



Data science for food and nutrition security

Zero Hunger Lab toward a world without hunger



Bytes for bites

Hunger remains one of the world's most challenging problems. According to the United Nations (UN), as many as 690 million people will go to bed hungry tonight and every ten seconds a child dies somewhere in the world due to hunger and malnutrition. Tilburg University's Zero Hunger Lab wants to use data science to help ensure global food and nutrition security. We call this *bytes for bites*.

Sustainable
Development
Goals

2 ZERO HUNGER



Sustainable Development Goal 2: Zero Hunger

Countries worldwide have agreed upon 17 UN Sustainable Development Goals (SDGs). The second goal of the SDGs (SDG-2) is Zero Hunger, which states the following targets:



2-1



2-2



2-3



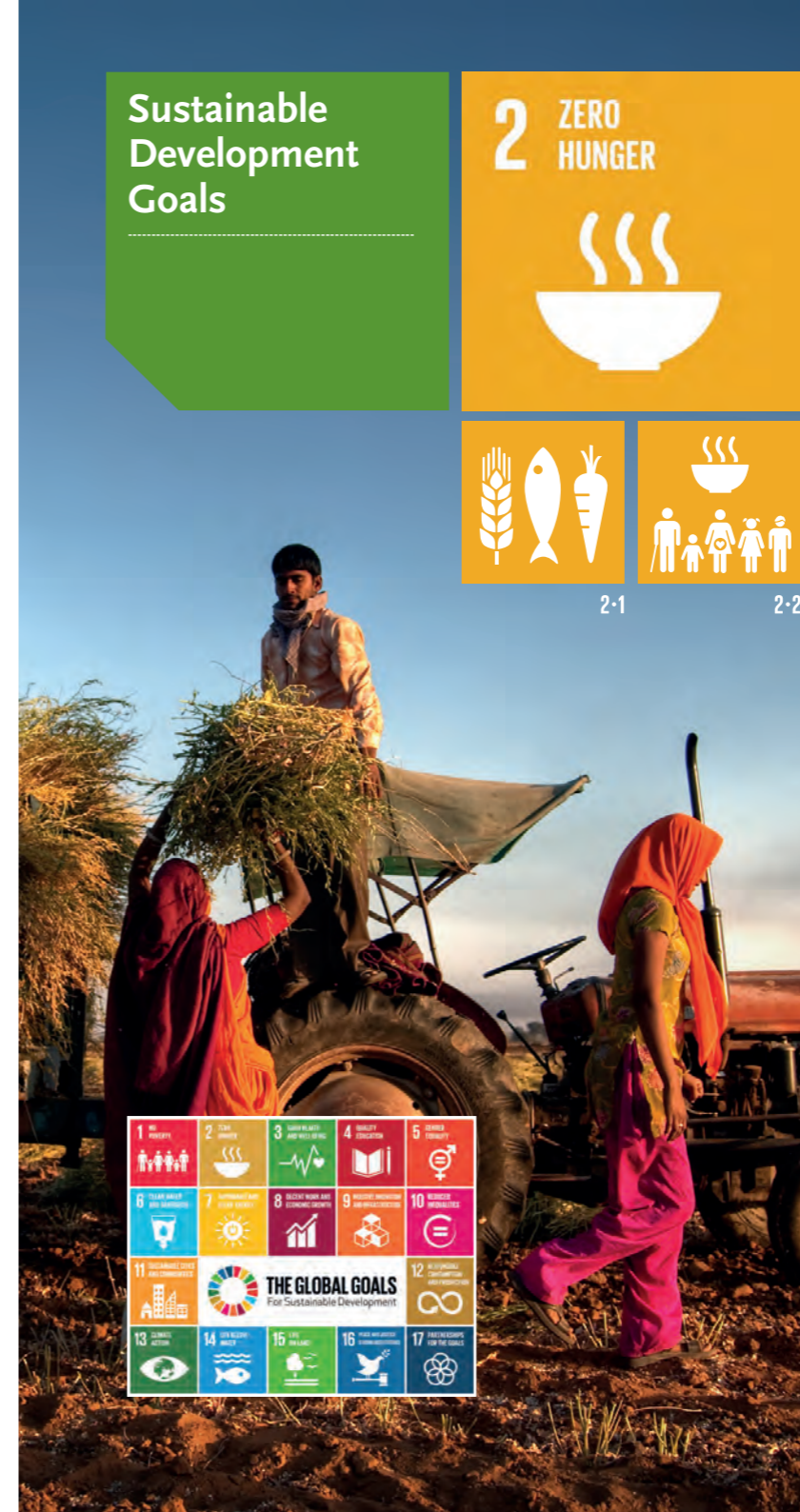
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2-5

- 2-1 By 2030, ensure safe, nutritious and sufficient food for all people
- 2-2 By 2030, end all forms of malnutrition
- 2-3 By 2030, double the agricultural productivity and incomes of small-scale food producers
- 2-4 By 2030, ensure sustainable food production
- 2-5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species.

Our food systems have to be fundamentally adapted over the next decade – of course in order to better help people in need when they are hit by war or natural disaster, but also to be able to provide more than 10 billion people with three healthy meals a day by 2050 within the planetary boundaries.



Data science for food security

Tilburg University's Zero Hunger Lab helps reach the five SDG-2 targets through data science. We do this by working together with aid & development organizations, government, businesses and knowledge institutions that are also committed to a world without hunger. We help them make better decisions in an increasingly complex world through smart use of mathematics and algorithms. In other words: How can you unlock the power of data science for a better world and a healthy planet?

Our mission is to make sure communities no longer depend on food aid, and empower them with solutions that help them reach sustainable food and nutrition security themselves. We do this not only in Africa, Asia and the Middle East, but also in the Netherlands, where more than 150,000 people depend on food banks for their "daily bread".

And we're doing it together!

In order to reduce the huge problem that is world hunger, more efficient and effective emergency food aid is required. In addition it is crucial to strengthen local capacities so that farmers, local businesses and communities can provide their own

sustainable food security and become independent of aid. It is therefore necessary to join forces and share knowledge, expertise and ideas.

The Zero Hunger Lab works with its own team to research and find solutions to the world hunger problem. There are more than 20 students and researchers from Tilburg University working in the lab. In addition to Tilburg University, the Dutch Ministry of Foreign Affairs is a strategic partner in the long-term research program of the Zero Hunger Lab. Research projects and knowledge-building are being planned or already implemented with many institutions such as:

- **Aid & development organizations:** *World Food Programme, Solidaridad, Welthungerhilfe, Food Banks Netherlands, Oxfam, Dutch Relief Alliance, Dutch National Operational Team-Corona, World Bank, One-Acre Fund.*
- **Knowledge institutes:** *INSEAD Humanitarian Research Group, Wageningen University & Research, Dutch Coalition for Humanitarian Innovation, Center for Frugal Innovation Africa, KU Leuven, University of Liberia.*



How you can help

Co-create

The solution to the food problem lies in cooperation. Help us as a strategic or project partner to achieve this. Sharing knowledge, data or joint research are among the ways in which this can be accomplished.

Donate

We cannot eliminate hunger and create sustainable food security on our own. In addition to knowledge and data, we also need financial support to continue and expand our research. Donations are therefore very welcome.

Participate in research

We are constantly looking for committed Master's students and PhDs – also from faculties such as Law, Humanities and Behavioral Sciences – who want to join our 'research forces' and fight Hunger

Visit www.tilburguniversity.edu/zerohungerlab to find out how you can contribute to solving the world hunger problem together with us.



Why Tilburg University?

Our lab is part of Tilburg University's *IMPACT program*, which connects scientists with social partners to make an impact together. After all, the joint efforts of all those involved – knowledge institutions as well as individual citizens – are important to further improve our complex society by means of knowledge and innovation.

Tilburg University is investing in data science with new educational programs, participation in the *Jheronimus Academy for Data Science (JADS)* in Den Bosch and further research, and by building a data science ecosystem with businesses and organizations in the province of Noord-Brabant.

We strive not only for new, better data science technologies, but also for transparency, reliability and honesty in the use of data. This is why we combine expertise in the field of data science with legal and ethical knowledge, as well as with knowledge of domains such as economics and logistics.



What have we already achieved?

Through co-creation with other knowledge institutions and aid and development organizations, we have been able to start more than twenty research projects. Some of them have already delivered impact, such as the *OPTIMUS* project. Others, although not yet implemented, have enormous potential, like the *Child Growth Monitor*. And yet others are in the draft phase, such as *ENHANCE* and *Under the Radar*. These too can make an important contribution to a world without hunger.

Read more about our projects at www.tilburguniversity.edu/zerohungerlab

OPTIMUS

OPTIMUS:

Solutions for more efficient food aid

The World Food Programme (WFP) of the United Nations helps people in crisis situations around the world. Since 2011, Professor Hein Fleuren and his students from Tilburg University have been helping WFP optimize their supply chain in crisis situations using data analytics. The intensive cooperation resulted in OPTIMUS, an innovative solution for more effective food aid that is now used by WFP in countries like Yemen, Syria and South Sudan.

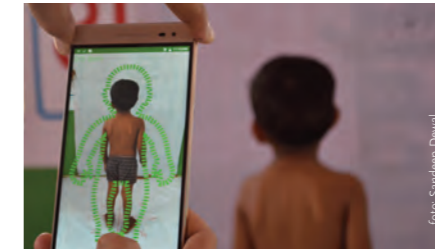
Based on the available data and smart algorithms, a mathematical model calculates the best way to organize food aid for a specific country or region. Models such as these implicitly assess millions of scenarios – more than our human brain can comprehend. The impact of these models is enormous: the better we organize food aid, the more people we can save with the limited budget available. Professor Hein Fleuren and several Master's students, including Koen Peters, developed the OPTIMUS model, with great results. Meanwhile, the use of data science has become common practice at WFP.

Concrete results:

- Thanks to the *OPTIMUS* model, in some cases up to 15-20% more people can be fed with the same aid budget.
- After successful use in many countries, the WFP will deploy the model in all its 80 countries.
- Koen Peters, PhD researcher of ZHL, now leads multiple optimization initiatives for the WFP.

Child Growth Monitor:

Fast, safe and simple measurement of malnutrition



Tilburg University's Zero Hunger Lab is working on the development of an AI algorithm that measures the level of stunting and wasting using mobile phone images. The algorithm will be included in an app of the German Aid & Development organization Welthungerhilfe to enable safe, simple and fast detection of malnutrition in children all over the world.

Approximately 200 million children go to bed hungry, according to FAO and World Bank statistics. Timely detection of malnutrition in children by means of adequate measurements is crucial for effective food aid. Statistics from the World Health Organization show that only 35% of malnourished children are adequately measured.

Welthungerhilfe is developing the Child Growth Monitor App with ZHL and other partners, which works with a mobile phone camera to assess the level of malnutrition in children. This solution will really help provide effective, faster and safer food and nutrition security everywhere.

ENHANCE:

Healthy people on a healthy planet

Our current food systems are not designed to provide the growing world population with healthy diets. Worldwide, about as many people are obese as malnourished, and a third of our food is wasted. The current food systems are to a large extent responsible for climate change, ecosystem degradation and loss of biodiversity.

Together with Johns Hopkins University, Cargemini and the WFP, the Zero Hunger Lab aims to use data science to help and advise governments on how to give all people access to healthy food and at the same time ensure that their food systems are sustainable "from farm to fork".

The first pilot models are being developed for Indonesia in 2020. ZHL researchers focus on the development of data science solutions which ensure that:

- in the event of major changes in price and availability of food, people with little or no income will continue to have access to sufficient and healthy food;
- farmers, producers, markets, grocery chains and consumers can also include the impact of their decisions on e.g. climate, water management and soil conditions.

In other words, "healthy people on a healthy planet".

For the near future, this unique alliance aims to further develop and implement the innovative ENHANCE solutions for countries in Africa. To this end, the alliance is actively looking for new funding and strategic partners.



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