

Annual Report 2025

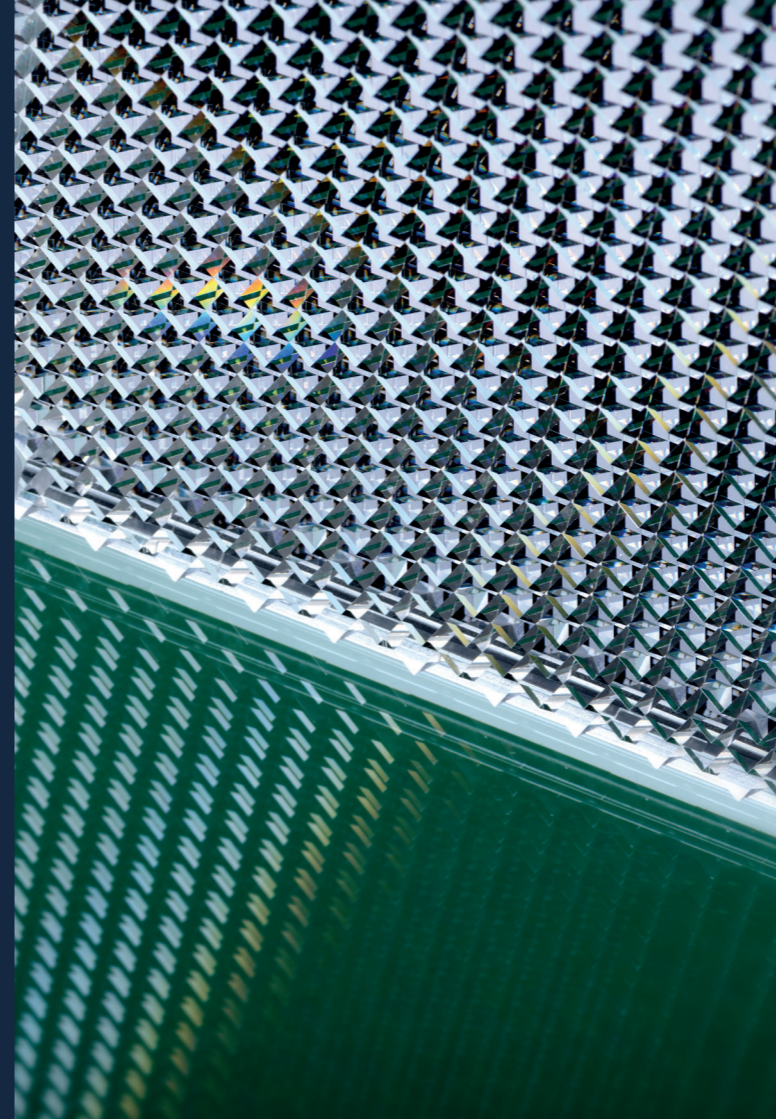
From **lab** to
daily life: where
chip technology lands



About OnePlanet Research Center

OnePlanet Research Center is an innovation center for chip and digital technologies in agriculture, food, health, and the environment, and is located in Wageningen and Nijmegen. It was founded in 2019 by microchip research center imec, Wageningen University & Research (WUR), Radboud University (RU), and Radboudumc. An investment from the Province of Gelderland made this possible.

Through groundbreaking innovations at the intersection of agriculture, food, health, the environment, and technology, OnePlanet contributes to solutions for major societal challenges, such as the nitrogen emissions issue and the growing capacity strain on the healthcare system. In this way, OnePlanet combines the domain expertise of WUR, RU, and Radboudumc with the deep-tech expertise of imec. By working closely with companies and societal organizations, solutions can reach the market and end users more quickly. This ensures maximum societal impact.



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F.l.t.r. Richard van Wezel, Gülden Yilmaz and Chris Van Hoof

Foreword

What started with big plans in 2019 became a **reality** in 2025: many innovations from OnePlanet Research Center came to fruition. In 2025, we demonstrated that the ingestible sensor pill, the smart toilet seat, and the nitrogen measurement equipment are feasible and scalable innovations. Market development processes have been launched for all three. This marks the final step from the lab to real-world application, and we are exceptionally **proud** of these achievements. Especially given the short timeframe —by innovation standards— in which this was accomplished.

Of course, an innovation doesn't just come to fruition overnight. Over the past six years, we have researched and developed various **digital** and **chip technologies**, ranging from sensor technologies to AI and data platforms. We translated these into applications in healthcare, agriculture, and the environment, by developing prototypes and testing their effectiveness. Rapid **developments** in photonics led to a “growth spurt” in our work in 2025, resulting in mature innovations. Photonic chip technology is the key technology that enables **affordable** volumes and scalability.

In addition to letting go—which happens when bringing innovations to the market—maturity also involves **exploring** new frontiers. If our technologies and applications can contribute to major challenges such as improved health (care) and nitrogen reduction, what else is possible?

That's why we're actively exploring **new applications** and **new markets**, keeping the recently published Wennink report in mind. After all, the key technologies we're working on are crucial to the Netherlands' **competitiveness** and to solving countless societal challenges.

After six years of development, OnePlanet Research Center has everything it needs to make a substantial contribution to this effort. We have broad knowledge of **key technologies** and how to translate them into **concrete applications**, a team of talented experts, a firm anchoring in the network of our four founding partners, and we are being sought out for major public-private projects. With the right mix of key financing instruments, from direct clients and major partnerships, to venturing and innovation grants, we are ready to go!

The management team

[Chris Van Hoof](#)

General Manager OnePlanet Research Center, imec

[Gülden Yilmaz](#)

Director AgriFood & Environment,
Wageningen University & Research

[Richard van Wezel](#)

Facts & Figures 2025

12

patents

36

PhD-students

23

scientific
publications

99

FTEs

19

mln total revenue

32

new
partnerships



Highlights



Klokhuis Science Prize winner

The Klokhuis Science Prize 2025 went to our smart toilet seat that monitors health parameters. Equipped with **chip-based sensors**, this toilet seat measures various health parameters, such as heart rate and weight, during a bathroom visit. In addition, the technology tracks bathroom habits, which is of great value for research into intestinal diseases as well as applications in elderly care.

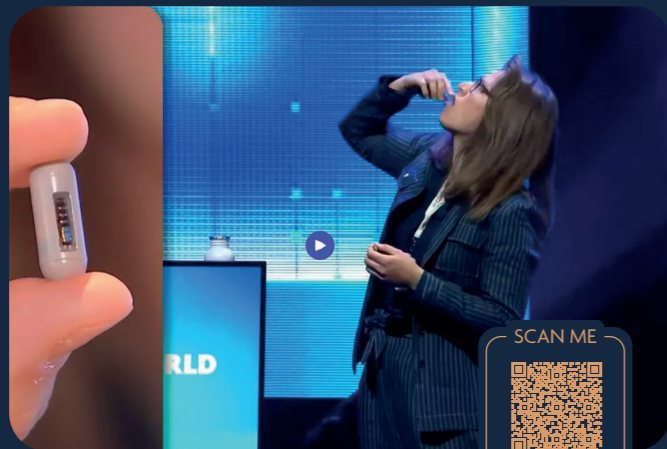
The research on the smart toilet seat, conducted by medical engineer Lotte Hazeleger and gastroenterologist Marjolijn Duijvestein of Radboudumc, was voted by children as the most interesting and relevant scientific project. During the InScience festival, Klokhuis presenter Janouk Kelderman announced the winner. More than 6,700 children cast their votes via the **Het Klokhuis** website. The show will dedicate an entire episode to the innovation in 2026.



Watch the episode of
Het Klokhuis about
the smart toilet seat.



Photo: Almicheal



Researcher swallows own research

At imec's flagship event, ITF World 2025 in Antwerp, researcher Aniek Even swallowed the smart sensor pill live on stage. The pill is 2.1 cm long and 0.75 cm wide, three times smaller than existing smart capsules. More than **2,000** people watched as the pill entered her stomach. The measurements could then be followed live on a screen. The sensor measures the redox balance, pH level, and temperature as it moves through the body. The response to the live demonstration was overwhelming. **Flemish Minister-President** Matthias Diependaele was impressed, and there was significant attention from the Dutch and international press.



Listen to the BNR podcast about the smart sensor pill.

PIC Summit Europe

At PIC Summit Europe 2025, organized by PhotonDelta, three OnePlanet demos took center stage:

- Gas sensing: A **photonic gas sensor** was shown that is capable of accurately measuring gases such as nitrogen. This is useful, for example, in environmental monitoring and agricultural applications, where continuous insight into air quality and emissions is essential for sustainability.
- Food processing: This demo demonstrated how sensors and digital systems can measure and control **product quality** in real time. This makes production processes more **efficient** and can reduce waste in the processing of food and protein-rich products.
- Biosensing at home: Biosensing solutions demonstrated **how personal health technology**, such as smart sensors, can be used to enable at-home measurements, such as monitoring health or lifestyle factors outside the hospital.

SCAN ME



Three mature innovations

Ingestible sensorpill: from an idea to an emerging venture

2025 was a remarkable year for the ingestible sensor pill: Nature Electronics published the first study using the pill in healthy adults, another study involving **patients** with chronic inflammatory bowel disease began at Radboudumc, and—last but not least – OnePlanet took steps toward launching a venture based on the ingestible sensor. An entrepreneur-in-residence conducted market research, drafted a **business plan**, and created a compelling pitch for investors. In just six years, the pill evolved from a first prototype to a budding venture, thanks to strong collaboration among all founding partners.

The ingestible sensor pill can **provide insights** into digestive processes in both healthy individuals, such as elite athletes, and patients. It may also offer patients diagnosed with intestinal disorders insight into inflammatory processes in their intestines, potentially preventing costly and painful internal intestinal examinations. Patients can swallow the small pill, and the built-in sensors measure various values in their intestines, such as pH, redox balance, temperature, and transit times through the stomach and intestines. The **data** is then transmitted to a portable device for further analysis using AI and to provide information for treatment decisions.

SCAN ME



Nitrogen measurement equipment makes target-based management feasible

The nitrogen monitoring equipment for **target-based management** is another OnePlanet innovation that came to fruition in 2025. In target-based management, farmers measure their own farm's emissions and adjust processes where necessary to meet the set targets. In just a few years, OnePlanet established itself as an indispensable supplier of data on the nitrogen emissions issue with this equipment. In 2025, this led to funding for the follow-up project "SightSense," financed by the Ministry of Agriculture, Fisheries, Food Security, and Nature, and the Province of Gelderland. The goal of this project is to develop photonic sensor systems over a two-year period that enable **affordable** and **scalable** measurements of methane (CH₄), ammonia (NH₃), and carbon dioxide (CO₂) in livestock barns.

Current measurement equipment is already light-based (photonics); thanks to **photonic chip technologies**, OnePlanet can create a miniaturized, on-chip version of this. This leads to more affordable, reliable, and **practical sensors**. The potential of the technology extends beyond the barn. The goal is to enable continuous, real-time measurement on and around the farmyard and eventually even in nature reserves.

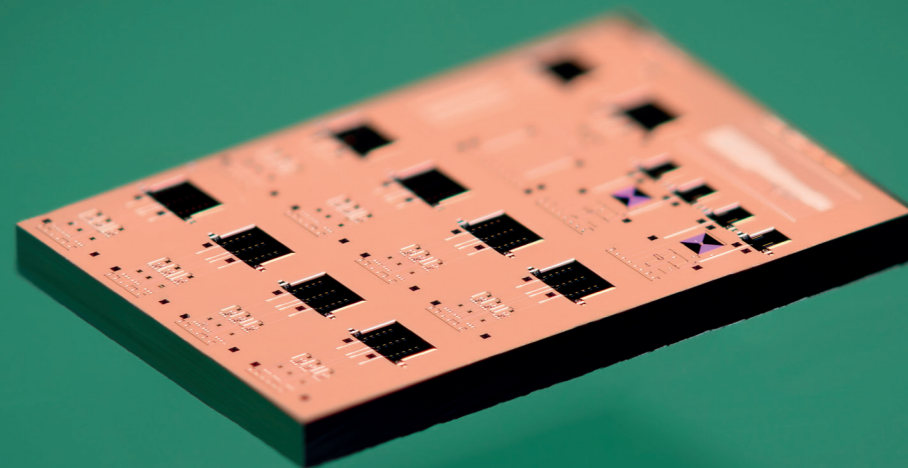


Following a successful pilot at the De Marke Agro-Innovation Center, an innovation farm of Wageningen University, the measurement systems will be installed in multiple barns in 2026, and the underlying technology will be further developed.

Share research data quickly & easily

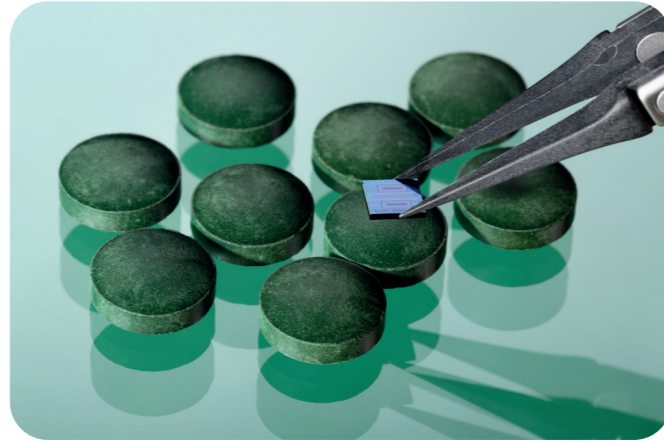
What was still a Proof of Concept in 2024 grew into a fully-fledged component of the Radboud Healthy Data program in 2025: the Healthy Data Portal. OnePlanet developed a **platform** where Radboud University, Radboudumc, and partners can easily share research data with one another. Because the data is sensitive, downloading and accessing it must be contractually agreed upon, which is no simple task. On this platform, researchers are guided through the steps toward such a contract.

This saves researchers a lot of time and gives them access to **data** that would otherwise be unavailable. As a result, they can reuse data more easily and thus do not need to conduct as much preliminary research. During the COVID-19 pandemic, it became clear how important this is, for example, when new vaccines had to be developed quickly. Although the program currently operates only within the Radboud environment, the plan is to roll out the portal nationwide. The possibilities for doing so will be explored in 2026. The technology will be further developed.



Towards new applications and domains

The maturity of multiple innovations by 2025 marks the culmination of OnePlanet Research Center's work. At the same time, it is just the beginning. Now that the underlying technologies have proven effective, they can solve many more societal challenges. As mature innovations are transferred to the market, OnePlanet is therefore actively exploring **new applications** and **domains**. Time for a sneak peek!



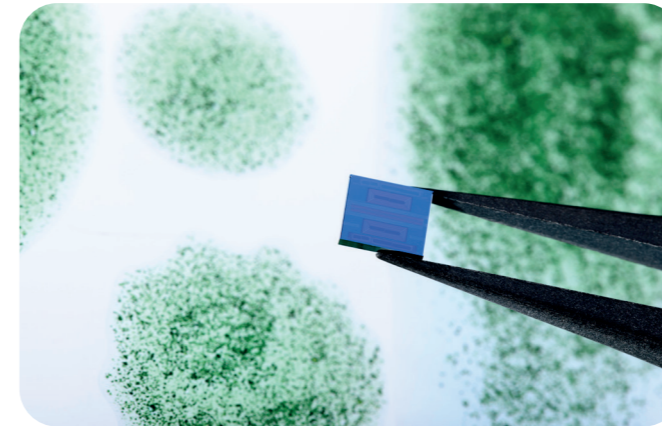
New Raman technology

One of these promising technologies is **Raman** spectroscopy. This is an optical technology that uses **laser light** to identify the chemical structure and composition of materials. Traditionally, this is done using large spectrometers and powerful, dangerous lasers, which is why the technique is primarily used in laboratories.

In 2025, OnePlanet introduced an innovative approach in which the spectrometer is replaced by a simple photodiode and an optical filter, and the conventional laser is replaced by a laser that quickly switches between multiple wavelengths. This can make the system **smaller**, **cost effective**, and **more accurate**, and because it uses safe laser light, more suitable for everyday applications. Think, for example, of at-home measurements for early disease detection or the optimization of bioprocesses in food production.

Measuring the composition and structure of food in real time

The composition of food can also be measured using Raman spectroscopy. In addition, texture can be measured using **Speckle Sensing**, another optical technology, that can also be used to measure sap flow in plants just as it can be used to measure vital signs such as heart rate in the human body. By measuring texture inline (directly in the production process), samples no longer need to be sent to the lab, and processes can be **adjusted** immediately. This prevents food waste and improves efficiency, through energy savings for example. After several demonstrations to potential customers, OnePlanet aims to make this technology ready for industrial use and to explore additional **applications**. For example, it is also suitable for measurements in materials such as paint or shampoo.



Bacteria as measuring tools

Another **promising technology** is that of living biosensors, or bacteria that can be used to perform measurements. OnePlanet is exploring their application in open water (for detecting contaminants) and in bioreactors where, for example, vaccines or new proteins are produced. "Conventional" **sensors** cannot measure in these types of complex environments with many different substances and contaminants, but bacteria can. By modifying the bacteria's DNA, they can emit easily measurable signals as soon as they detect the substances to be measured, for example by glowing. This makes continuous, real-time measurement in complex environments possible after all.

The technology itself isn't new, but the full integration of genetically engineered biosensors, the use of optical technologies, and **data processing** certainly is. OnePlanet is currently developing this into a new sensor prototype. Technically speaking, living biosensors could also be used in a swallowable sensor pill, but we're not quite there yet.

From robotic arms in greenhouses to humanoid robots?

In recent years, OnePlanet has also achieved impressive results in the field of **robotics**. For example, it has developed sensors that monitor the condition of greenhouse plants and transmit the data to a trained AI model that makes autonomous decisions regarding cultivation, such as when to water the plants. Such an autonomous greenhouse can be set up anywhere in the world for local food production. OnePlanet has also developed a robotic arm capable of autonomously pruning fruit trees.



Together with its founding partners, OnePlanet is exploring how the combination of **sensor technology** and **AI** in robotics can be applied more broadly, for example to facilitate interactions with people. A robotic arm that prunes plants is quite different from a robot that serves tea in healthcare facilities. This requires robotic systems that can navigate safely in a dynamic, human-centered environment, perform multiple and sophisticated tasks such as picking up a glass without breaking it, and interact with people, for example by seeing, hearing, and feeling. Europe is striving for independence in the necessary sensor technology and AI. With its low-cost and scalable miniature **chips**, our founding partner imec can, and wants, to play a key role in developing technology for these humanoid robots.

The Power of Collaboration

In short, there is no shortage of opportunities and explorations, but they can only make the leap “from the lab to everyday life” with sufficient funding and the right partners. **Collaborations** such as the Gelderland-based Lifeport Semicon are therefore crucial. Together with **companies, educational institutions, and government** bodies in the Arnhem-Nijmegen region, OnePlanet is working in that region to develop new products and services based on chip technologies. OnePlanet looks forward to continuing to make an active contribution to these kinds of exciting collaborations in the future.

Locations

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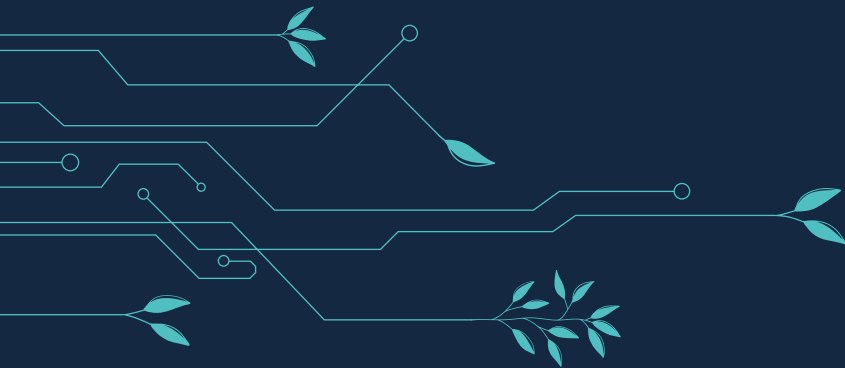
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