UN World Food Programme: Towards Zero Hunger with Analytics

LNMB/NGB seminar, January 2025

WFP
World Food Programme

SAVING LIVES
CHANGING LIVES

Tilburg University

In this presentation

- **Brief intro on how the WFP-work started** — Hein Fleuren
- Optimization at WFP — Koen Peters
- The Zero Hunger Lab — Hein Fleuren

Development of tools: In COP

Here I met several of the WFP representatives

WFP head office in Rome

Peter Bakker (CEO TNT)

A long story short

- Talked to many people about Analytics for almost two years
- I was allowed to start with a series of Master Thesis students and among them: Koen Peters
- And the rest is history…

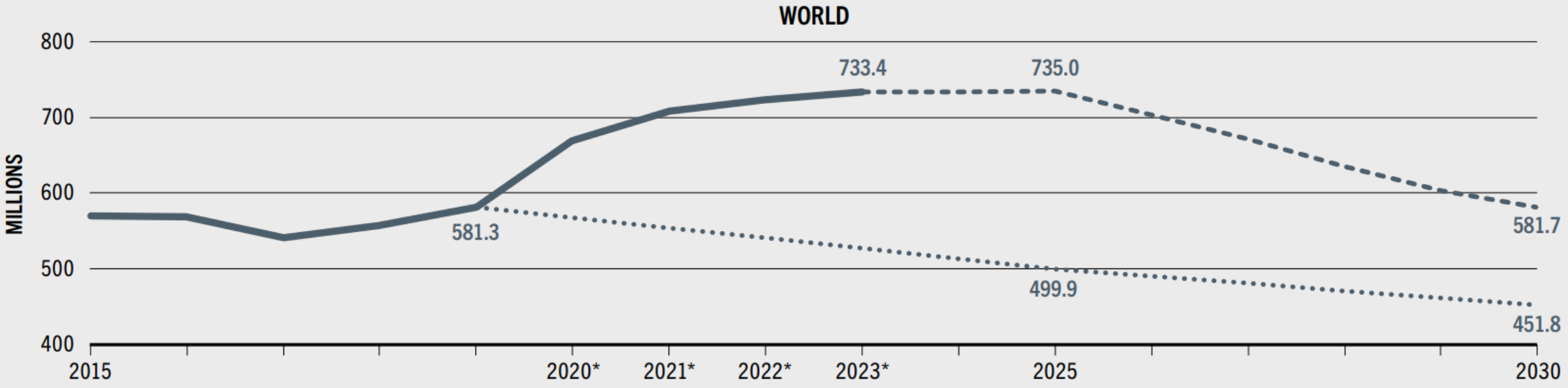
In this presentation

- Brief intro on how the WFP-work started — Hein
- **Optimization at WFP** — **Koen**
- The Zero Hunger Lab — Hein

SUSTAINABLE DEVELOPMENT GOALS

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

Trends in food security



Since COVID-19 we have seen a significant deterioration in global food security

- 733 million people (9.1% of the global population) are estimated to be undernourished.
- 2.8 billion people, more than one in three, could not afford a healthy diet in 2022.
- Humanitarian needs are skyrocketing, with 309 million people requiring assistance in 2024.

WFP

World Food Programme

SAVING LIVES

CHANGING LIVES

WFP IN NUMBERS

152

MILLION PEOPLE

estimated to have received assistance from WFP in 2023

6.5K

TRUCKS

140 aircraft and 20 ships are on the go on any given day

21.4

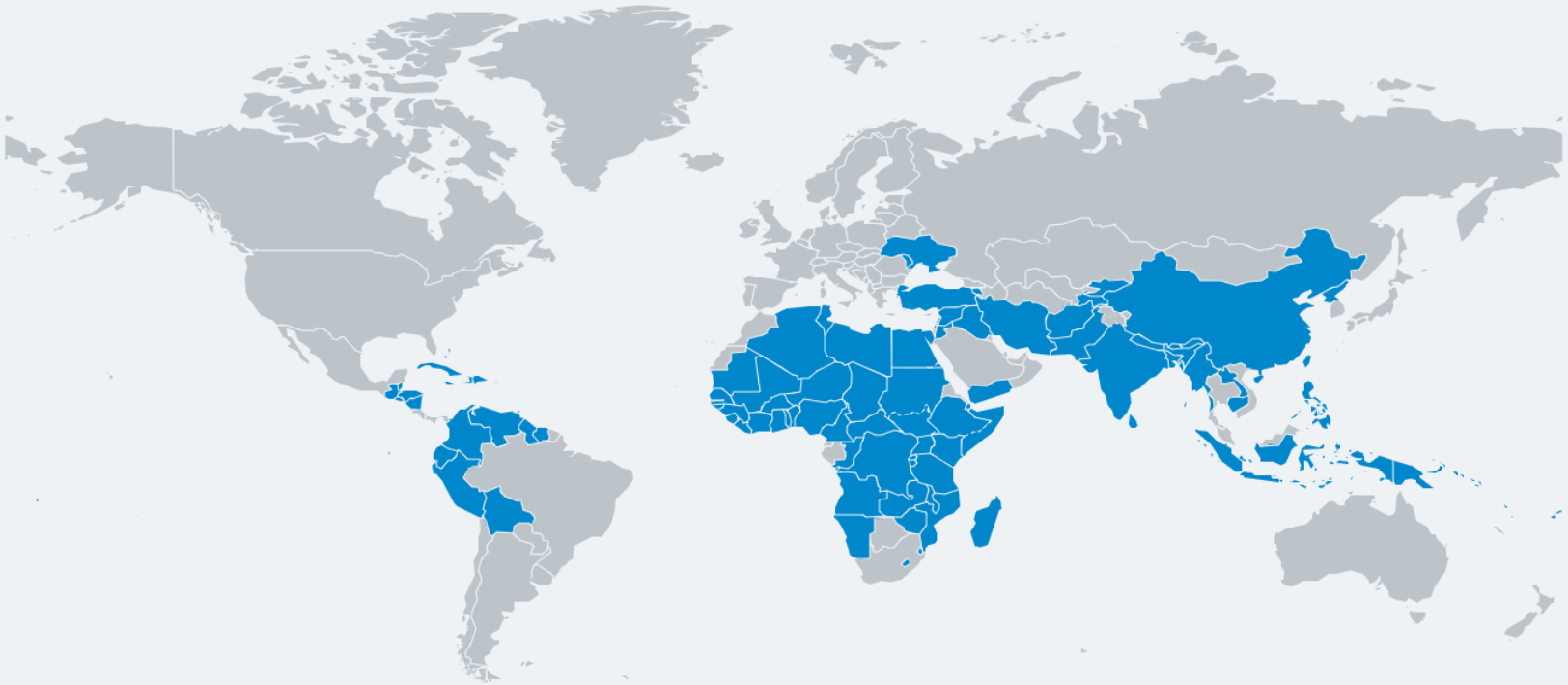
MILLION CHILDREN

estimated to have received nutritious meals, school snacks or take-home rations in 2023

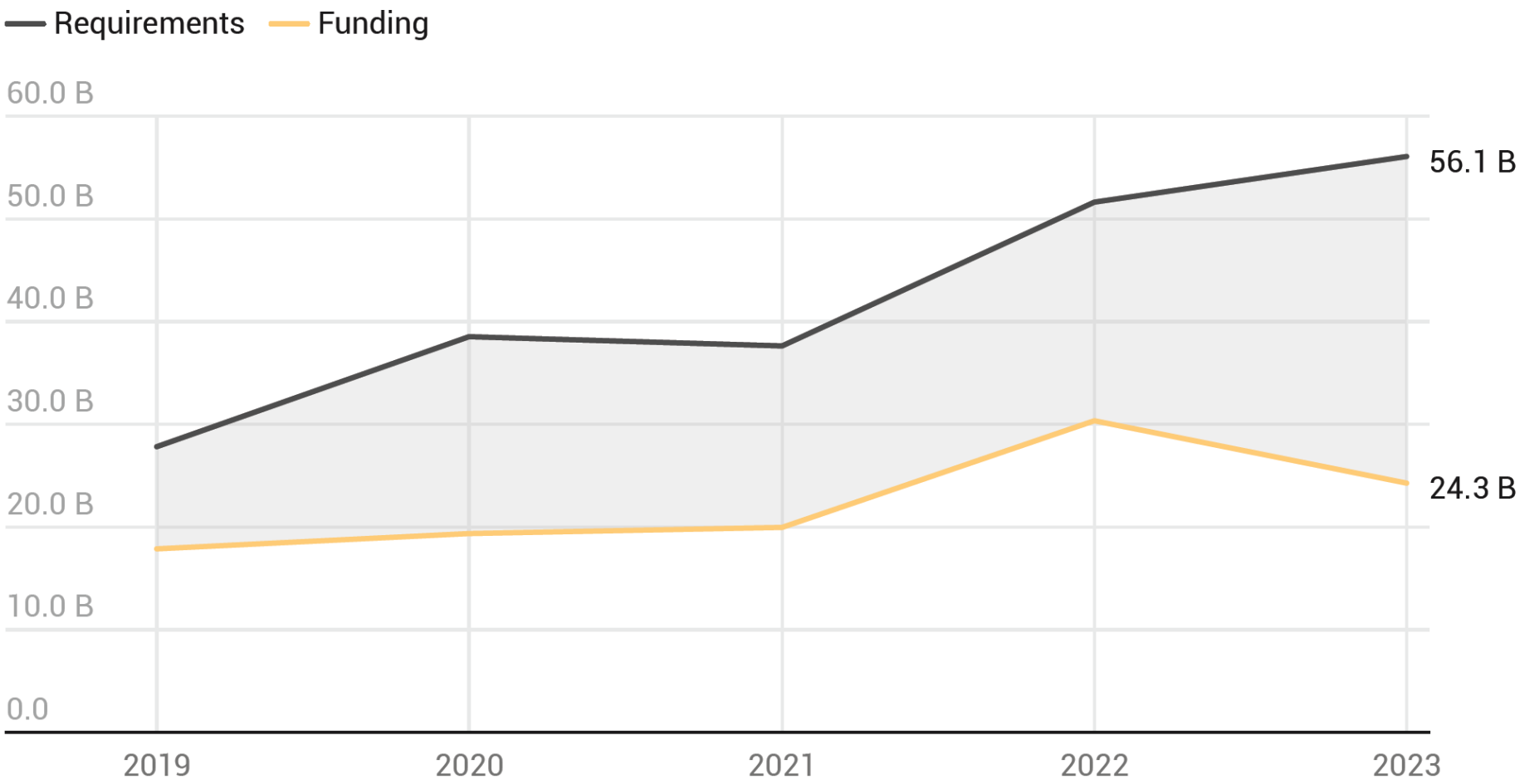
WHERE WE WORK

WFP has a presence in over **120 countries and territories.**

VIEW ALL COUNTRIES



Humanitarian needs are rapidly increasing, but funding is lagging behind



Analytics: promise vs reality

- Many researchers have highlighted the **potential impact** of Operations Research and other analytics to support food security (e.g. INSEAD, CHORD, ZHL, ABW).

- Similarly, UN reports often highlight the potential of data and analytics as a **driver for food systems transformation** (e.g. UN 2.0, FAO, WFP).

- However, for many years there was **scepticism** about the actual impact of such methodologies, as well as a (perceived) **lack of evidence**.

What makes it so challenging to operationalize analytics?

Context: A Complex Environment to Operate…

HIGH & VOLATILE DEMAND

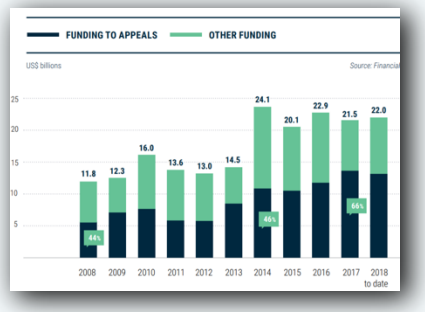
- **Food security is deteriorating** - *Volume*
- **Sudden-onset disasters:** earthquakes, cyclone, conflict escalation, etc. *Speed & Agility*

ACCESS & SECURITY

- **Conditions:** rainy seasons, lack of infrastructures, high insecurity locations, …
- **Long lead-times, extra costs**

COMPLEX FUNDING

- Only **half of needs are funded**
- **Drip-feed funding** only covering next 3-4 months
- Most donations are **earmarked**



DATA & TECHNOLOGY

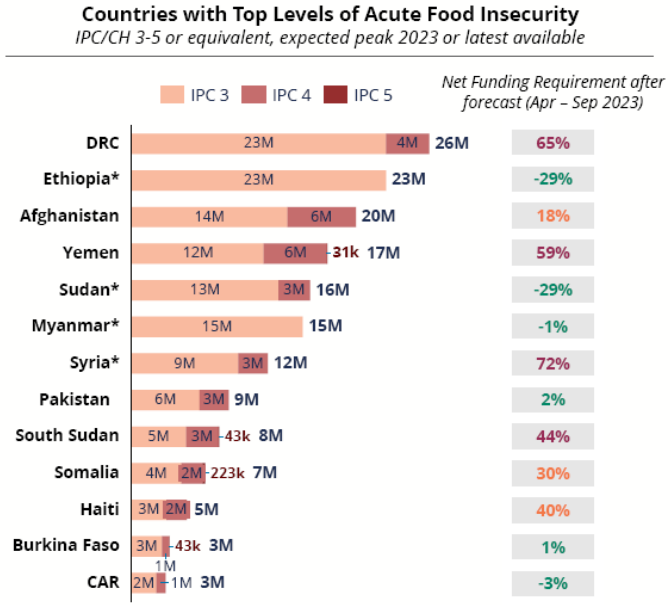
- **Lots of data** must be analyzed to get a holistic picture, often conflicting, spread across systems/files
- Not always with **electricity, connectivity…**

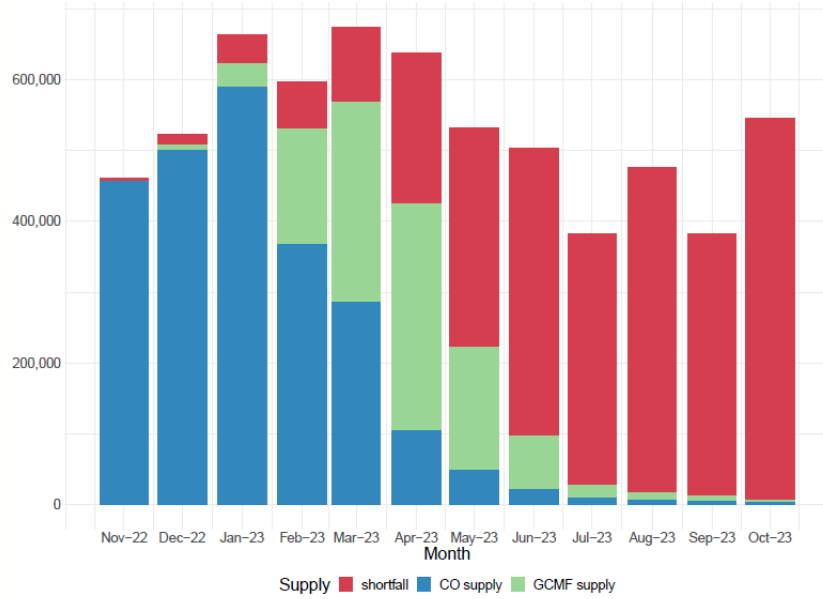
Advanced planning & analytics capabilities are critical

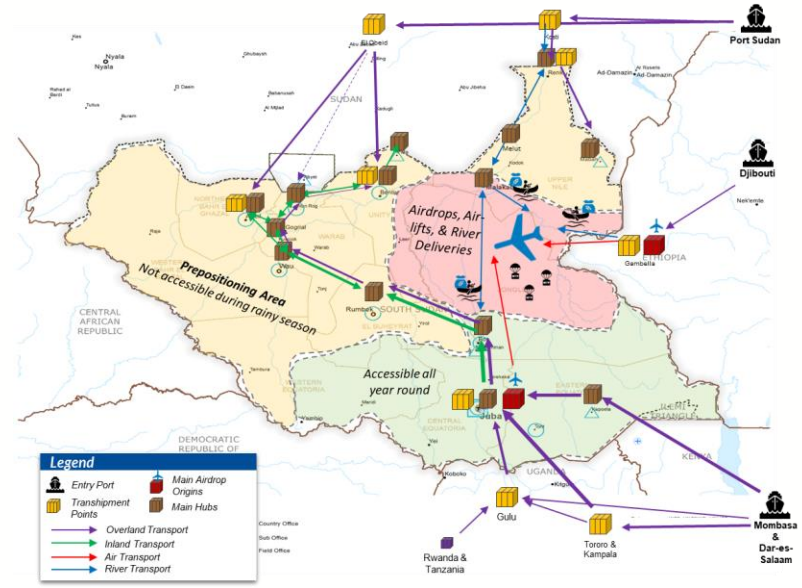
Descriptive Analytics
Dashboards, trend analyses

Predictive Analytics
Forecasting, operational alerts

Prescriptive Analytics
Optimization, decision support





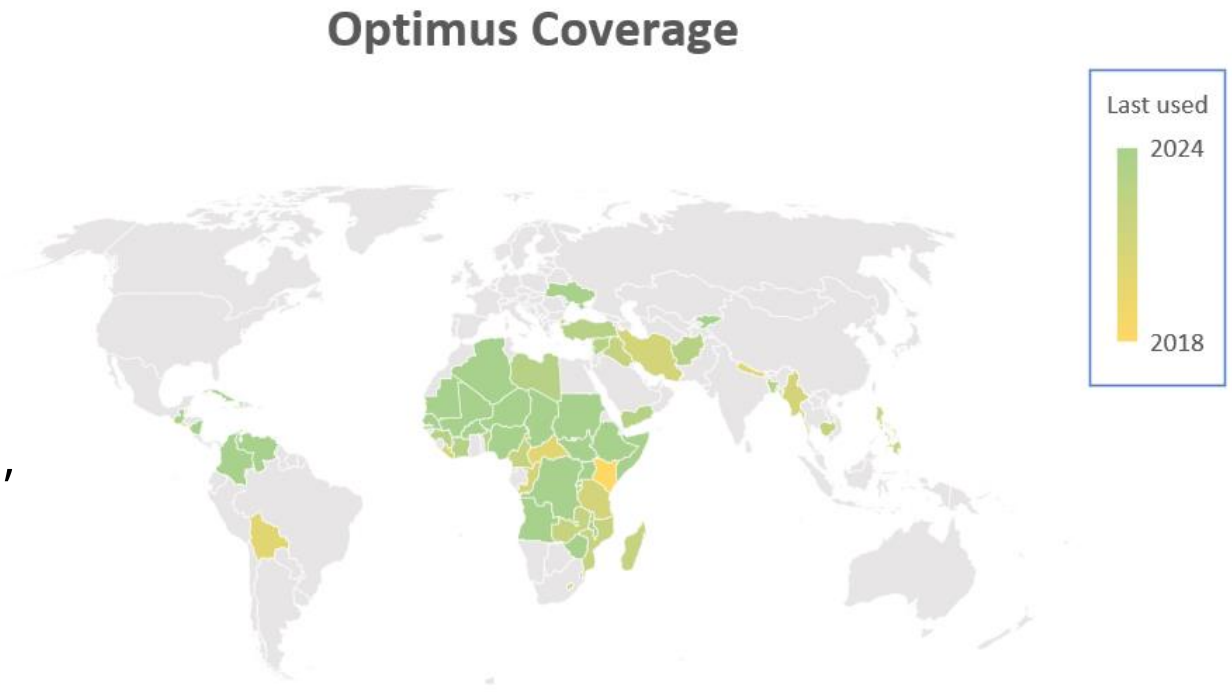


A decade of operationalizing analytics

- We have spent the last decade developing and **operationalizing analytics** for WFP's operations and those of its partners.

- Many of these solutions are now used globally to support operations, such as **Optimus**, **Prisma**, **Scout**, **Route The Meals**, and the **Corporate Alert System**.

- The team has grown to almost 50, and our analytics have helped WFP save more than **US$ 150 million** and were awarded the 2021 Franz Edelman Award.

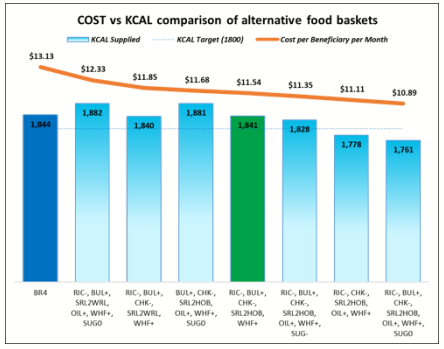


58 countries used Optimus to date
29 countries used Optimus in 2024

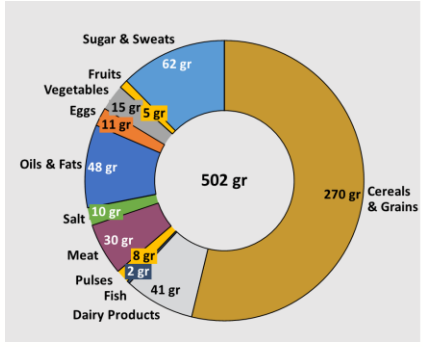
Optimization can help tackle several types of challenges

Transfer design

(food baskets, caseloads, transfer modalities)



Food basket design



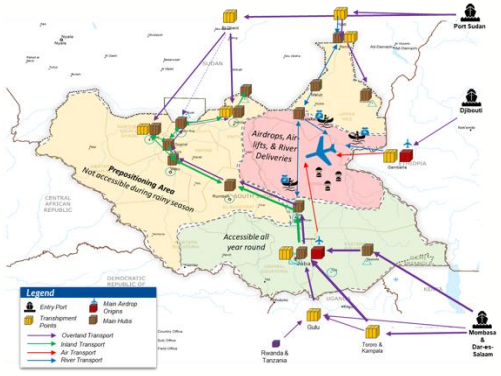
Transfer modality cost-effectiveness

Food Basket	Performance			Funding Scenarios										
	USD / Ration	KCAL (%)	NVS (%)	25M USD	30M USD	35M USD	40M USD	45M USD	50M USD	55M USD	60M USD	65M USD	70M USD	75M USD
GFA IK P1	$ 11.57	101%	80%	2.2	2.6	3.0	3.5	3.9	4.3	4.8	5.2	5.6	6.0	6.5
WHF75 YSP10 OIL8	$ 11.19	98%	71%	2.2	2.7	3.1	3.6	4.0	4.5	4.9	5.4	5.8	6.3	6.7
WHF75 YSP10 OIL4	$ 10.38	90%	67%	2.4	2.9	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.7	7.2
WHF75 YSP05 OIL4	$ 9.79	85%	64%	2.6	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.6	7.2	7.7
WHF50 YSP10 OIL8	$ 8.39	74%	62%	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.1	7.7	8.3	8.9
WHF50 YSP08 OIL8	$ 8.16	72%	61%	3.1	3.7	4.3	4.9	5.5	6.1	6.7	7.4	8.0	8.6	9.2
WHF50 YSP05 OIL8	$ 7.80	70%	59%	3.2	3.8	4.5	5.1	5.8	6.4	7.1	7.7	8.3	9.0	9.6
WHF50 YSP10 OIL4	$ 7.59	66%	58%	3.3	4.0	4.6	5.3	5.9	6.6	7.3	7.9	8.6	9.2	9.9
GFA IK P2	$ 6.99	61%	55%	3.6	4.3	5.0	5.7	6.4	7.2	7.9	8.6	9.3	10.0	10.7
WHF25 YSP10 OIL8	$ 5.60	50%	49%	4.5	5.4	6.3	7.1	8.0	8.9	9.8	10.7	11.6	12.5	13.4
WHF25 YSP05 OIL4	$ 4.20	37%	41%	6.0	7.1	8.3	9.5	10.7	11.9	13.1	14.3	15.5	16.7	17.9

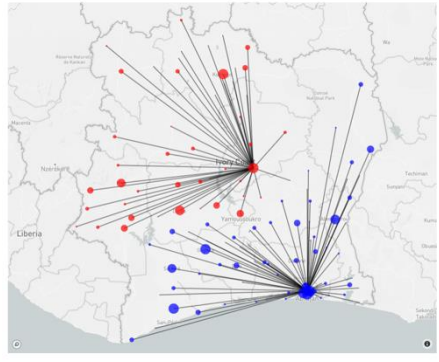
Scale-up scenarios

Sourcing & delivery strategies

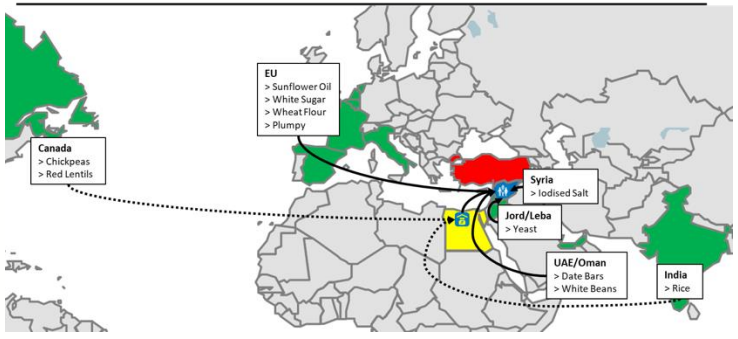
(procurement strategies, network design, vehicle routing)



Corridor optimization



Network design



Sourcing strategies

The food basket optimization challenge

Meals are provided to different **age groups**, each with their own **nutritional requirements**

Many of the food items have **complex supply chains** to manage (e.g. fresh foods, imported products, some may require cold storage)

We have **dozens of potential food items** to choose from, each with different **nutritional values** and **costs**

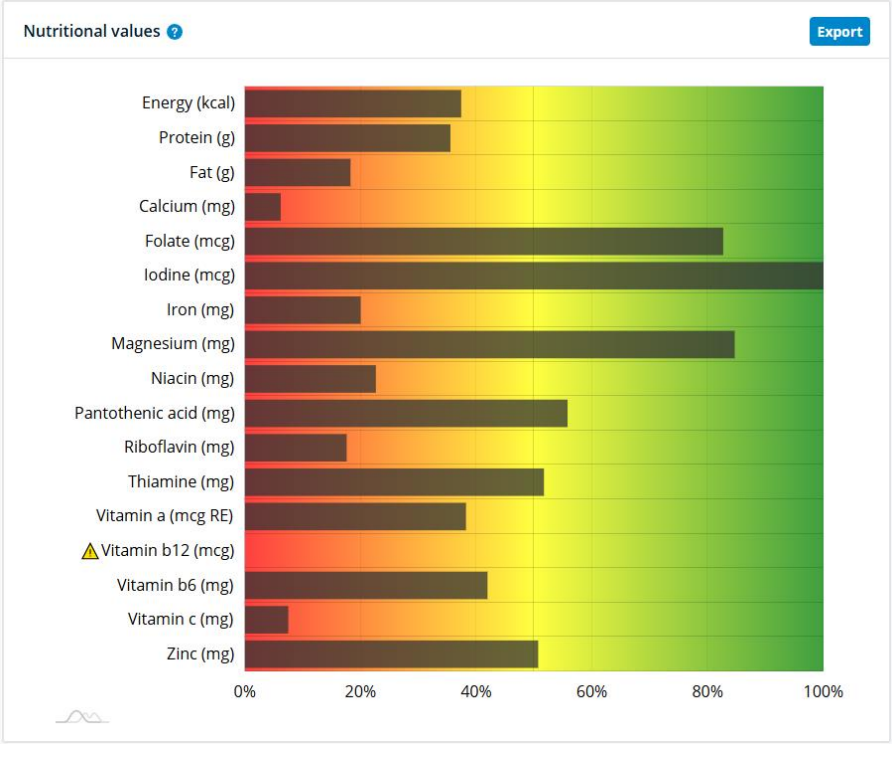
We want to buy as much as possible from **local suppliers** (e.g. smallholder farmers)

Meals should be **easy to prepare** for a large number of people, with some **diversity** throughout the year

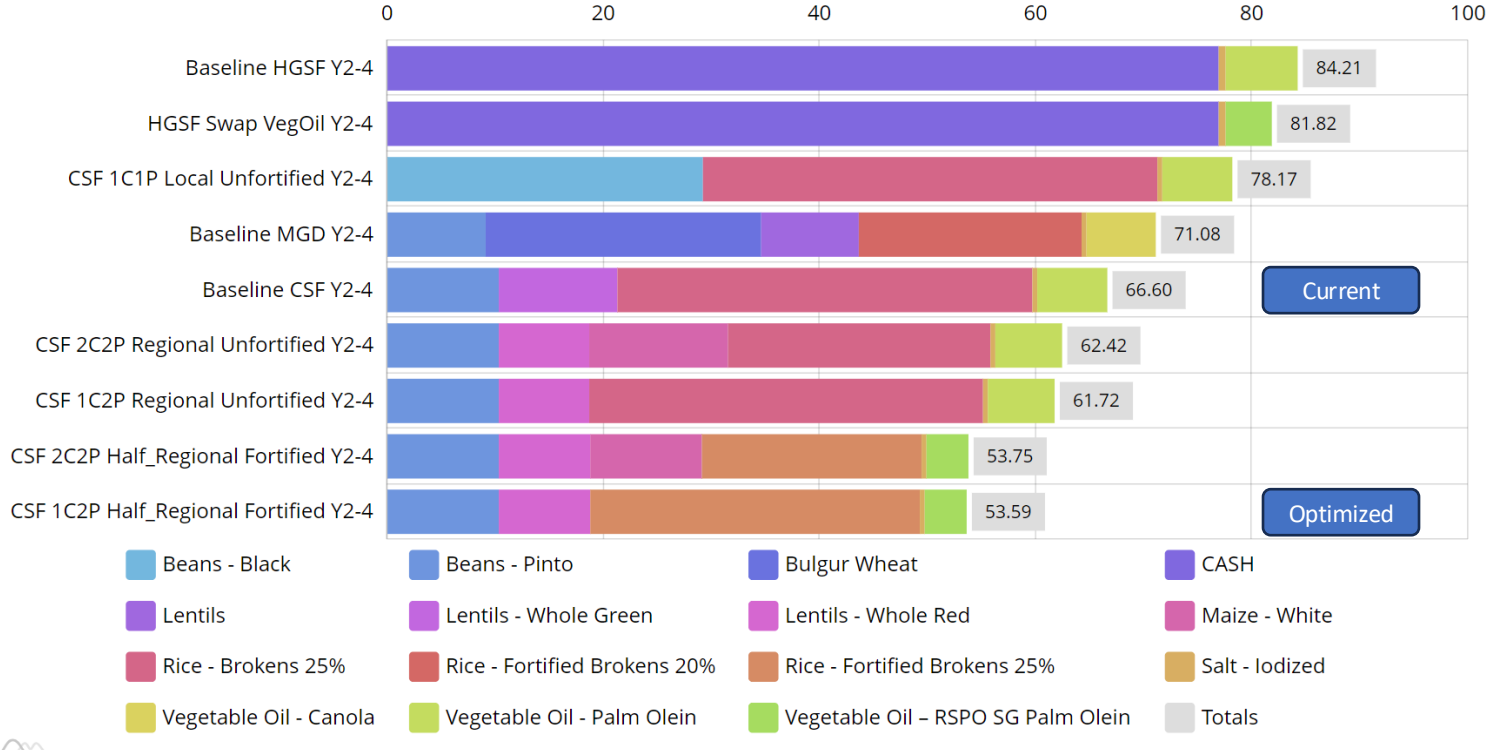
We want to minimize **food losses** and the **environmental footprint** throughout the supply chain

Exploring alternatives for a WFP school meal

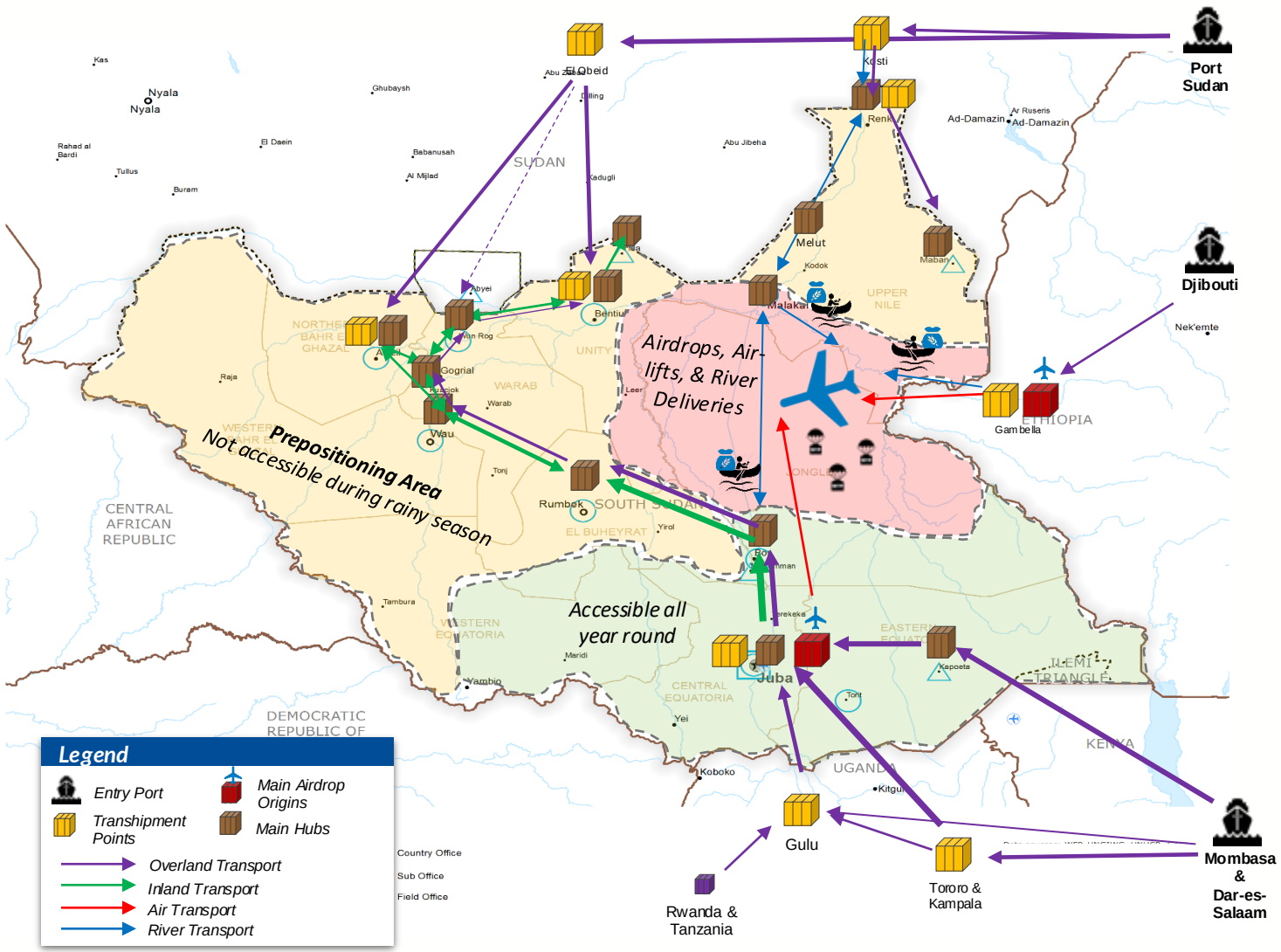
The baseline menu was low on many micro-nutrients



Optimization analyses identified cheaper and more nutritious menus



The Logistics Optimization Challenge



1. **What is the optimal setup for our logistics network**

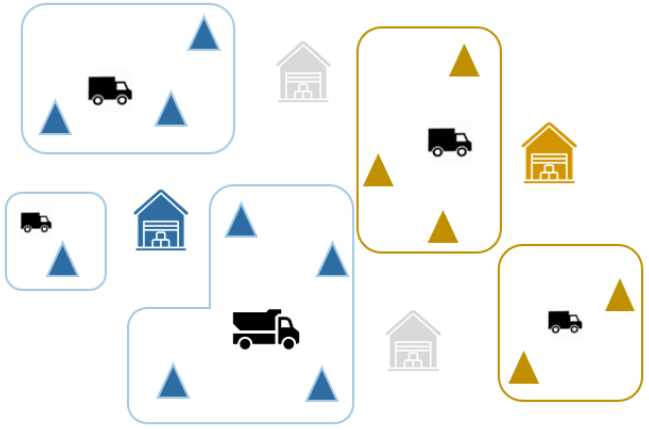
2. **How do we optimally plan deliveries within that network**

Optimization based on ready-to-use modules

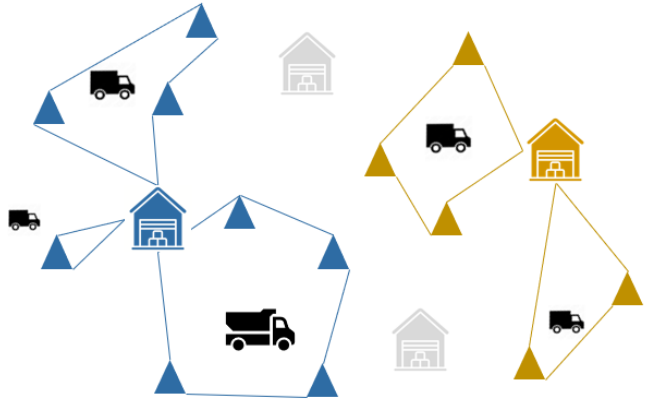
1. Location Model
(e.g. Côte d'Ivoire 2021)

2. Allocation Model
(e.g. India 2018)

3. Clustering Model
(e.g. Haiti 2023)



4. Routing Model
(e.g. Venezuela 2022)



Modelling challenge

What does **optimizing** look like?

Maximizing Coverage
Will Ukraine receive their full wheat requirements for March?

Minimizing Cost
Are the pulses for Sudan being sourced for the lowest cost all considered?

Minimizing Travel Time
Is the Vegetable Oil for Benin arriving as soon as possible given costs?

Maximizing Sustainability
Are there lesser emitting super-nutritious food delivery plans all considered?

Maximizing Robustness
Is enough buffer cereal in storage at Lome given our regional instability concerns?

What do **constraints** look like?

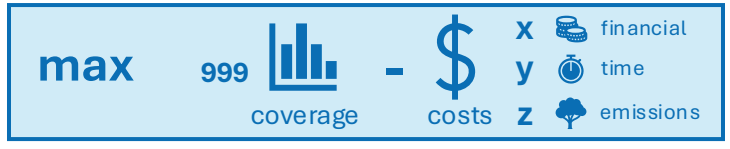
Supplier Capacities
Commodity supply capacities fluctuate based on factors such as harvest seasons

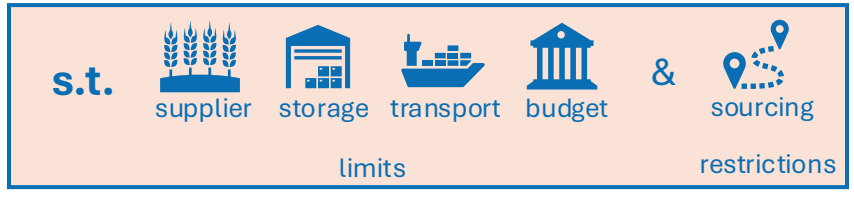
Storage Limits
Storage locations can have limits and may be less suited for sensitive commodities

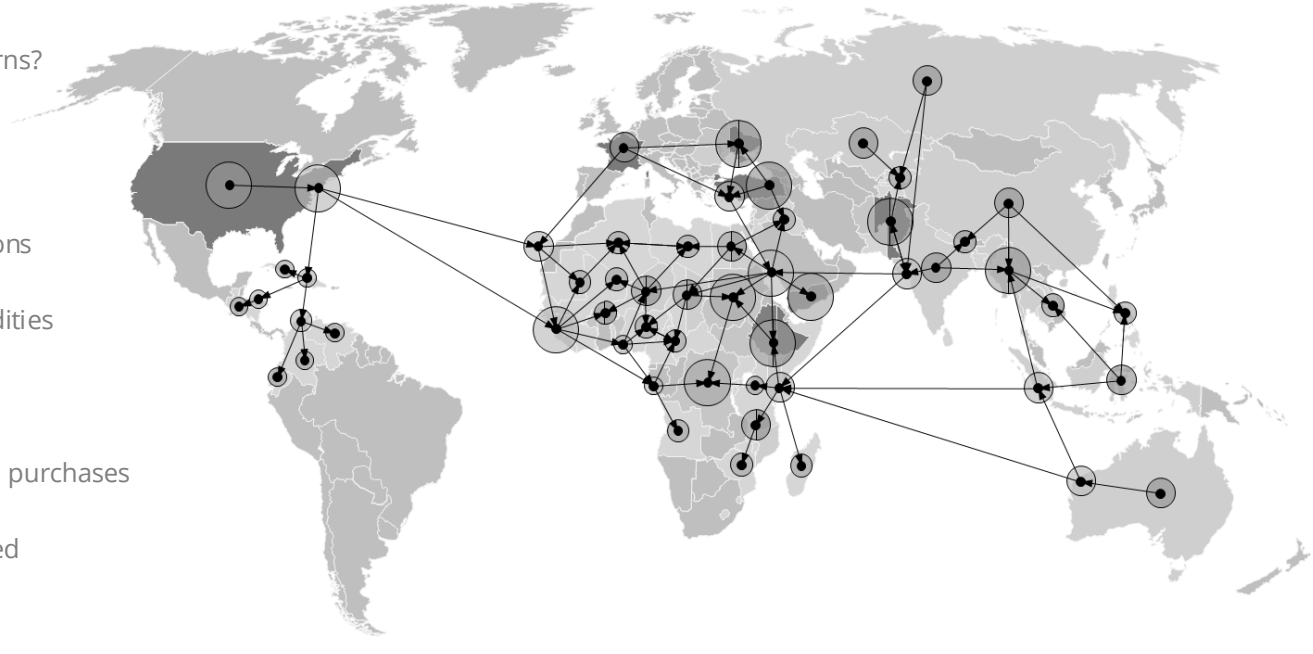
Transport Capacities
Ships, trucks and air transport have cargo limits and varying associated costs

Sourcing Constraints
Geopolitical and cultural preferences impact which countries will accept which purchases

Budget Limits
Donations will vary country by country and will sometimes have terms attached







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Conclusion

Global food security is at a critical stage, requiring innovative and cost-effective solutions.

- Analytics can be a great **driver** for this transformation.
- In cases where analytics is successfully operationalized, it leads to **significant improvements to food security**.
- We hope WFP's examples and best practices can be a valuable resource to help accelerate the adoption of analytics in other organizations and achieve **Zero Hunger** by 2030.

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Want to learn more?

informs
http://pubsonline.informs.org/journal/inte

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THE FRANZ EDELMAN AWARD
Achievement in Operations Research

UN World Food Programme: Toward Zero Hunger with Analytics

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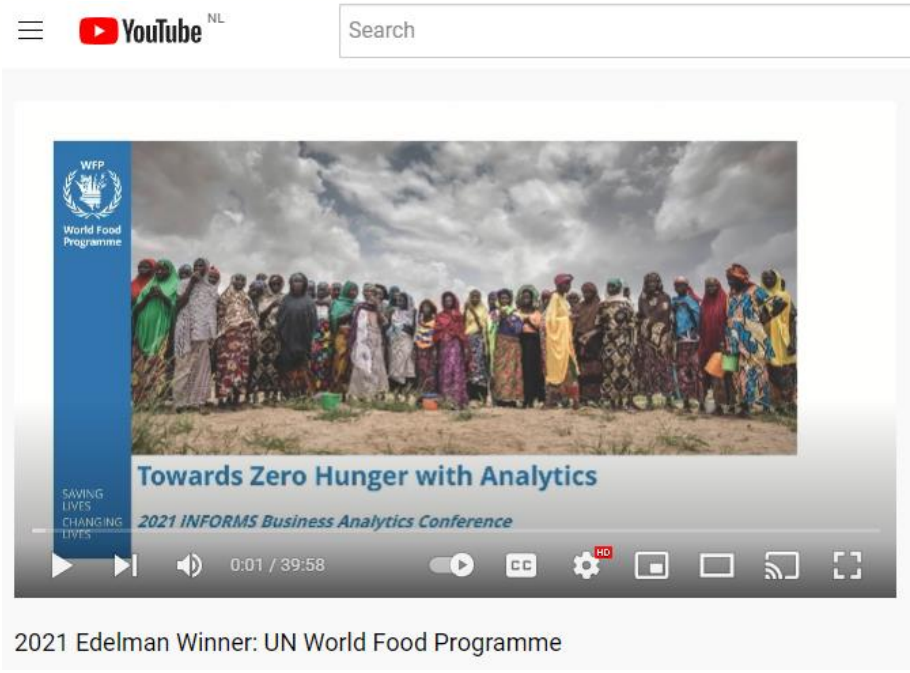

https://doi.org/10.1287/inte.2021.1097

https://www.youtube.com/watch?v=wdEcVj5LTGg

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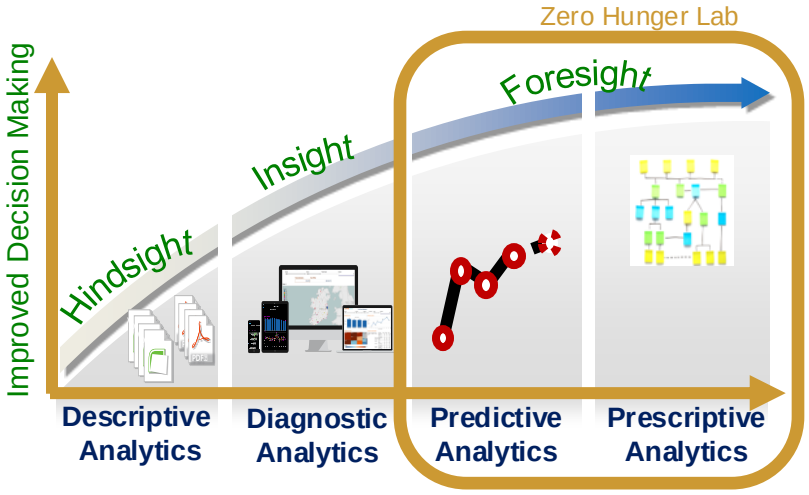
Zero Hunger Lab: With Data Science we can make an impact



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Research question from partners

Better decisions

Emergency relief

Sustainable development

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Zero Hunger Lab - How we are organized

(Nearly) Finalized other projects

Detection in children

- **Goal:** a mobile device with an AI-app to detect malnutrition

- **How**: neural networks for automatic body measurement
- **Impact**: many early detection of malnutrition for children avoids later (brain and body) damage, moreover it saves a lot of time from mothers, doctors and nurses

Healthy diet for healthy peope and healthy planet.

Goal:

How: multi-objective modeling of diets

Impact: WFP and local governments are using it to find affordable diets (Myanmar, Cambodia)

Effectivity of cash programs

- Household data of four years in Burundi, Nigeria and Sudan
- Detailed analysis of household spending shows very interesting results and clearly shows how cash programs can be made more effective

Newly started research

Anticipatory Action - Worldvision

- What is anticipatory action?
- In which situations should we use it?
- How to make it work?
- How to convince donors?

Effects of climate change for the local population - ZOA

- Can we predict effects of climate change on relatively local scale?

  Using data of NGO's, and public data like satellite images, Twitter, etc.

Dynamics of food supply on conflict – Embassy S Sudan

- We have thought for a long time that bringing food reduces conflict. but more and more question marks arise

Together with:

- University of Juba, South Sudan
- University of Western Bahr el Ghazal, South Sudan
- WCDI - Wageningen

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Towards the next
Edelman!
More about Zero Hunger Lab:
Thank you!
Contact: Fleuren@tilburguniversity.edu