiatives like "National FieldLab Precision Agriculture, and Farm of the Future in Lelystad aim to help farmers and growers in the Netherlands with the application of techniques.

We hope this special will inspire and reach out to other actors in the field of Agri & Food worldwide that are working on this same transition. We like to thank all the many people that contributed to this edition.

**Willemien van Asselt**
Dir. Int. Strategy
Topsector Agri&Food

**Leo den Hartog**
Boardmember
Topteam Agri & Food

# Making Smart Farming even smarter

**What is Smart Farming?**
From agriculture to livestock farming and aquaculture. Smart Farming is a very broad concept. In this special edition, we zoom in on technological solutions and innovations from the Netherlands in three sectors. We identified four key technologies, in which Dutch companies, farmers and knowledge institutes are taking a lead and use these technologies to work towards more sustainable food systems and production: Internet of Things, Big Data, Artificial Intelligence and Robotics.

In no other sector the connection between humans, nature and the environment is as strong as in agriculture: livestock farming, arable farming, fishing. Farmers look after their land and livestock, and every day, the result of their work is evident on our plates and in our environment. But to be able to continue to feed the world in the future and to reduce the ecological footprint at the same time, the sector must make an important transition to a more sustainable, climate smart approach, using the latest technologies. This is where climate Smart Farming comes in Dutch innovations are already aiming to make a difference - at plot level in their country as well as on global level through international cooperation.

Dutch farmer in a potato field.

“Precise production, on an individual level, with less resources.”

Worldwide developments fuel the need to make the step towards Smart Farming: over the next 30 years, the world’s population is expected to increase to more than 10 billion people. These people must all be given food produced in a way that contributes to the health of humans and animals while taking into account the climate. And this whilst agricultural land, raw materials and fresh water are becoming scarcer, the sector is aging and climate change has a direct impact on our food system.

## Feeding 10 billion people

According to the Food and Agriculture Organization (FAO) of the United Nations, currently more than 800 million people suffer from hunger every day and the diets of around 2 billion people are not varied enough, resulting in malnutrition and micronutrient deficiencies. At the same time, an increasingly larger and more prosperous part of the world population is asking for more food variety, high-quality proteins, and consumers are increasingly making the conscious choice to eat healthier foods. According to the FAO, to feed ten billion people in 2050 and to meet all dietary needs, food production will have to increase by 50 to 70 percent.

How that food is produced is increasingly the subject of both national and international debate. For example, there is a need to reduce nitrogen and $CO_2$ emissions to improve animal welfare, to reduce the use of chemicals (such as pesticides and fertilizer) and to improve the transparency of the entire food production chain. The impact of the agricultural sector on the climate and environment is changing for the better, but much remains to be done, states the Organisation for Economic Co-operation and Development (OECD), which has been monitoring the impact since 1990 using 62 indicators.

**Wageningen University & Research**
Wageningen University & Research (WUR) combines various areas of expertise in the following domains: food, feed, biobased production, natural resources and the living environment, society, and well-being. It is therefore able to innovate, but also to study whether innovations are ethically justified and fit into social structures.

## Smart Farming explained

Smart Farming allows the sector to meet these objectives. Smart Farming lately has seen a big development thanks to technologies as big data, artificial intelligence (AI), the internet of things (IoT) and robotics, which enables farmers to improve the management of their crops and animals using (among other things) models, sensors, robots, and data management software. “Smart Farming is about understanding of what the system needs, when it needs this, how much it needs and where. Subsequently, actions and input are provided in a precise manner. In some cases crops and animals are even managed at an individual level”, says Simon van Mourik, researcher at Wageningen University & Research (WUR), the world’s top agricultural research institution.

Simon van Mourik, Assistant professor Agrotechnology at Wageningen University & Research.

Corné Kempenaar, senior researcher Agriculture and Agrotechnology at Wageningen University & Research.

# “Smart Farming means a break in routine.”

### A growing sector

The rise of Smart Farming – also referred to as precision farming or agriculture 4.0 – began in the early 1990s, with the use of robotic milking systems for dairy farmers, and satellite images clearly showing field variations, enabling farmers to farm those area more accurately. “It really gained momentum around fifteen years ago, after developments in technologies (IoT, big data, AI, and robotics) followed in quick succession and became accessible to a wider audience”, explains senior researcher Corné Kempenaar from the WUR. In many Western countries, Smart Farming is now a basic principle in arable farming, livestock farming and aquaculture. In average plots or animal houses, vehicles will almost autonomously determine their next action based on sensors and farmers read simple data compiled about crops and animals from those sensors. Land-based fish farming was given an enormous boost by innovations in technology of Recirculating Aquaculture Systems (RAS). The anticipated growth in the value of Smart Farming shows that there is still enough room for new applications: 9.58 billion USD in 2017. By 2025 it’s expected to be 43.4 billion (source: statista.com). Gert Kootstra (WUR): “We have only just begun to make an impact in making agriculture more sustainable with smart farming technologies. There is still a lot of potential and a lot of research and innovation is needed.”

### A new approach

Smart Farming means a break in routine. Simon van Mourik from the WUR: “Since the 1950’s farming was greatly intensified. Agriculture, horticulture, and livestock farming were organized with the single goal of high production/production increase. A lot of pesticides and too much water and antibiotics were used.” These large-scale systems with monocultures may have been good for optimizing food production, but have an impact on the environment. We now look at alternative systems – for example based on intercropping. Many different plants in a field, make for much more robust systems, with plants helping each other (e.g., by insects attracting them, more difficult spreading of diseases, etc). However, this requires much more labour and drives up costs enormously. Smart farming offers (in the future) technologies with which these kinds of cultivation systems can be (semi-)autonomously managed by machines/robots and transforms the sector to Climate Smart Farming. From technology for large-scale production, to technology for precise production, on
an individual level. With less resources. Van Mourik: “Actually, that means working in a way that farmers worked for thousands of years. They walked to their field or herd, saw what was going on, what the weather was going to do and, based on that, did whatever was necessary. Modern agricultural businesses are too large for that approach, but Smart Farming allows us to partially establish the specific needs of their plot or livestock.” Gert Kootstra: “The use of smart-farming technology

# “The agricultural sector is aging and labour shortage is expected to become a bigger challenge in the upcoming years.”

allows to determine exactly what an organism needs and to autonomously apply that, which minimizes the use of resources such as pesticides and fertilizer.”

## Guiding the transition

The Netherlands has Climate Smart and sustainable farming high on its nationals agenda and wants to play a leading role in the search for, development and implementation of innovative technologies. That is not surprising. For decades, the Netherlands is on the forefront in agriculture, as an innovator, producer and exporter of knowledge, technology, and food. In the Netherlands, sentiment is also shifting and the importance of a more sustainable agricultural sector for good food supply, a healthy living environment, and a strong business model for businesses (see frame) is widely highlighted. Kempenaar: “Smart Farming offers everything to facilitate the transition of agriculture. There is growing awareness that Smart Farming can play that role and governments, knowledge institutes and businesses are increasingly finding ways of forming partnerships with one another. Everyone recognises the benefits from a climate, commercial and social perspective.” For example, various projects are being implemented at Wageningen University & Research that fall under the broad umbrella of Smart Farming. In collaboration with other Dutch knowledge institutes, the government and the Dutch business community, the university is developing new technologies and studies how these can be applied in practice on farmland, in animal housing and in the fishing industry.

Dutch innovations in arable farming, livestock farming and aquaculture focus on a wide range of subjects and on all key

**Economic opportunities Smart Farming**

Smart Farming plays a key role in tackling social challenges and move towards more sustainable food systems and nutritious foods, At the same time it offers farmers economic opportunities. Smart Farming enables them to get more out of their business, at lower costs. The key technologies enable farmers to operate their business as effectively as possible, based on data, intelligence, and smart technology. Technologies that help a farmer to map out the situation in terms of land, animals, harvest, and biodiversity. This allows the farmer to improve commercial goals and resource efficiency with less input”, says Corné Kempenaar from Wageningen University (WUR). By joining forces and pooling knowledge, the Netherlands wishes to contribute to social challenges and, at the same time, increase the sector’s economic strength, in its own country and internationally.

## The biggest advantages of Smart Farming according to Dutch farmers

*source: Rabobank

More efficient use of crop protection products

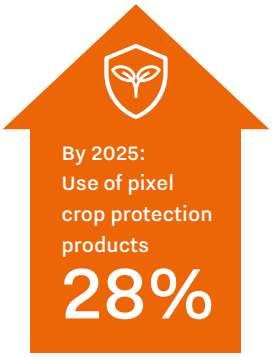
64%

Working more precise

44%

More efficient use of fertilizers

42%



technologies in Smart Farming: IoT, Big Data, AI, and robotics. The innovations help to increase yields, improve animal welfare, food quality, security, safety and to lower the sector's costs and ecological footprint.

Examples of current projects at Wageningen include a study into the use of autonomously operating agricultural vehicles in controlling weeds, the goal being to dramatically reduce the use of pesticides. The livestock sector is investigating how farmers can continue to manage their ever-larger herds in an animal-friendly manner with the use of smart cameras, which enables them to see the gait of individual animals. For fisheries, one of the studies focusses on registering fish in nets, which should result in a more sustainable fisheries by better understanding the fish populations, and reducing the amount of bycatch.

Gert Kootstra, researcher Agro Robotics at Wageningen University & Research.

These studies are carried out on farms, 'in the field', with farmers. The Ministry of Agriculture also supports innovation in the National FieldLab Precision Agriculture and Farm of the Future, where a number of promising experiments involving robots, data bundling of soil data and more eco-friendly irrigation is taking place. Overall – these projects and fieldlabs are key in testing en scaling promising technology innovations with a larger group of farmers. The Farm of the Future also offers a perfect place for international cooperation as climate smart farming is a global challenge and joining forces is key.

## The farmer holds the key

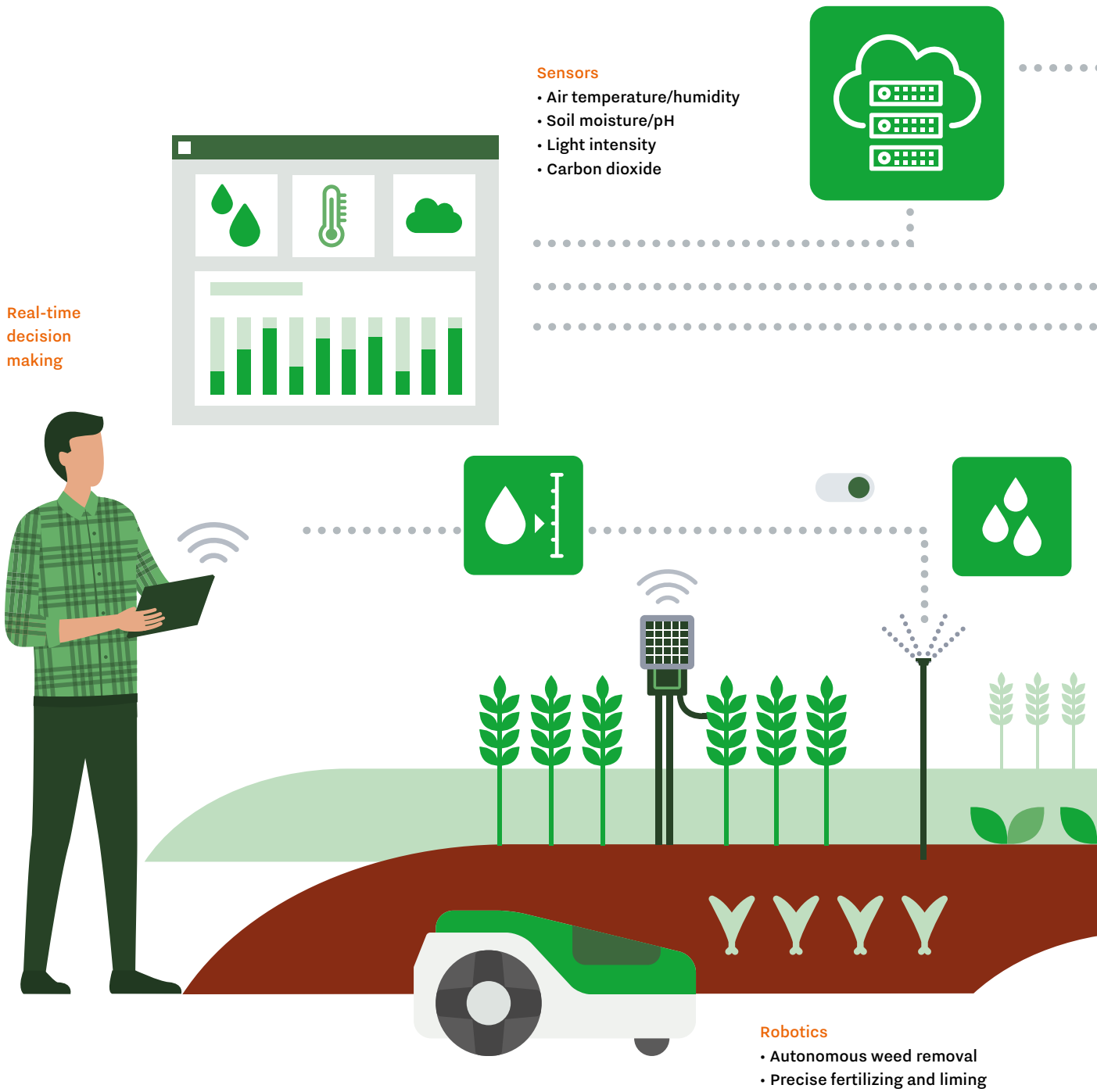
Although part of the Dutch farmers enthusiastically work with various innovations, adoptation of precision farming is challenging. Farmers generally still have to get used to new technology and tools, and the benefits of Smart Farming if precision farming really is going to be the future of the agricultural sector. A study by the Rabobank amongst Dutch farmers revealed the various challenges. Sixty percent of farmers, for example, cited the high investment costs as the greatest obstacle to not yet choosing Smart Farming tools. The other main hurdles cited are the lack of interoperability between the different technologies of the various manufacturers, the lack of a clear revenue model (margin constrains/fair prices) and the lack of knowledge about the possibilities.

"We will have to involve farmers properly with innovations at a very early stage", says Corné Kempenaar. A well-informed farmer is more likely to opt for new technologies, even if that new technology is still on the expensive side during the early stages. In addition, further innovations must push down the price of smart technologies, which would make the choice easier. Kempenaar: "The interoperability of the technologies is another important point that needs to be tackled. From a technical point of view, we can already do a lot – for example, we store a lot of data in cloud solutions. But I do wonder whether we really are getting everything out of it. If we want to convince farmers of the added value, it must be much simpler to interconnect the main bulk of extremely varied data. It has to be possible to share and use data more easily and securely, allowing farmers and fishermen to improve their focus on optimising the social and commercial goals within their businesses. For this, even closer cooperation and the sharing of knowledge is essential."

National Geographic discovered how the Dutch agricultural sector is leading the way with smart technologies. Scan or click on the QR-code.

# Smart Farming in the field

Drones, sensors, GPS, robotics and artificial intelligence. With Smart Farming technologies, farmers are able to give their crops precisely the treatment they need, with great accuracy.



Satellites

- Precise determination of moisture content and temperature of soil and plants
- GPS information for tractors and robots

- Collecting and interpreting data with AI

Drones

- Mapping/Surveying
- Monitoring
- Crop spraying
- Crop protection

Tractor

- More precise and semi-autonomous harvesting

How the Netherlands collaborate in Smart Farming

# The Dutch Diamond: unique and essential

**The agri-food sector faces substantial societal challenges. The Dutch government, companies and knowledge centres have joined forces to tackle those challenges, based on guidance by the mission-driven Top Sectors and Innovation Approach Climate Smart Farming is one of the main cornerstones of the transition to a more sustainable agricultural sector. That collaborative approach is also known as the Dutch Diamond. Ernst van den Ende (knowledge centres), Leo den Hartog (the business sector) and Peter-Paul Mertens (Ministry of Agriculture, Nature and Food Quality) talk about the added value of that unique approach.**

The Dutch Diamond is the well established term for the close collaboration between the Dutch government, business sector, knowledge centres and societal organisations. It is used within a number of large sectors such as Agri & Food. All stakeholders focus on the same societal goals. Ernst van den Ende, general director of the Plant Sciences Group at Wageningen University (WUR): “Motivated by a shared interest, funding is provided by numerous stakeholders for large high-impact programmes that make the sector more sustainable.” Drs. Peter-Paul Mertens, MT member Strategy, Knowledge & Innovation at the Ministry of Agriculture, Nature and Food Quality: “Representatives from all stakeholders are involved in those programmes. This inclusive dialogue and cooperation are necessary to achieve a sustainable and economically viable food system. The Dutch Diamond underpins a strong, knowledge-intensive and efficient ecosystem of Dutch parties.” It is remarkable to see how the Dutch are working together to tackle major societal challenges. “Everyone realises that we must all contribute to this.”

“It is striking that not only large capital-rich companies participate and make an impact”, says Leo den Hartog, director of R&D and Quality Affairs at Nutreco and member of the Top Team Top Sector Agri & Food, “but also the medium and small enterprises, retailers and farmers. This elevates the entire sector to a higher level. Abroad, people often react with surprise to the close collaboration between companies

that are actually competitors. But I think it's only logical, because the challenges that we face can never be tackled by one party alone." Mertens: "A few examples of that collaboration are the 'Farm of the Future' (Boerderij van de Toekomst) and the 'National FieldLab Precision Agriculture' (Nationale Proeftuin Precisielandbouw). In both projects, knowledge centres and developers of technological innovations work with farmers to translate Smart Farming applications into everyday practice."

## Smart Farming

Innovations are essential in the transition to sustainable agriculture. Mertens, Den Hartog and Van den Ende agree that the Dutch Diamond model not only forms a solid basis for Smart Farming innovations, but also accelerates those innovations. Mertens: "It is possible to speed up innovations by learning from one another and joining forces." Den Hartog: "It is an interaction, where knowledge centres, companies and farmers put forward new ideas to one another. To do that effectively, you have to be open with one another. We have that attitude in the Netherlands." Van den Ende: "Although we do have to remain alert to ensure that we involve everyone, meaning all farmers and society. I believe that Smart Farming technologies have an important role to play. Drones, robots and sensors really do capture the imagination. This gives farmers a clear insight into what this means for them and society is able to see how the 'new way of farming' is more sustainable than current methods."

## What is the farmer's role?

Dutch farmers play an important role in the search for innovative solutions. Den Hartog. "It is a push and pull collaboration. One minute, the parties are working on an idea that a farmer has, whereas the next minute the knowledge centres are taking the initiative." Van den Ende: "At the WUR we frequently work with farmers; For some years, we have noticed a significant increase in interest amongst farmers in Smart Farming, fuelled by technological advancements and more financial opportunities. It is great to see how, for example, the number of data platforms that help to make growing more sustainable have increased exponentially."By means of various tools, the government facilitates farmers to take a step towards Smart Farming. Not only tools to enable participation in knowledge and innovation projects, but also financial schemes. Mertens: "Every farmer can apply components of Smart Farming in his business, but a degree of support is often still required. A new model is, for example, the Subsidy module agricultural business advice and education (Subsidiemodule agrarische bedrijfsadvisering en educatie – SABE) that enables farmers to obtain independent advice, for example, about precision agriculture."

> "Everyone is convinced that significant changes are required."
>
> **Peter-Paul Mertens**

The foundation for the Dutch Diamond was laid in the 1920s by the agri-food sector. At regional level, the government, knowledge centres and businesses worked on improvements and innovations, financed by public-private resources. After the Second World War, the importance of this joint approach even became crucial in the mission to guarantee food security ('never go hungry again' - 'nooit meer honger'). There was a large national movement, in which public-private partnerships focused on exchanging knowledge and the use of new methods. With the focus on the long term and the identical goal. Through that joint approach, the Netherlands succeeded in increasing and intensifying agricultural production and it acquired an important global position in agriculture. Although the missions and social goals are now different, the Dutch Diamond still underpins the Dutch approach.

Learn more about the National Experimental Garden for Precision Farming.

## International collaboration

A strong trait of the Netherlands is its global outlook. Dutch parties are also joining forces with foreign organisations in the field of technological innovations, such as in cross-border public-private partnerships. Van den Ende: “We are one of the global leaders in Smart Farming. We disseminate our knowledge to other countries, at the same time acquiring knowledge from those countries that we use for new research and innovations.”

Could the Dutch Diamond model also be used as a blueprint for models of cooperation in other countries? Yes, say all three interviewees. Den Hartog: “But you do have to be entrepreneurial and innovative, plus you have to be open to others. This is seen as the norm in the Netherlands. In the internationally-orientated Seed Money Projects of the Top Sector, we translate some of that Dutch Diamond thinking into cross-border consortiums.” Mertens: “You can take certain mechanisms from the Dutch way of working, such as the mission-driven approach that challenges all stakeholders to put forward new innovations. Interpretation for a multi actor approach may differ off course and has to be tailor made for each local ecosystem.”

Six missions as the driving forces behind innovations
Within the scope of the Mission-driven Top Sectors and Innovation Policy, the Dutch government has formulated \its ambitions for a number of large sociatal themes. The top sectors Agri & Food, Horticulture & Propagation Materials and Water & Maritime industry have drawn up a joint Knowledge and Innovation agenda over the years 2020-2023. The agenda was drawn up in close consultation with the stakeholders: government ministries, the public sector, the business sector, regional authorities and water boards. This makes the agenda a widely-supported document that is backed by a 4 year public private investment budget.

The following six missions cover the areas of agriculture, water and food:
- Circular agriculture
- Climate-neutral agriculture and food production
- Climate-proof rural and urban areas
- Healthy, safe and appreciated food
- Sustainable and safe North Sea, oceans and inland waters
- The best protected and liveable delta in the world

Scan the QR code and read more about the six missions and the Knowledge and Innovation Agenda of the Netherlands.


Seaweed cultivation can play a large role in the food production chain. The University of Wageningen conducted tests on the farming of sea lettuce in the Oosterschelde, in the Dutch delta.

# International collaborations

**As well as searching for collaborative partners in their own country, the Dutch also frequently look abroad. Successfully.**

### PPS - Transition towards a data-driven agriculture

A Dutch-Japanese consortium comprising governments, the National Agriculture and Food Research Organization (NARO), WUR and companies, such as Kubota, IMEC, Solynta and FME, started the public-private partnership (PPP) Transition towards a data-driven agriculture. This project involves new sensors and artificial intelligence being used to create a potato production chain not only with greater yields, but that is also circular. During the initial trials in 2020, drones (among other things) monitored crop development in a potato field and experiments were conducted with sensors that visualise the growth of potato tubers in the ground. Simultaneously, experiments were conducted in Japan by NARO.

Learn more about this project:

### PPP – Make Brazilian soy cultivation sustainable with Dutch precision technology

In 2020, a group of Dutch and Brazilian companies and knowledge centres researched how to make Brazilian soya cultivation sustainable using Dutch precision technology and how this knowledge can be applied to emerging European soya cultivation. Globally, soya is one of the five most important crops for the cultivation of proteins for animal and human consumption, but it faces several environmental problems.
Led by the WUR, a consortium of Dutch SME businesses such as Bioscope, Hiber and Rometron, as well as Syngenta, the Dutch embassy in Brazil and a number of Brazilian companies and knowledge centres, researched which technologies are of interest, who has what expertise and how that can be interwoven to establish a good project. As part of a PPP project, the aim is to develop smart sensors, robots and advanced decision support management systems to significantly reduce the use of fertilisers, crop protection products and irrigation water, therefore making soya cultivation more sustainable.

Bioscope: www.bioscope.nl
Hiber: www.hiber.global
Rometron: www.rometron.nl

### PPP – The Next Fruit 4.0

In recent years, a Dutch-American consortium-led project, Fruit 4.0, successfully worked on new technologies and data management for the Dutch fruit cultivation sector. This project will continue under the name The Next Fruit 4.0, which focuses on the pear. Work is taking place on high-tech and data-management applications that help to make cultivation and the chain more sustainable, maximising yields and minimising costs.
The Nederlandse Fruittelers Organisatie (The Dutch Fruit Growers Organisation - NFO), along with the employers' organisation for the technological industry FME and the platform FRUITVOORUIT.nl, initiated the follow-up project. Wageningen University & Research and the Delphy Improvement Center will execute the project. This project is co-funded by the Top Sector, by a consortium of 31 fruit growers that are members of the NFO and an expansive consortium from the Dutch and Belgian business communities from the sector. A special aspect of this project is the financial contribution by the Washington Tree Fruit Research Commission, which enables cooperation with American universities and industry.

Learn more about this Dutch-American partnership:

## Dutch organisations join forces in cross-border partnerships.

# Smart Farming for livestock

Smart technologies in livestock provide specific insight into animal health and enable farmers to better manage their animals and their businesses.

Real-time decision making.

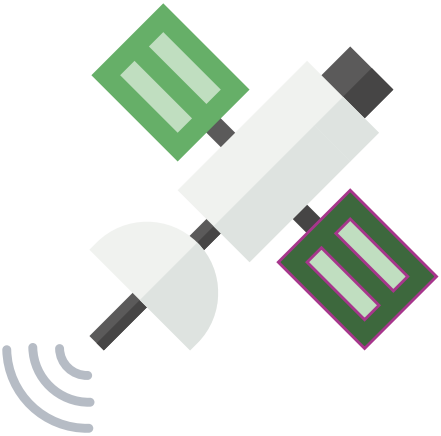
**Sensors**

- Measuring growth and yield of fodder crops

**Tractor with soil scanner behind it**

- Sensors measuring quality of soil
- Precision spraying trough smart camera's.

Big data



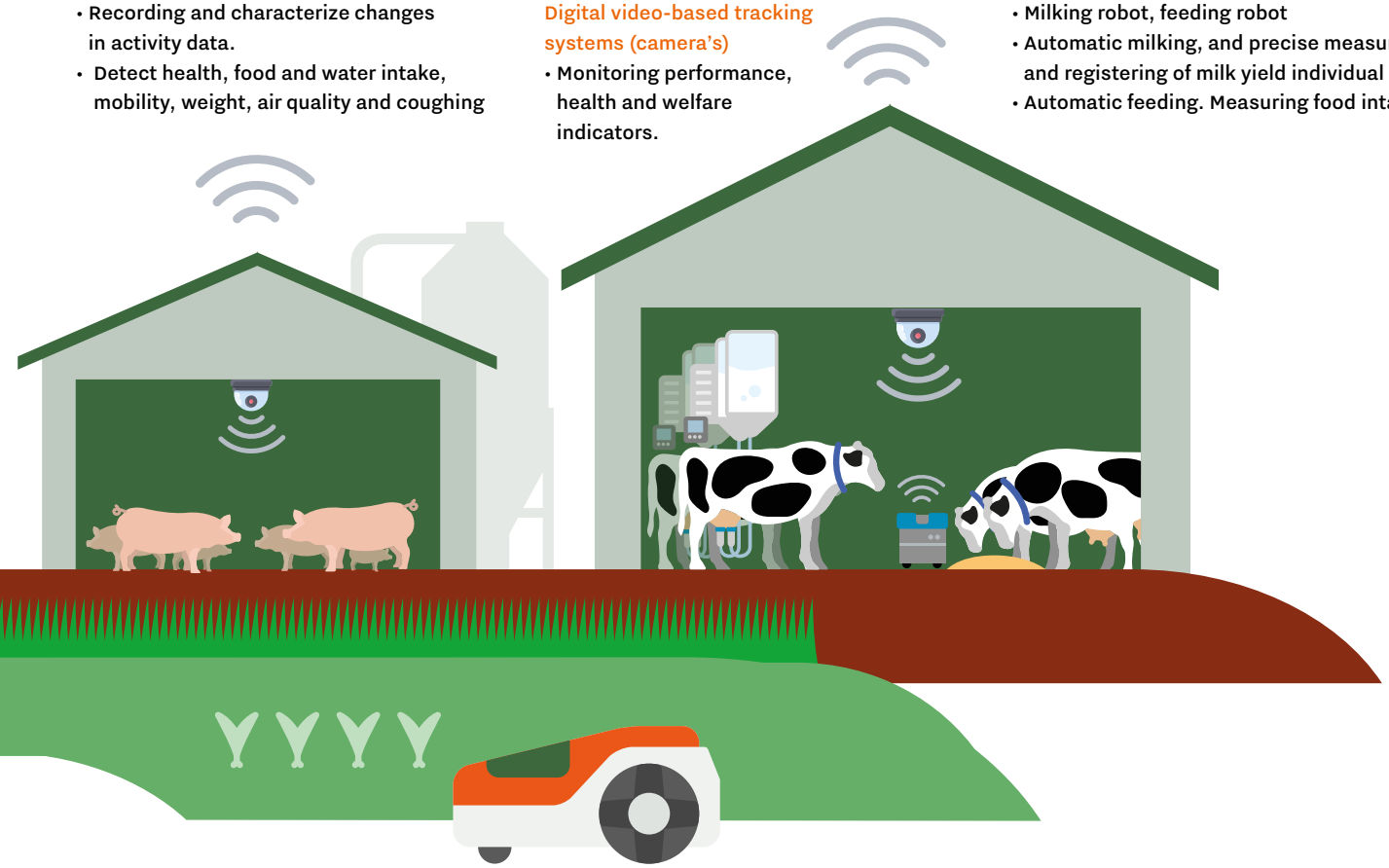
Satellites
- Mapping soil fertility
- Measuring fodder crops quantity

Sensors
- Sensors (in collar of cow)
- Measuring behavior and mobility
- Monitoring health

Sensors
- Early warning systems to prevent tail-biting
- Recording and characterize changes in activity data.
- Detect health, food and water intake, mobility, weight, air quality and coughing

Digital video-based tracking systems (camera's)
- Monitoring performance, health and welfare indicators.

Robotics
- Milking robot, feeding robot
- Automatic milking, and precise measuring and registering of milk yield individual cow
- Automatic feeding. Measuring food intake



Robotics
- Autonomous weed removal
- Precise fertilizing and liming

# For the benefit of farmers

**Farmers around the world are embracing smart farming as the key to better animal welfare and a more efficient and sustainable agricultural. They play a key role in the transition. Four Dutch farmers talk about how their business flourishes thanks to smart farming technologies.**

## ‘I look at my land and cows differently, with knowledge I didn’t had before’

**Ad and Annette van Velde run the Hunsingo Dairy farm with over 200 cows. They are participating in the National FieldLab Precision Agriculture (NPPL).**

Ad van Velde

“Smart Farming technology allows me to see at any time of the day how a cow is getting on, even from the other side of the world. We have been using milking robots for decades. Our cows take themselves into the machine when they want to be milked and we have immediate access to the relevant data. I now also have detailed knowledge and data about my land, where I grow roughage for my cows. I have an insight into the quality of the soil and I know how to fertilise as effectively as possible, plus I am aware of the right time to mow. To this end, we use precision fertilisation and yield measurement with Infrared Proximity Sensors, which is all about the right amount of manure, in the right place, whereby the manure is optimised based on biomass maps. For this process, our plots are divided into “mini gardens”, which are analysed one by one. All of those data are of value to optimise forage yield and quality. Better feed results in healthier cows and, ultimately, a better end product: the milk. Our goal is that our farm works as effectively as possible, in terms of the animals and the land. We can see the big picture; Smart Farming is a normal part of business. I now walk around my land differently, I am more involved now that I have knowledge that I didn’t have before. Everything currently happening in the Netherlands in this field is just amazing and innovative.”


Marcel Kuijpers

# ‘I have an unbridled need for knowledge’

**Along with his brother and his two sons, Dutch farmer Marcel Kuijpers operates a poultry chain, with parent stock, a hatchery and 250,000 broilers. Kuijpers combines the data from numerous sensors with block-chain and a data warehouse.**

“Smart Farming enables us to closely monitor our entire chain, from egg to slaughter. Our data warehouse collates all data obtained from sensors throughout the chain. Our chain is short as we do everything ourselves and therefore all information within the chain is traceable, through the data that is stored. Supposing I have a pack of chicken fillets and I want to know the history of this piece of meat. Using a QR code on the packaging, I can view the animal’s entire life history: when the egg was laid, when it was placed in the incubator, when the chicken was slaughtered. This origin analysis is available within 10 seconds. We also have a destination analysis, which shows me within just 4 seconds which batch of feed has gone to which animal. Both analyses are guaranteed through blockchain, as this is where our company data and data from our suppliers are stored. The main steps are included in the data warehouse and the blockchain acts as a kind of backbone. The warehouse is constantly being filled with valuable knowledge which helps us to improve the monitoring, analysis, and management of our processes, and with which we can enter into partnerships with innovative parties. For example, in collaboration with Philips, we are now researching the effect that light has on chickens and are testing a new method of vaccination, the outcome of which can be measured in just two weeks. Wherever possible, we exchange knowledge for knowledge. Every morning, I open the Data Dashboard on my computer and I think ‘it’s all there again’. The possibilities are amazing, thanks to Smart Farming, I enjoy it every day.”

Jacob van den Borne

# ‘Smart Farming made me become a farmer again’

**Jacob van den Borne has an arable farm with potatoes, corn and sugar beets. He has been deploying Smart Farming on his 200 plots since 2006, including sensors, satellites and self-steering tractors.**

Jacob started using Smart Farming technology to efficiently manage his diverse and smal plots. “By using that technology and collecting data, new questions arise. As a famer you will find the answers in the field, which brings you much closer to you crop. Because of Smart Farming, I feel I have become a farmer again, because my work transformed from arable farming to growing plants on an individual level. It makes my work more interesting and enjoyable.”

Collecting data is one thing, interpreting it is the real farming. “I still adjust the definition of my final yield daily, because it’s not just about yield in kilograms, but also about the size of the potato, the underwater weight and a lot of other factors. I’ve really gotten to know my plants because of the technology I’m using.” Van den Borne uses three apps designed specifically for his farm, which provide immediate feedback. Based on this data, he can make adjustments where necessary.

“We will eventually deploy artificial intelligence with the aim of finding out if relationships can be found between datasets, which I have been collecting since 2012. The real farming remains anticipating and asking yourself why you see variations in your crop and acting on them, which too is the core of Smart Farming.”

And the future? “We are only at a fraction of the opportunities Precision Farming offers. Almost all the technology on my farm is in a 1.0 version, and I already know what the next versions should look like. But I notice that my colleague’s interest in Smart Farming still has to flourish, and manufacturers are waiting with their innovations for more users. So my mission is to bring everyone along in precision agriculture.”

# ‘Big data makes our business processes really transparent’

**With four locations, 5,000 sows and 45,000 fattening pig places, the Houbensteyn Group is a well-known name in the Dutch pig sector. By managing the data of his organization every day, owner Martin Houben is able to make his pigs ‘happier and his company smarter’.**

“Thanks to mechanization and automation, pig farmers have been able to grow substantially in recent decades. So did we. We have been using various computer-controlled technologies and sensors at our four locations for quite a few years now. These provided us with a considerable bulk of data, but we didn’t really make a lot of use of it. Since 2018, we’ve made significant steps in that direction with the purchase of new, even smarter devices, a data management system and the recruitment of a data manager, which as far as I know is unique in our sector.”

“The devices are installed in various areas in our stables and are linked with each other. For example, we have smart weigh scales, sensors in the insemination room and smart $Co_2$ and temperature sensors that provide us with a lot of data on feed conversion and the indoor climate. With that data we can make more targeted analyses. We used to work a lot on our experience and feeling. But now we can actually see what is happening in the figures, we can make daily adjustments and provide tailor-made solutions for our animals and our employees. Animal welfare rises and our people can do their jobs better.”

“Big data is making our business smarter, more efficient and more sustainable, with lower costs and happier, healthier pigs. But big data is complex and you have to take care of it properly if you really want it to work for you. That’s why in the near future we will also invest in Artificial Intelligence. I strongly believe in the value of these techniques.”

Martin Houben

# Smart Farming for aquaculture

Technologies such as Internet of Things, Big data, Artificial Intelligence, and robotics provide fish farms with a set of smart solutions to complete all production and management operations, in a more sustainable and animal-friendly way.

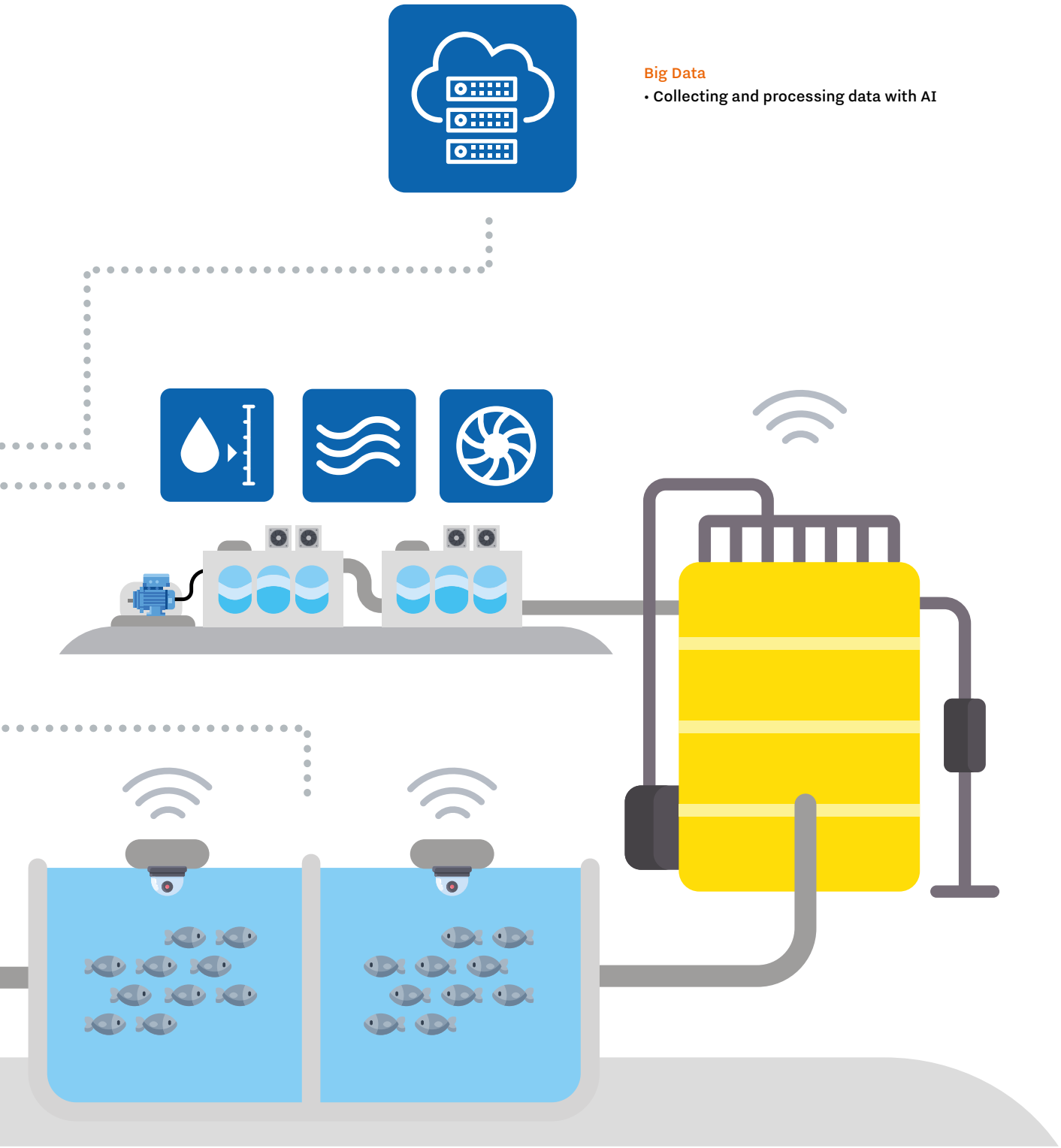
Sensors (Temperatur, Ph, ultrasonic, light)

- Harvest prediction
- Feeding prediction
- Water quality monitoring
- Remote monitoring

Real-time decision making.

Artificial Intelligence (image processing)

- Monitoring health indicators
- Better estimates of the biomass of fish
- Counting fish



**Big Data**

- Collecting and processing data with AI

**Robotics**

- Operation production
- Automatic inspection
- Intelligent sorting

In the spotlight:

# Dutch innovations in key technologies

## Robotics
## AgXeed

Due to the use of heavier agricultural vehicles, agricultural soils are increasingly being compressed. Soil compaction is a serious problem in agriculture because it affects the quality of the soil. The Dutch company Agxeed developed an autonomous agricultural robot, Agbot, a much lighter machine that rides on tracks. Two features that prevent soil compaction. Thereby the structure of the soil improves and crops are of a higher quality. To get started, the farmer enters various parameters in the portal, based on which the AgXeed starts working autonomously and the farmer has time for other tasks.
Learn more about Agbot by scanning the QR-code below.

## Remote Sensing
## VanderSat

Precise determination of moisture in soil and crops, right through the clouds

Water plays a crucial role in the daily work of farmers. A shortage or surplus of water can be disastrous for crops and livestock. Thanks to the unique and patented technology of the Dutch company VanderSat, farmers get insights into the local water balance using satellite images. “We measure the natural radiation of the earth with passive microwave technology, which allows us to determine the moisture content and temperature of the soil and plants accurately, digitally and on a large scale. This allows us to map entire fields. We are the only company that can provide these images in such high resolution, even when it is cloudy,” says Robbert Mica, co-founder and Head of Marketing at VanderSat.

The satellite images provide significant data. “If you know how healthy your crop is and how moist the soil is, you can make a good estimate of what the quality of the harvest will be,” Mica describes the predictive value of the data. “Also, with the right knowledge at the right time, you can adjust your business processes where necessary.” VanderSat’s data doesn’t go directly to farmers, but serves as the basis for various Smart Farming applications from third parties, such as apps for precision spraying. With apps like these, farmers are able to do their jobs better. Six years ago VanderSat started, now the company has 41 employees and their data is used worldwide.

## Drones/sensors
## HAS University of Applied Sciences Den Bosch

Precision cooling via drones

The HAS University of Applied Sciences Den Bosch is conducting research into the precision cooling of cows via drones. Precision cooling saves water, energy and labor. At a nearby farm HAS is using sensors to map out when a cow is suffering from heat stress. Heat stress occurs when there is an imbalance between a cow’s heat production and heat release, making a high-yielding cow more likely to become unbalanced. The respiratory rate, rectal temperature and body temperature (with thermal cameras) of the animals are recorded. As well as the temperature and the humidity of the environment. Sensors around the neck and legs keep track of how long cows lie down, feed, stand and ruminate. In the future it may be possible that sensors indicate which animals need cooling. Which can be executed by sending a drone that blows cool air and sprays water.

Image processing

## Image processing Kingfish Zeeland

Making the perfect fish with best in class RAS-facility and precision aquaculture

Kingfish Zeeland is one of the leading companies in farming fish in RAS systems. Based in the Dutch province of Zeeland, Kingfish Zeeland taps into the pristine marine estuary water of the Eastern Scheldt, a Natura 2000 nature reserve, to deliver a healthy, antibiotic-free premium delicacy in a sustainable way: the Dutch Yellowtail (Seriola lalandi / Pacific Yellowtail / Hiramasa).

Innovation is a key aspect at Kingfish Zeeland. “Healthy fish are central to our work and we are constantly optimizing our RAS systems and the water the fish grow in. Technology and innovation are tools for us to create the most pristine and optimal environment for the fish”, General Manager Maryke Musson says.

On different levels, Kingfish Zeeland is looking at ways to innovate. For example, currently Kingfish is looking at the implementation of Artificial Intelligence (AI), specifically image processing, to be able to manage its stock even better. Musson: “There are about 50 health indicators that we can use to confirm how healthy the fish are. Instead of working on predictions, smart technologies are providing us detailed and reliable information at an early stage, which we can use to tweak different aspects of our processes. On a day to day basis. With really good image processing we can get more accurate estimates of the biomass of our fish, and, for example, are able to adjust the feeding accordingly. We just installed a trial AI system to specifically detect real time appetite levels so that feeding levels are then adjusted accordingly limiting waste and thus retaining optimal water quality. These fish grow so fast, we have to be on top of your game. With smart technologies such as AI we can be.”

Want to know more about Kingfish Zeeland?
Scan the QR-code with you smartphone

Consultancy/big data

## Resilience/ Smart Farming B.V.

The Dutch company SmartFarming B.V. develops user-friendly platforms (app, sms, web applications) that translate the input and knowledge of agronomists, meteorologists and pathologists into practical information for small-scale farmers in developing countries. Also in areas without much network coverage. Thanks to the apps, farmers can grow their crops more efficiently and sustainably, from sowing to harvest. The affordable apps provide practical advice on an individual level that takes into account local conditions. The app offers eight different functions, but the focus is on prevention of diseases and pests. The app sends the farmer important advice and encourages them to take preventive measures. In addition, the app includes calculation modules for customized irrigation and fertilization recommendations.

SmartFarming B.V. was founded in 2014 and since 2021 is part of Resilience BV, an international development entrepreneur. Co-founder Jelle van den Akker “With SmartFarming BV we form a bridge between digital technologies and the daily practice of agriculture. We want to make social impact by enabling farmers to perform better thanks to access to the right information at the right time.”

Operations Manager Daniël Levelt: “Where our target group now often harvests 30-40% of the potential yield of a crop, our ambition is to enable them to independently increase production to 60-70% of the potential yield. We are looking for natural solutions and improvements from, for example, organic cultivation methods, so that the crop and the soil become healthy in a sustainable way.”

Read more about the possibilities of the platforms of SmartFarming B.V. and practice stories at:

# Dutch Smart Farming expertise in brief

Looking for specific expertise or technological solutions? In this section Dutch technology providers with international track records introduce themselves and their portfolios. Read all about their expertise to identify possible partners in your next step towards Smart Farming successes.

**ABB**
Lei Gommers

new.abb.com/drives/segments/food-and-beverage/poultry-farming
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ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB's success is driven by about 110,000 talented employees in over 100 countries. At ABB, we have always taken a sustainable approach to agro business. Sustainability is a key part of our company purpose and of the value that we create for all of our stakeholders. We believe that sustainable development means progress towards a healthier and more prosperous world today and for future generations. This means balancing the needs of society, the environment and the economy.

As customer demands evolve, the need to improve animal welfare, maintain a sustainable environment and retain reliability are in focus in livestock farming. With ABB drives and motors we make this possible by increasing energy efficiency while ensuring stable operation of the production application in use.

ABB drives, for instance, that are easy to commission and use are highly reliable devices with a mean time between failure (MTBF) exceeding 60 years (or over 500,000 hours), while often achieving in excess of 50 percent energy saving. Special features improving robustness to keep animals safe and comfortable. New technologies like Solar Drives for off grid operation, DC networks, arc (faults)detection to reduce fire risk for improved safety and reliability are also part of ABB's portfolio.

**AgXeed B.V.**
Rienk Landstra

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Today's farmers are struggling to find skilled labor, while at the same time, farmers are forced to produce much more food. To realize this, agricultural machines have become more productive. But also heavier, larger and more complex.

Usage of this heavy machinery comes at a high price; the weight of these machines have compacted our soils. This is negatively impacting the biodiversity inside the soil and the ability of plant roots to reach the nutrients in the deeper layers. As a result; crop growth will not be optimal; this irreversible process results in less productive fields.

To compensate for this farmers are using chemicals and fertilizer. If we do not put a hold to this it will inevitably lead to erosion and ultimately desertification. Our fertile soil is a non-renewable resource!

Our all-in autonomy system is a big part of the solution. We have developed an autonomous agricultural vehicle taking labor out of the equation thereby putting an end to the 'bigger is better' trend. Smarter is better; with our AgBot we stay under the irreversible soil compaction limit. Our hard- and software modules can be combined to realize plug and play machines providing unlimited flexibility in meeting specific customer and regional demands. Our platform is able to perform all tasks conventional tractors can do and is equipped with a standard front and rear hitch to connect with existing equipment the farmer already has in use. We do not throw away decades of experience in cultivation of our soils!

**AIC B.V.**
Antoine van den Oever

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Agri Intelligence Centre (AIC) is a global network with local organized competence centers, for the development, acceleration and scaling of innovative ICT Solutions in agriculture. It is driven by the belief that impact can be created for millions of farmers in a sustainable and business- orientated way, by providing an Agri-Platform.

For sustainable improvement of yield AIC offers farmers near Realtime actionable insights about the need of the crops at each individual field globally. The information helps to gain higher yield, with lower resources such as water, fertilizer and pesticides AIC makes a high-end farmer solution accessible for all famers. Example of current AIC solutions are:

- The Grower apps are build on the vegetation Data Services of among others e-Leave and infoplaza. The app will enable farmers to do better farming and create a better life for their families.
- The Crop Disease Alert will inform the farmer that he needs to act before his crops are harmed to avoid a loss of yield, actually reducing the use of pesticides.
- Land development and Carbon Emission will reverse the effect of deforestation and create new income streams for underdeveloped and developing countries.
- Self learning algorithms combining the data of millions of farmers to improve customized information and impact.

All AIC solutions are tailored for the local needs.

**Aurea Imaging B.V.**
Bert Rijk

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The future of horticulture is autonomous growing. Aurea's Crop Intelligence technology helps to enable completely autonomous orchards, resulting in higher revenue, better yields, lower cost and less dependency on labor.

Aurea's Crop Intelligence is a combination between sensors on tractors and drones, analytics using deep learning and agronomic decision support tools. Aurea's products are used to manage on a tree level, instead of on a field or farm level. The main applications are growth regulation using 3D vigor maps, precision thinning strategies, pest & disease control and fruit load mapping.
Aurea's cloud platform integrates with most major farm management systems and machinery.

Aurea's products help to reduce environmental impact, improve fruit yield & quality, reduce dependency on labor and increase farmers revenues. Tree-specific, tailor made agronomic applications that optimize yield, lower cost and increase profitability.

**BlueReactor Systems B.V.**
André Kapitein

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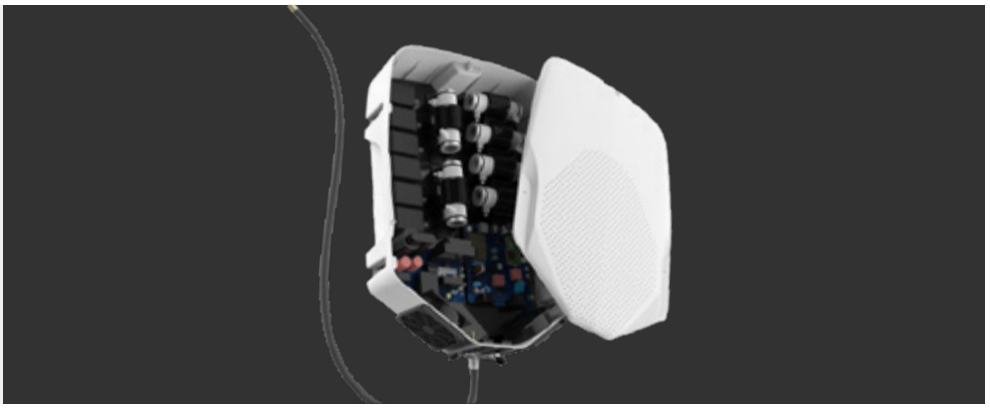

The BlueReactor uses a revolutionary (and patented) pulsed power plasma technology that reduces or even eliminates the negative impact that live stock farming has on the environment. Not only harmful gasses like $H_2S$ (hydrogen sulphide) and $NH_3$ (ammonia) are removed but also viruses, bacteria and bad odors.

Our technology can be used end-of-pipe or in stables to create a healthy climate ensuring healthier animals with less stress, it greatly reduces the use of antibiotics, in the end it increases the meat production by 20% and greatly reduces the risk of spreading diseases.

**Dairy Data Warehouse B.V.**
Joyce Nuys

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Dairy data can act as enabler of the digital transformation of the dairy value chain. The solutions from Dairy Data Warehouse give you the opportunity to get easy and immediate access to artificial intelligence tools. Our deep learning-based technology helps you to optimize management of your dairy factory or your dairy herd(s) for sustainability and performance. There is no need to buy any additional equipment or software. The solutions from Dairy Data Warehouse will work seamlessly with most commercial herd management systems. PREDICTA Health Ketorisk, PREDICTA Milk, PREDICTA Inventory and OptiHerd are the solutions available to start your digital transformation.

**Danfoss B.V.**
Ruud Versluis

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Danfoss Drives. Danfoss is one of the leading drive suppliers. We deliver and maintain drives worldwide with local support.
Our customers are international players in the Agriculture, Horticulture and related industries in knowledge, products and services. End-users are working with live-stock, fresh products and/or in harsh conditions. In their business climate control is key and resilient products are needed for a long lifetime. Danfoss drives are of high quality and endurability for e.g. climate control, water and food supply. At the same time the use of embedded smart technologies together with edge or cloud connection will optimize efficiency, reduce downtime and ensure food safety.

Danfoss frequency converters are well-known for their high reliability. The worldwide used VLT® HVAC Drive is ideally suited to applications where failure of the ventilation can lead to an enormous loss. For example, applications in the livestock breeding (pigs and broilers), greenhouse cultivation, mushroom cultivation, composting and potato storage.

Optimal climate: A step less regulation by means of a frequency converter ensures under all circumstances for an optimal climate.

Energy costs are reduced: By using a VLT® HVAC Drive the energy costs can be halved.

Less maintenance: Less wear means less maintenance and at the same time greater operating reliability.

**DeLaval B.V.**

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info.nl@delaval.com


Our vision is to make sustainable food production possible. As a company built on innovation, we constantly work to find ways of helping our customers, dairy farmers, do more with less by providing world-leading milking equipment and solutions. Today, DeLaval has approximately 4,500 passionate professionals operating in more than 100 markets around the world. DeLaval is part of the Tetra Laval Group. See more at www.corporate.delaval.com

Because the world population is growing, there is a growing demand for high-quality food, produced with an decrease on the environmental footprint. We support our customers in reducing their environmental footprint while improving food production, profitability and the well-being of the people and animals involved.

DeLaval VMS™ V310 is a milking robot who can detect automatically heat detection and pregnancy checks. The RePro™ module on the DeLaval VMS™ V310 turns the ultimate milking and animal welfare system into a reproduction management tool as well. By providing a clear picture of each animal's reproductive status using DeLaval DelPro™ BioModels, progesterone levels are taken automatically in milk samples. All critical reproduction questions can be answered automatically with notifications within the DelPro farm management applications. All of this adds up to healthier cows, reduced vet costs and lower environmental footprint. Having cows become pregnant at the right time will result in more productive lactations – which means a better cow longevity.

**DEMCON advanced mechatronics Delft**
Gertjan de Ruijter

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We are working on solutions to social challenges in the area of agri & food. We do this by developing, manufacturing and supplying high quality technology and innovative products. The company was created as a result of the passion of its founders for solving challenging technological and social problems. We develop high-quality, innovative, complex systems and products, and can also take care of production ourselves. This way we create value for our customers. In a society faced by major challenges, we carry out projects that have a positive impact on people and the world they live in. We work on smart applications in various sectors, such as healthcare, safety, water, energy, production and communication. In addition to technological innovation we also devote our efforts to promoting entrepreneurship and investing in talent and education.

**Dutch Seaweed Group B.V.**
Amber Klijn

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Dutch Seaweed Group stands for truly sustainable, healthy and local seaweed. As an innovative partner, we develop and supply Royal Kombu and Wakame from our own sustainable farm in the Eastern Scheldt. With large volumes of sustainable quality seaweed, we are moving in the market searching for partners and buyers who are open to all the wonderful applications of seaweed. All this with the idea that seaweed can have an enormous impact on our society in several areas. While everyone is looking for sustainable solutions to improve the world, Dutch Seaweed Group contributes to this through the sustainable cultivation of seaweed. The more seaweed, the more solutions. We are ready for anyone who shares these thoughts, together we can make more impact!

**Fancom B.V.**
Anja Theeuwen

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Fancom is leading in helping poultry producers, pig producers and mushroom growers improve processes in livestock houses and growing rooms. Thanks to smart climate, feeding and biometric systems, sensors and control computers, we improve operating results and the living conditions of livestock.

We offer future-proof and innovative technology for livestock houses that enables farmers to produce more efficiently, uniformly, safely and profitably in a way that respects animals and the environment. At a reduced cost, with less waste and a lower labor input.

The nature of our product is technical; the nature of our service provision is personal. With 40 years of experience, no one knows the business like Fancom. Fancom is the partner who helps farmers to look forward and lead the way. Whatever their ambition is, Fancom will help them achieve it. And what if different requirements are set in the future? Then we will identify them in time, together with our customers, and react to them. We call this 'Forward thinking'. This is a commitment we can make because we are the leaders in our industry.

**Farmertronics Engineering**
Thieu Berkers

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Farmertronics Engineering developed the eTrac, this is a light weight electrically driven robot tractor for fruit growers to maintain their orchard like mowing, weeding and spraying without using fossil fuels and without the need of a driver.
A complete route through the orchard can be preprogrammed and monitored remotely using an android app. During mowing a 3D scan can be made of the orchard to get real time data for a more effective way of managing the orchard. By using GPS-RTK positioning is done with an accuracy of 2 centimeters and spraying will be controlled through GPS-RTK. By automating repetitive tasks the grower can spend his time now in a more effective way.

**Food Insights**
Wilbert Hilkens

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FOOD INSIGHTS
supply chain solutions

FoodInsights supports food companies in (1) ensuring the quality and sustainability of the products they are buying, (2) to finance the goods they are buying and storing, (3) to forecast production and demand combined with optimization to maintain the financial health and (4) to do the storytelling of their products from farm2fork. With our supply chain solutions we combine the creation of consumer trust to promote sales with maintaining a grip on the costs and improve sustainability.
The data driven approach provides the quantitative decision support for managers of farming and food companies.

A client case can be found on https://foodinsights.nl/data-driven-storytelling/

FoodInsights is located in the Netherlands has a strong focus on food supply chains.

**Gearbox Innovations**
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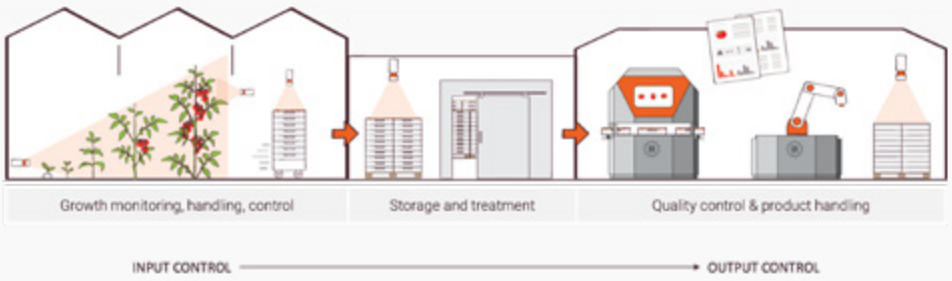


GEARBOX
work smarter every day

The next generation of horticultural workforce. Gearbox Innovations is enhancing growers, breeders & traders to safeguard quality and to work smarter every day. Gearbox sets new quality standards in monitoring, grading and control by converting data & insights into efficient crop, fruit and flower handling through AI and Robotics.

Gearbox develops, designs and builds advanced AI and data savvy machinery & equipment to enable the hortibusiness, food and agriculture to have the highest possible degree of control over their product quality. The integrated solutions based on vision, sensoring, AI and robotics, consolidated in our data driven cloud platform, makes Gearbox a data driven technology company.

We create insights by real time growth monitoring and growth forecast, secure quality by post-harvest inspection, reduce risk and save operational costs to create the highest level of control and consistency for our clients.

**Hak&Partners B.V.**
Jan Hak

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Hak&Partners contracts and executes projects and assignments including feasibility studies and trouble shooting in the area of agricultural development and food preservation for selected clients. Services rendered include sector studies, design and specification, project management, technical and technological assistance respectively training. Hak&Partners acts also as contractor for the execution of turnkey projects in specific cases.

The development of Hak&Partners has much to do with the accumulated know how, networking and experience of its owner and partners. Hak&Partners was established in 1992 and references worldwide are proof of Hak&Partners abilities. Hak&Partners is member of the QuaTerNes Group (www.quaternes.nl).

Today, Hak&Partners is active in contracting as well as design, engineering and construction of potato, fruit and vegetable processing plants. The organization has a team of specialized project managers, designers and coordinators with various backgrounds, dedicated to the food processing industry.

**Hol Spraying Systems**
Hendrik Hol

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Orchard sprayer manufacturer with focus on GPS and sensor spraying. We have developed and certificated our H.S.S. ISA spray Techniek for maximum deposition and minimum spray drift. In 2022 we are on the market with the first fully unsupervised autonomous self-propelled orchard sprayer.

**Impact IoT Solutions**
Pieter Hoenderken

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IMPACT has many years of experience in Internet-of-Things (IoT) solutions development for Data-Driven agri-tech, smart-logistics and building infra/utilities and offers end-2-end solutions design and -services like: smart Devices, Connectivity, Portal, Dashboarding & API services.

Develop new models for 'predictive analytics', to grow from 'Hindsight' (what happened?), via 'Insight' (why did it happen?) to 'Forsight' for 'what will happen'? This often requires multiple (external) inputs to be added to sensor data.

Improve efficiency of current operations or generate new revenue streams by Remote Sensor/System Monitoring, -Control, Analytics and Alerting incl. integrated Dashboarding, AI/ BI Using IoT strategies. Often even 'analogue' systems can be connected!

In order to have sufficient potable water for people and animals in the future, we have to act now. We must provide insight into the consumption of water in order to prevent it from being wasted. It is essential for animals to drink enough water. The use of intelligent water meters can provide this insight.
A number of pig farms have installed intelligent water meters in their stables, which provide insight into the amount of water consumed by the animals. Depending on the weight of a pig, it drinks an average of 8 - 20 liters a day. The insight into water consumption also provides insight into the health of the animals.

**Innoveins Seed Solutions B.V.**
Niels Peeters

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Innoveins Seed Solutions B.V. is a company who is focusing in providing support and research programs on seed technology for the crop protection, seed and field services industry.
We combine knowledge of coating, priming and phenotyping with high tech facilities to support on specific seed technological challenges and product development.

**Inventeers Research & Development B.V.**
Jasper Neuteboom

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Inventeers is an engineering company with almost 50 engineers. We develop and produce applications for other companies. We are a specialist in developing smart technology for both plants and animals applications. To develop successful applications, knowledge of both plants and animals and technology is required. The technical possibilities are endless. Inventeers has already conducted projects in the field of precision agriculture and vertical farming. But Inventeers does more.

In more and more projects we use vision technology. With cameras and sensors we collect data on plants and animals. We analyze this data, with or without the help of artificial intelligence, and use it to optimize the process. A link to the internet ensures that the results can be followed anywhere. Examples include the sorting of plants according to future length or the sorting of potatoes according to quality. We use sensor data to determine the yield per piece of land during harvesting. We also use sensors to determine abnormal behavior of cows so that we can detect diseases early.

**JASA Packaging Solutions**
Denise Baths

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JASA represents innovation. Thinking out of the box is our second nature, a trait that enables us to offer our customers innovative and smart packaging solutions. We also bring in our 35 years of experience as a system integrator; in that position, we assume full ownership for your complete packaging process. We will handle it all. From product infeed to weighing to (robotized) filling and closing the packaging. While designing our packaging solutions, JASA always keeps the environment in mind. We believe it is crucial to reduce plastic packing materials and reduce energy consumption while creating maintenance-friendly systems.

**KNAP Automation**
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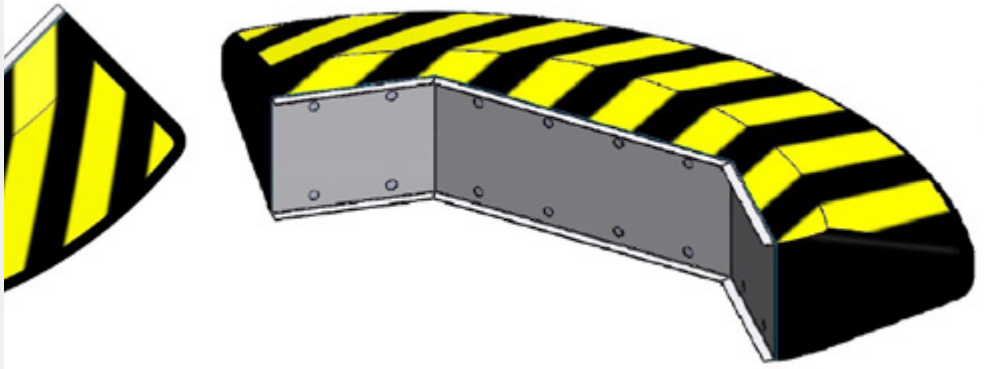

KNAP Automation is specialized in ASO Safety sensors. We deliver 'standard' material but are also capable of making customize solutions for the customer's needs. The sensors are used for/at; AGV's, Feed Pushers, Adjustable work platforms, Lifting vehicles, Vertically and horizontally moving parts, Conveyor belts Scissor Lifts and many more applications.
With the ASO sensors people and their surrounding can be protected against impacts and entrapment.
Safety Bumpers: The individually designed foam cores gently buffer during overtravel and the integrated sensor in the SENTIR bumper ensures fastest reaction paths.
SENTIR Edge: The contact edges have a patented double chamber system that offers unsurpassed protection from external influences. This is due to the internal switching chamber with integrated sensor element that ensures optimum cycle times and continuous process stability. The simple handling of the innovative KS4 Plug'N'Sense system means a significant minimization in production downtime, procurement and storage is achieved.
SENTIR Mat: Safety Contact Mats are equipped with a structural surface and laminated section sensors, the SENTIR mat safety contact mat protects and detects. Easily integrated into any environment to protect from danger or injury.
The mission of KNAP Automation is to provide (tailor-made) high-quality solutions that meet the wishes of the customer. We may also be able to help you with your problem and come to a good solution together. If you would like to have more information, feel free to ask.

**KSE Process Technology B.V.**
Nathalie Melis

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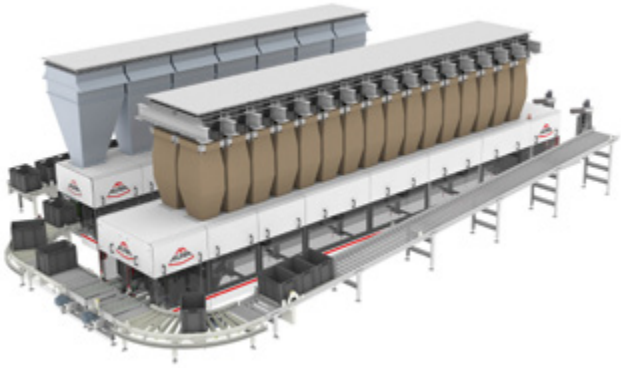

From flour to salt, vitamins and minerals: animal and cattle feed can contain up to 50 raw materials. KSE's machines, process lines and smart software ensure that all the ingredients end up in the end product quickly and in the right dosage.

KSE Process Technology (founded in 1973) is a world player in the field of dosing systems, weighing systems and automation software for the feed industry, pet food industry and premix industry. KSE excels in modular solutions for issues with a high degree of customisation.

KSE is a supplier of ALFRA dosing and weighing systems. The machines with which animal feed producers can measure each product safely, flexibly and efficiently. They are machines for each step in a process: from the intake of raw materials solutions to the dispensing of a finished product.

KSE has incorporated its many years of expertise in the field of production processes in the animal feed industry into the PROMAS automation software. This software guarantees greatly simplified management, operation and maintenance - for both simple and complex factory layouts.

**Kubota Holdings Europe B.V.**
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Kubota has been a leading manufacturer of agricultural, turf and construction equipment and Industrial Engines since 1890. With world Headquarters in Osaka Japan, and offices in more than 120 countries, and with over 41,000 employees throughout North America, Europe and Asia, Kubota achieved revenues in 2020 of $17.3 billion. Although agricultural equipment is Kubota's primary line of products, Kubota also produces a diverse portfolio of other products including city wide water filtration systems, irrigation, piping, roofing, housing and large underground valves.

Our mission 'For Earth, For Life' speaks of our commitment to the preservation of the Earth's natural environment while aiding the production of food and water supplies that are vital to societal needs as our world population continues to grow. That mission is realized each time a Kubota tractor harvests the land to produce life-sustaining food or our construction equipment excavates to transport water resources or provide shelter. For more information on Kubota, please visit www.kubota-global.net or www.kubota-eu.com.

**Logiqs B.V.**
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The name Logiqs stands for logistics quality systems. With more than 45 years of experience and know-how, gained in the field of internal transport and logistics systems for greenhouses, automated warehouses and vertical farms, our industry leading solutions help our customers to achieve a higher profitability and a stronger competitive position within the worldwide marketplace.

Our company is active in 3 main industries: Horticulture, Hydroponic vertical farming & Warehouse automation. In our company the following mission stays central: Accelerate Access to Honest Food.

We advise, design, produce and install complete logistics systems that solve our customers' logistics challenges while providing an unparalleled level of control through our industry leading control and registration software.
By working closely together with our customers, we always want to offer an highly reliable service, as well as intelligent solutions for all logistics automation problems that our customers encounter.

Our Vertical Farming solution is the Greencube. A unique, modular vertical farming system which provide every grower a stage in there production process. Our solution is widely used for microgreen, leafy greens, herbs, propagation and floriculture. We closely working together with clients to improve our solution.

**MoveRTK**
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MoveRTK is the standard for reliable, precise and brand independent GNSS RTK-signals across the Benelux.

Supporting all modern GNSS (GPS, GLONASS, GALILEO and BEIDOU), MoveRTK's corrections signals allow accurate steering and machine guidance with 1-2 cm accuracy, 24 hours per day. MoveRTK is therefore a small but vital component for precision and smart farming. It is also one of the bases for the development of robots and precise use of drones in agriculture and construction.

**MTA B.V.**
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MTA develops and produces high-tech mechatronic systems in series. Our customers are renowned Original Equipment Manufacturers (OEMs), scale and start-ups in various markets.

We develop mechatronic products in such a way that they can intrinsically be produced in series, at a pre-defined price point, at a pre-defined quality level and with the shortest time-to market. Our unique 'V²-way of working' enables viable business cases. This is how we make a difference in the world of mechatronics.

We know how to connect customers, development, engineering, supply chain (partners) and production (partners) in such a way that effective and efficient collaborations are created. As a network director, we create mechatronics.

We know what is going on within Agrofood robotics. MTA has been an early entrant in this market and has been delivering economically viable business solutions, not just prototypes or proof of concepts. We know how to combine our knowledge and experience of robotics with the needs of the agricultural markets. The application of robotics makes a significant contribution to the efficiency of handling and harvesting locally grown crops, and thus, to the alleviate scarce availability of personnel in agriculture and horticulture.

**Oceanz B.V.**
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For the food sector, it is more important than ever before to be able to switch quickly, to adapt processes and to seize opportunities. Within the sector, the demand for smart industry is also increasing, with a growing role for 3D printing. Because only 3D printing materials that are intended for food contact and certified for food safety may be used for 3D printing of food applications, professional 3D printing company Oceanz offers the option of 3D printing through EC 1935/2004 certification.
In order to deliver a food-safe 3D printed product, the material must be suitable according to the requirements of EC 1935/2004 and produced in accordance with the EC directive 2023/2006 (Good Manufacturing Process).
The material is therefore safe for production with consumption purposes or may come into contact with food. Oceanz 3D printing processes are designed to comply with these regulations. The processes are included in the quality system and validated by external accredited parties. These testing facilities will adhere to various government-mandated risk tolerances and approved substances.
The choice to opt for 3D printing within the food tech industry offers advantages such as design freedom. Think of the production of custom parts and complex or organic shapes. This, in particular, can be very attractive for food-related applications. It also enables small stocks and ensures rapid development from prototypes to functional parts. Some application examples: grippers, nozzles, machine parts, prototypes, robots, and drones. Oceanz Food Grade is also well applicable within the AgriTech sector.

**Odd.Bot**
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The Weed Whacker is the solution for the biggest problem farmers face at the moment: weeding. The Weed Whacker is the solution for weeding and thereby reducing the use of chemical herbicides and manual labor. The Weed Whacker can work day and night to remove weeds and improve the efficiency of producing healthy food in a sustainable manner.

Odd.Bot is a new technology startup, an advocate of sustainable farming and aims to enable 100% organic farming on a global scale. Advanced AI based image recognition models allow the GroundBot to distinguish weed from the crops and mechanically eliminate it, 100% herbicide free. Not only will Odd.Bot increase the yield of the farm, it will do so while reducing costs and without emitting CO2 or compressing the soil.

Odd.Bot develops a lightweight, AI based, electrical robot that will be able to autonomously navigate, detect, and mechanically remove weeds in the crop row and between plants.

Odd.bot provides an autonomous mechanical weeding robot equipped with a mechanism in the center of the robot, then extends down to extract weeds as it moves. Cameras and sensors keep the robot on task and away from growing crops, regardless of row width. The Weed Whacker reduces the use of manual labor and chemical herbicides, increases the yield, and contributes to a more sustainable farming culture.

**ProPhyTIS B.V.**
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ProPhyTIS, established in 2015 aims to promote international application of the ProPhyTIS technologies worldwide. The ProPhyTIS system, together with its international partner network offer a competitive edge in many foreign markets.

Our aim is to contribute to World Food Security, by supplying multiplication technologies worldwide in selected areas, using the most novel and proven knowledge. Thereby ensuring healthy produces and take into account the environment.

Our priority: Potatoes and Fruit Trees.

**QING Mechatronics B.V.**
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QING consists of a dynamic team of 80 inventive engineers, consultants, project managers and advisors.

From an unstoppable curiosity, we provide innovative and sustainable solutions for a large number of clients in agri and food. We find answers by continuing to ask questions and help you with solutions that take you further. We provide access to technological expertise and innovative power. In this way we not only solve complex problems or capacity issues. This also gives you a strategic advantage in your market. Our engineers find answers by continuing to ask the right questions. Dissect to the core and make new connections from there. Linkages that lead to inventive solutions that enable real progress.

**R&R Systems B.V.**
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R&R Systems is a manufacturer and supplier of sustainable energy systems allowing government, businesses and individuals to save a great deal of energy, and subsequently make a valuable contribution to the conservation of the environment. We devise and integrate sustainable corporate and residential solutions with energy concepts developed by us. Our energy concepts are based on geothermal energy (geothermal heat), solar energy and heat and cold storage. We have all the specialist skills in-house, which means we can deliver turn-key projects, and you only have to deal with one party.

Our sustainable energy systems are suitable for a wide range of customers and uses, such as: residential and non-residential buildings, the recreation sector, the agricultural sector, industry and private individuals. It is no coincidence that R&R Systems is known as De energieverdieners (The energy earners). R&R Systems is active in various segments within the agricultural sector. An important contribution can be made with reducing thermal energy with technologies such as heat recovery and heat pump technology. Our PVT-panels can have a large contribution in solving this problem.

Power profit solar panels for: Cattle farming, Fish farming, Horticulture, Industry, Non-residential and recreation, Pig Farming, Poultry farming, Private individuals, Residential housing.

A panel with two functionalities. It not only generates electricity through solar energy, but also extracts heat/cold through the R&R heat exchangers. Makes a perfect match with heat pump technology.

**Saia Agrobotics B.V.**
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Every nation should have access to local, high quality fresh produce. The demand of healthy fruits and vegetables is increasing rapidly worldwide because the expanding middle class and population growth. Meanwhile in open field farming, climate change and the depopulation of farming areas are already having a large negative impact on yields and food security.

Indoor Farming offers a controlled climate and protection from the changes outside. It brings a solution to the increasing global water scarcities by using drastically less water. Yields are typically higher too, so less land has to be used.

However, scaling up Indoor Farms around the world is not as easy as it seems. A local, reliable pool of quality workers is needed, which is increasingly hard to come by. Also, to control such a farm, a lot of expert knowledge needs to be learned.

SAIA aims to support in those needs such that indoor growing becomes accessible everywhere. We need robots to help the workers and we need A.I. to empower the growers in controlling their farms optimally.

Through SAIA we will help transition to Autonomous Indoor Farming. For better food security, better jobs and more healthy vegetables for everyone.

**Sentech**
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Sentech makes customers' machines smarter through our passion for technology. Our sensor experts develop smart sensor solutions together with our customers. These are sensor issues that the large-scale sensor manufacturers cannot solve with standard products from their catalogs. We develop robust integrated sensors for manufacturers of heavy-duty machinery, large agricultural vehicles, and big installations that have to continue operating under harsh and changing (weather) conditions. Reliable, durable sensors are essential under such circumstances.

Our sensor experts use specific operating conditions as the starting point for developing sensor solutions. Depending on these circumstances, sensors must be able to withstand large and sudden temperature variations, chemicals, salt, dirt, mud, moisture, and tremendous forces. With integrated sensor solutions, we enable our customers to considerably reduce downtime and repair costs.

We supply suitable sensor integrations in the form of sensor assemblies, including wiring, electronics, connectors, casing, and mounting accessories. These sensor solutions are robust waterproof, dirt-proof, and chemical-resistant end products that can be installed effortlessly.

**Sieplo**
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Sieplo, manufacturer of innovative precision feeding systems, has introduced the Sieplo feeding robot into the market for the precise feeding of calves, goats, and young cattle. The result is; less feed loss, less residual feed, more use of residual flows, savings on fuel costs and labour, and healthier animals. This responds to sustainability and circularity in the agricultural sector.

Sieplo wants to launch FEEDR 2.0 in the near future. The Feedr will be used more broadly as the extra eyes and ears of the farmer. Sieplo wants to measure the stable climate in addition to measuring the barn climate and detecting health problems in animals.

The Sieplo Smart Feed and Indicate System plays a central role in measuring animal growth and animal health, administering the correct amount of feed, possibly supplemented with the necessary required vitamins, minerals or medicines, and minimising feed waste. In addition Sieplo would like to provide a data platform where the different data of feeding, climate, animal health, but also external factors such as weather influences, are combined.

**Spectro-AG B.V.**
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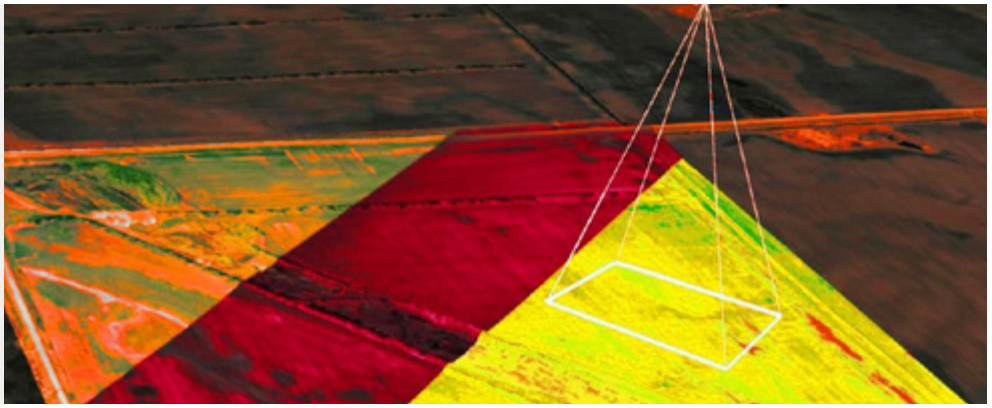

Spectro-AG

Spectro-AG B.V. is a knowledge-based startup that focuses on research and development of solutions based on hyperspectral sensing, artificial intelligence (AI) and drone solutions for precision agriculture, especially grass farming. We have developed a compact drone hyperspectral (hardware and software) solution, called HyperSlit, to acquire, qualify and process big data about grasslands in (semi) real-time. Unlike available drone hyperspectral system in the market that are expensive (~100K Euro) and complicated, our HyperSlit (~20K Euro) is affordable and automatic for generating georeferenced maps about crops traits such as protein and fiber content in grasslands. This information are immediately available after flights over farms and it can supports farmers and contractors to improve their management practices such as grass manuring and mowing as well as soil treatments.

**STALMEESTERS**
Christine Tuch

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STAL MEESTERS

Together for a future with perspective. Livestock farmers can maintain this movement by using modern techniques such as platforms and sensor techniques from Stalmeesters. This allows them to continue to influence their future.

Influence : By speaking and communicating with the other stakeholders with substantiated facts.

Farmers can collect data themselves with Stalmeester's technology and then discuss it with colleagues and stakeholders.

**Stienen Bedrijfselektronica B.V.**
Janneke Stienen

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Stienen BE Agri Automation: Stienen BE is a leading family company (1977) which has strong roots in the livestock farming. By nature we are very close to the farmer. We are a global supplier of innovative automation solutions for poultry and pig farms. Climate solutions, automation systems, management software and peripheral equipment are developed and produced in-house.

FarmConnect: Stienen's innovative Cloud Computing system. You can access your farm data from anywhere in the world by means of the IP-485 gateway. All management information from the process computers is stored in the cloud at the data center. You can use an SSL-protected web browser to logon to the cloud and access your farm data. This data, which may concern different locations, is centralized to give you a comprehensive overview. Customer-specific user screens ensure rapid and easy implementation of the new system. FarmConnect lets you control your farm without any problems, wherever you may be.

**VBTI Consultancy B.V.**
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VBTI is an artificial intelligence engineering company. The company developed and patented a generic vision module for measuring plant morphology. This product can be integrated in agrirobots or used stand alone as plant monitoring sensor. Currently, the technology is used for a cucumber plant deleafing robot, measuring cucumber plant leaf area, counting strawberries and detecting asparagus.

**VDL Cropteq Robotics**
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VDL CropTeq Robotics stands for automation in (greenhouse) horticulture with a focus on autonomous robotics and high-tech equipment in the treatment of crops.

Providing solutions as alternative for labor shortages is our number one priority, bringing together vision, robotics and crop knowledge to transform the future of Agriculture and FoodTech. We do this off course with partners and the growers.

Our goal is ambitious: we want to give automation in horticulture and agriculture an innovation boost to improve performance, reduce costs and produce food safely.

Robotics, especially for labor-intensive applications, such as leaf cutting and harvesting in high wire cultivation for cucumbers or tomatoes.

VDL has a unique position of knowledge and experience in mechatronics, robotics and AGVs. We also have a very varied track record in the automation of mass production. All this makes VDL an interesting partner for growers with their knowledge of crop cultivation.

These competencies, in combination with the state-of-the-art vision and artificial intelligence, make it possible to automate the work in a greenhouse.

**Vencomatic Group B.V**
Victor van Wagenberg

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Vencomatic Group represents well-known brands in the poultry sector: Vencomatic, Prinzen, Agro Supply, Van Gent and Rondeel. Combining these brands we offer a full range of innovative systems for equipping modern poultry farms all over the world.

Vencomatic started with a breakthrough innovation for breeder housing: the first automatic breeder nest. After this success the development of innovative products continued and Vencomatic grew out to a well-known brand for sustainable and poultry friendly housing equipment. Prinzen offers complete solutions in egg handling equipment; from simple on-farm egg packers to complex egg & tray handling systems for hatchery applications. The Agro Supply systems offer climate solutions to control the climate in the house at all weather conditions with minimal energy use, reducing emissions of ammonia, fine dust and CO2. The Van Gent brand stands for high quality and durability. The products are designed with a balance of operating efficiency and promoting natural behavior of the birds. In the Rondeel, chickens are kept with great care for animal welfare and the environment, based on all the natural needs of the chicken and with attention for low environmental impact.

**Winterwarm Heating Solutions B.V.**
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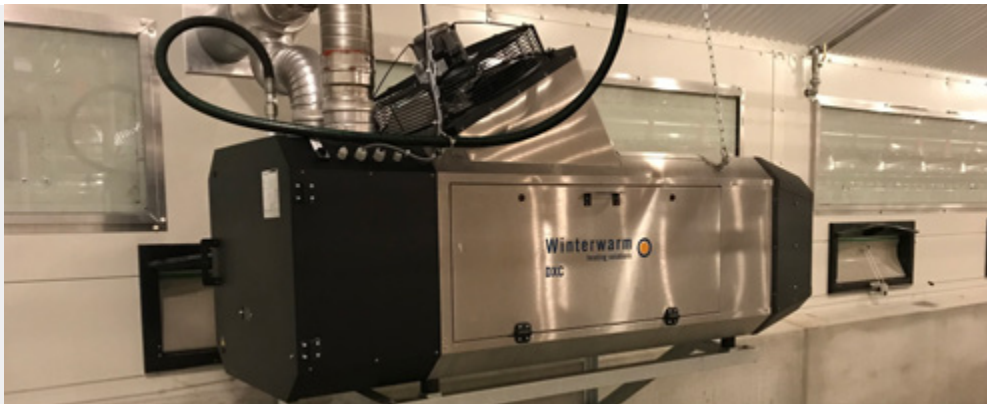


Today Winterwarm is one of the leading manufacturers in the industrial and agricultural heating market throughout Europe. In 2008 we became active in the agri heating market. Since then we have developed a whole range of different types of heaters for poultry houses and green houses, mainly gas fired (one model oil fired). Meanwhile we have sold our heating systems throughout the whole world and Winterwarm has become one of the main suppliers of gas fired heaters for poultry houses.

We have our own R&D department which develops new products and improves existing ones. Our goal is to provide our customers with reliable products of high quality for a reasonable price. Before any heater leaves our factory, it is always submitted to an extensive final test. Another focus of Winterwarm is to offer adequate support to our dealers in all countries. This means advice on selection of heaters, adequate order information and quick reaction to service requests. Besides that, our webshop provides clear information and quick delivery of service parts.

In short, Winterwarm is a successful international organisation which is happy to provide the heating for your poultry house or your glass house.

This is a publication by:
Top Sector Agri & Food and FME

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 This publication was edited by Willemien van Asselt (Top Sector Agri & Food), and Maureen de Haan (FME). Concept development, copywriting and design by Fortelle.

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Visit us at www.topsectoragrifood.nl/en.

Netherlands

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