



blonk ▶ consultants ◀

Giving shape to sustainability



Welcome

Fruit and Vegetable Workshop Aspen

Potential Role of IT in Altering Fruit & Vegetable Food Systems Outcomes

Hans Blonk

Director, Blonk Consultants

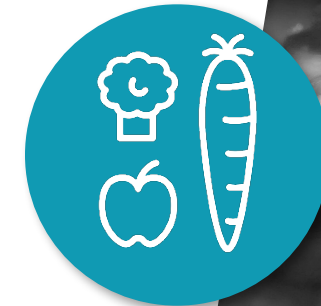
Keystone

2 August 2018

Content

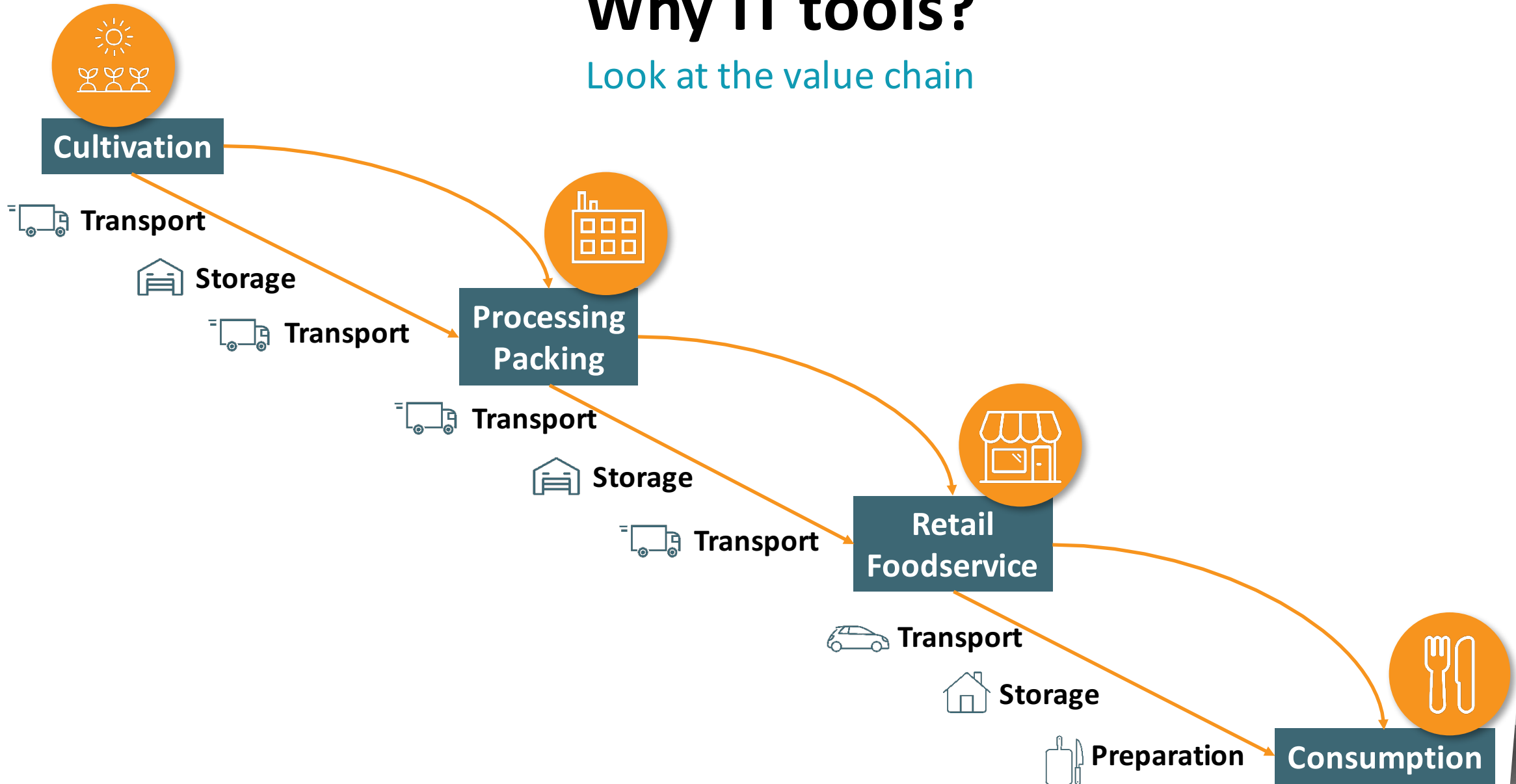
Potential Role of IT in Altering Fruit & Vegetable Food Systems Performance

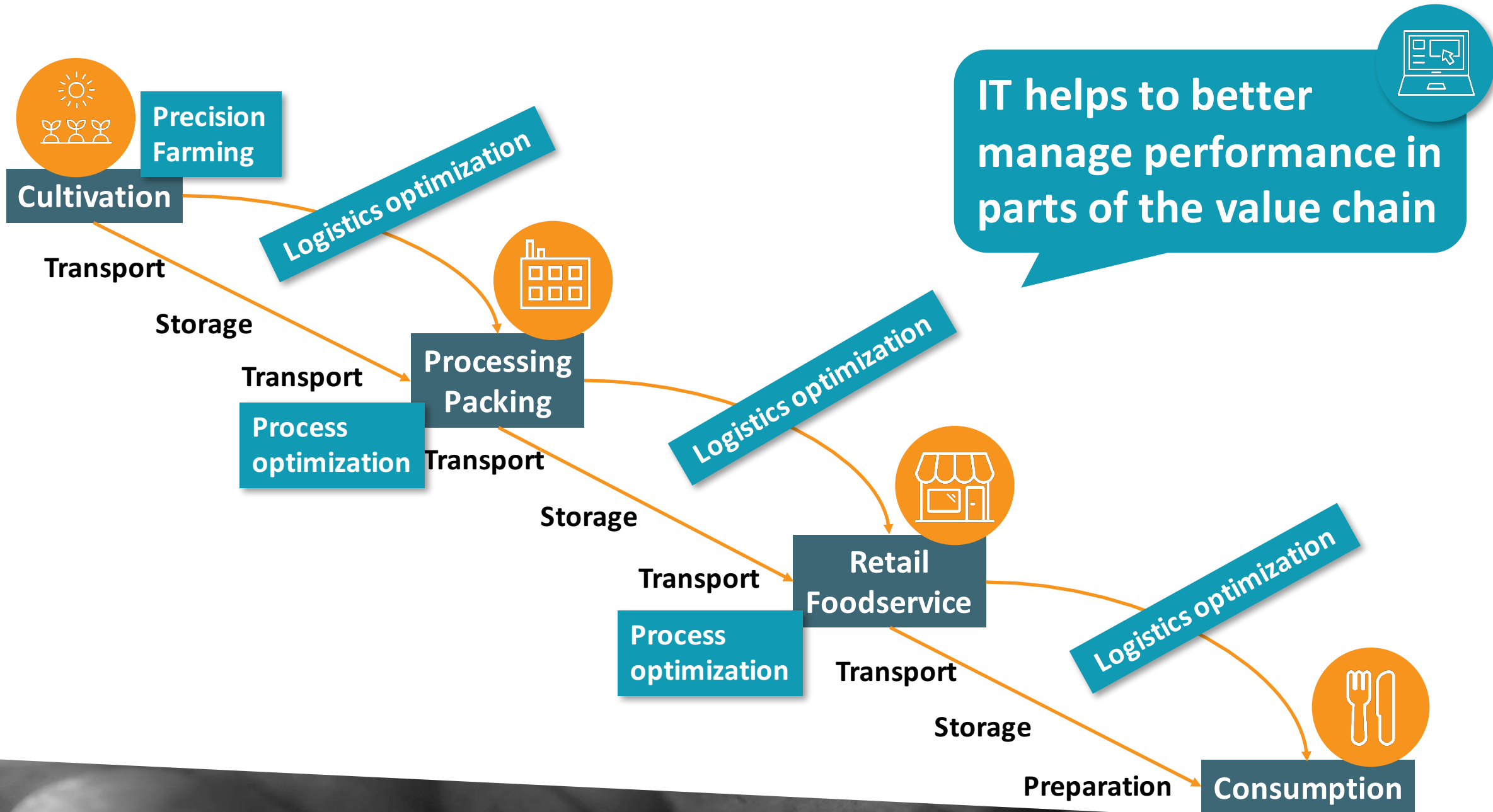
- Why IT tools in F&V value chains?
- What type of IT tools exist or emerge for improving F&V production and consumption systems?
- What is the expected impact of IT tools?



Why IT tools?

Look at the value chain







IT at cultivation

More and more data can be made available to support management that improves yields with avoiding unnecessary inputs



■ *Open field*



■ *Protected cultivation greenhouses*



IT at cultivation



- Data are all around but are only valuable if IT generates ready to use feedback that enables growers to act



- More and more IT tools provided by the private sector



IT at cultivation

Example “plant empowerment”



PLANT
EMPOWERMENT

PLANT EMPOWERMENT: A PLANT PRODUCTION STRATEGY WHERE PHYSIOLOGY MEETS PHYSICS

What is the most sustainable way of growing in my greenhouse, where I convert the available resources to maximum production and quality? During the Greentech a new book will be presented, called Plant Empowerment; the basic principles. In this book extensive methods are explained to give your plants the right energy! Empower your Plants!



Its starting point is the natural behavior of plants related to the greenhouse environment described by **six balances concerning energy, water, CO2 and assimilates**. Monitoring these balances utilizing sensors, combined with crop measurements in a coherent framework based on physical and plant physiological knowledge and insights, provides hard facts required to control and improve the cultivation process.



IT at cultivation

Example “plant empowerment”



Proven impact

- Increased yield Qty
- Increased plant health → crop quality
- Decrease in energy use (at least 10%)

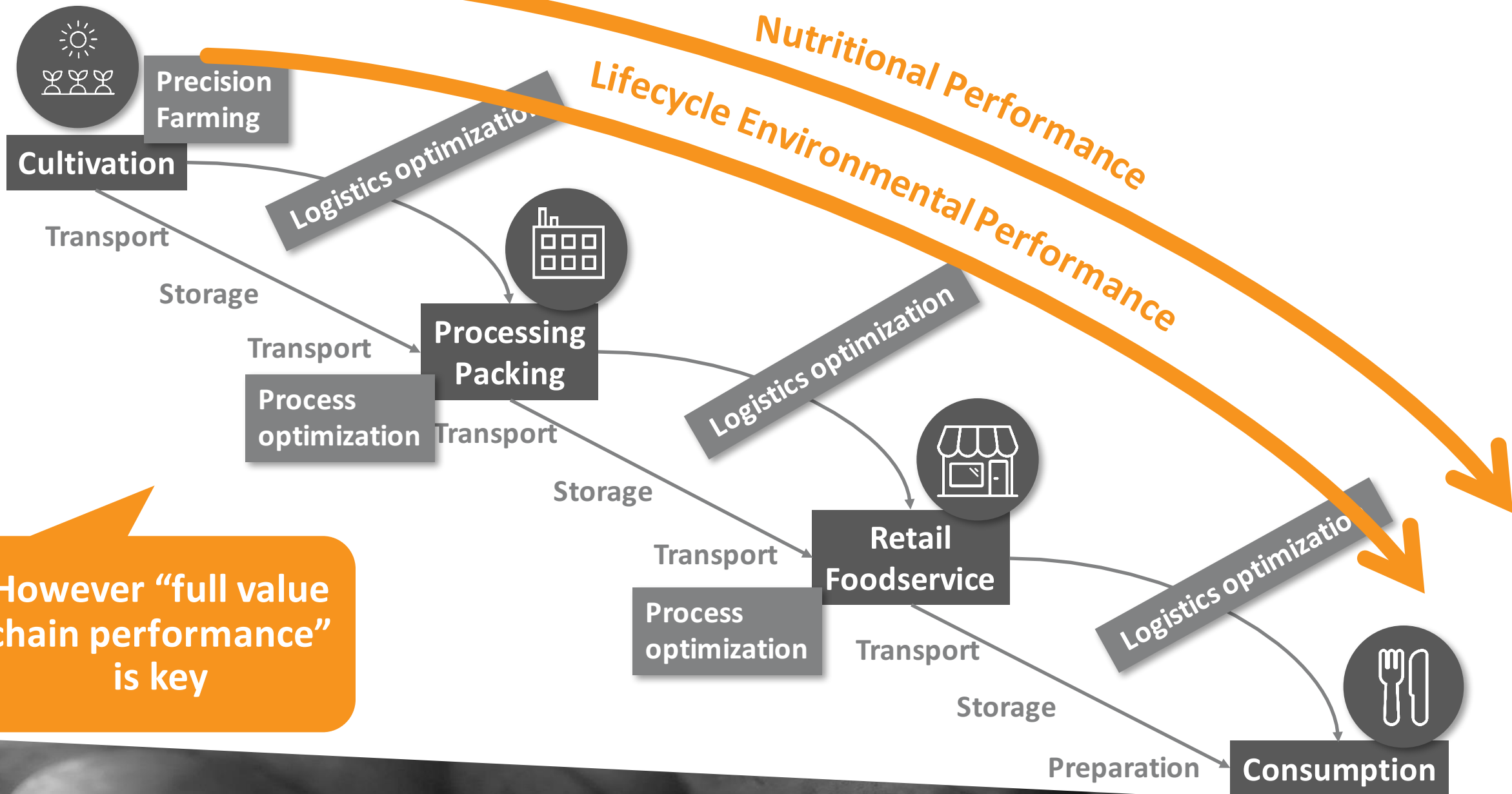


To be analyzed in coming study

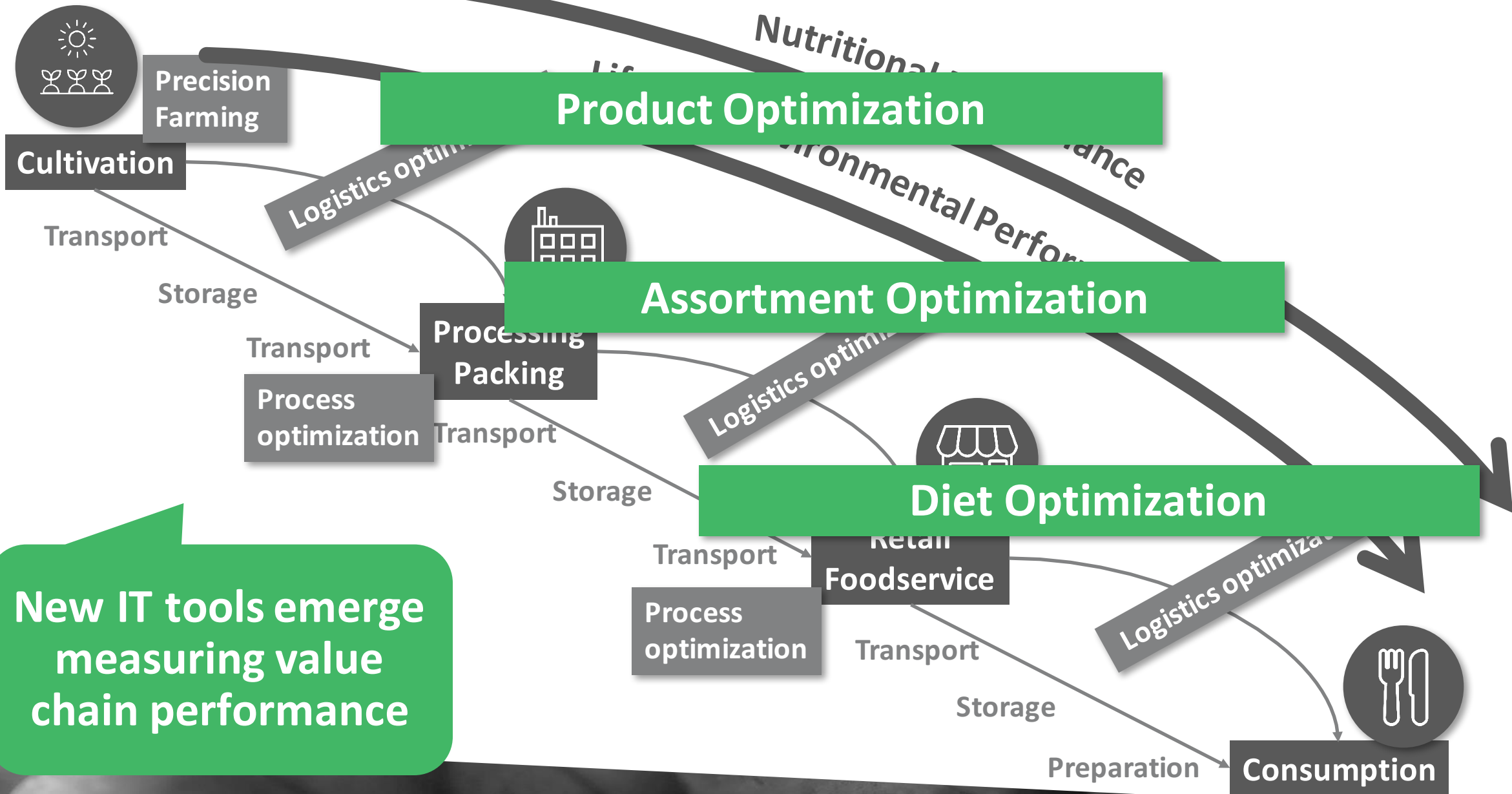
- Carbon footprint
- Water footprint
- Nutrient emissions
- Pesticides impacts

Crucial condition is that grower is owner of data.





However “full value chain performance” is key



New IT tools emerge
measuring value
chain performance

Two types of IT solutions

1. IT solutions on level of sub systems, to realize better performance on business level

- Cultivation efficiency and resilience (precision farming)
- Processing optimization
- Logistics optimization
 - Applications are mainly built on own data
 - EXAMPLE: PlantpowerModel (Letsgrow)

2. IT solutions on level of composed products, assortments and diets

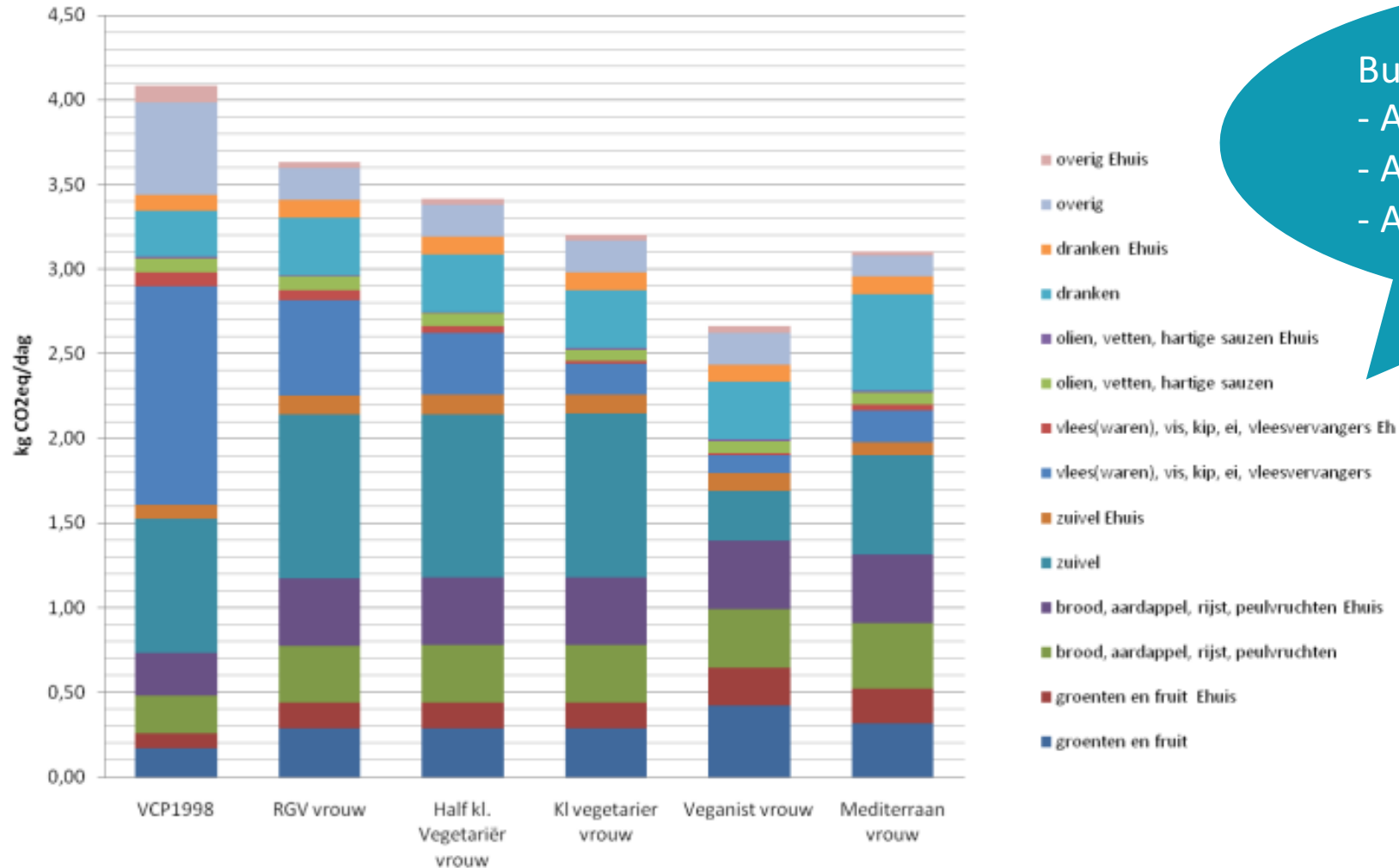
- LCA based
- Combined sustainability performance defines optimal solutions
 - Applications are mainly built on LCA data of supply chain
 - EXAMPLE: Optimeal (Blonk Consultants)



IT on dietary level: Optimeal for sustainable nutrition assessment

Sustainable Nutrition Assessment: the old way

reasoning from predefined diets



But:

- Are they nutrient equivalent?
- Are these diets healthy?
- Are they the optimal solution?

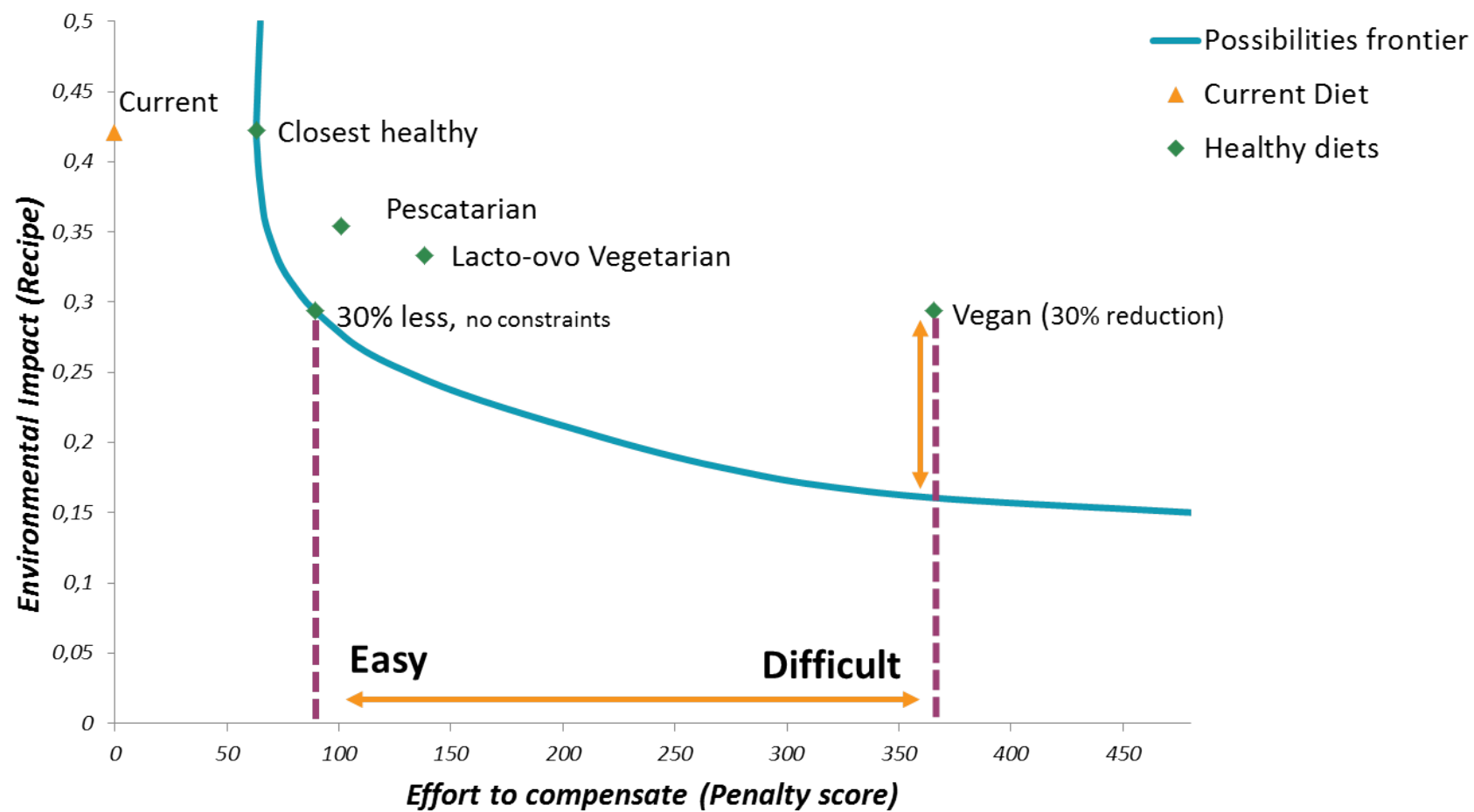
Sustainable nutrition assessment:

Optimeal®



- Software tool for optimization of diets on **nutrition AND sustainability**.
- Developed by Blonk Consultants in cooperation with Netherlands Nutrition Centre.
- Defining healthy and sustainable food patterns based on **sound data**:
 - Baseline diet
 - Data on nutritional and environmental properties of products
 - Dietary constraints
- Optimeal engine uses either **linear programming** (LP) or **quadratic programming** (QP) to find the optimal solution to a research question

Results derived with Optimeal



Optimisation

Examples



1. WWF UK Livewell (2017)

Eating for 2 degrees – New and updated Livewell Plates



2. NZO (Dutch Dairy Association) (2015)

Environmental impact of dairy substitution in a healthy diet

Eating for 2 degrees

The Paris agreement



Keep global warming well below 2 degrees

In the UK

Committee on Climate Change advised:
reduce territorial emissions by 61% from 1990 levels.



rounded this down to 60%

- 30% through production
 - 30% through consumption
- target: -30% UK food consumption in 2030**

Eating for 2 degrees

Main objective

Can we develop Livewell Plates that respect national climate change mitigation commitments and stop deforestation at the same time?

Climate change*	1990	current	2030
Total carbon footprint (MtCO ₂ eq)	152		106.5 (-30%)
Individual carbon footprint (kg CO ₂ eq)	7.28	5.17	4.09



Eating for 2 degrees

Starting point optimisation

Current diet:

EFSA Comprehensive Food Consumption Database (ECFCD) and National Diet and Nutrition Survey (NDNS)

Nutritional properties of food products:

McCance & Widdowson's and French Ciquel

Environmental properties of food products:

Life Cycle Assessments (LCAs) by Blonk Consultants

Applying
quadratic
programming

Nutritional properties

58 implemented

Macronutrients	Vitamins and minerals	Amino acids
Energy (kcal)	Retinol eq. (µg)	Tryptophan (g)
Energy (KJ)	Retinol act. eq. (µg)	Threonine (g)
Protein total (g)	Vitamin B1 (mg)	Isoleucine (g)
Protein vegetable (g)	Vitamin B2 (mg)	Leucine (g)
Protein animal (g)	Niacin (mg)	Lysine (g)
Fat total (g)	Vitamin B6 (mg)	Methionine (g)
SAFA (g)	Folate eq. (µg)	Cystine (g)
MUFA (g)	Vitamin B12 (µg)	Valine (g)
PUFA (g)	Vitamin C (mg)	Histidine (g)
Linoleic acid (g)	Vitamin D (µg)	
ALA (g)	Vitamin E (mg)	
EPA (g)	Vitamin K total (ug)	
DHA (g)	Vitamin K2 (ug)	
Trans fatty acids (g)	Calcium (mg)	
Fatty acids n-3 (g)	Phosphorus (mg)	
Fatty acids n-6 (g)	Iron (mg)	
Cholesterol (mg)	Haem iron (mg)	
Carbohydrates total (g)	Sodium (mg)	
Mono- and disaccharides (g)	Potassium (mg)	
Lactose (g)	Magnesium (mg)	
Polysaccharides (g)	Zinc (mg)	
DHA+EPA (mg)	Selenium (µg)	
Fibre (g)	Copper (mg)	
Water (g)	Iodine (µg)	

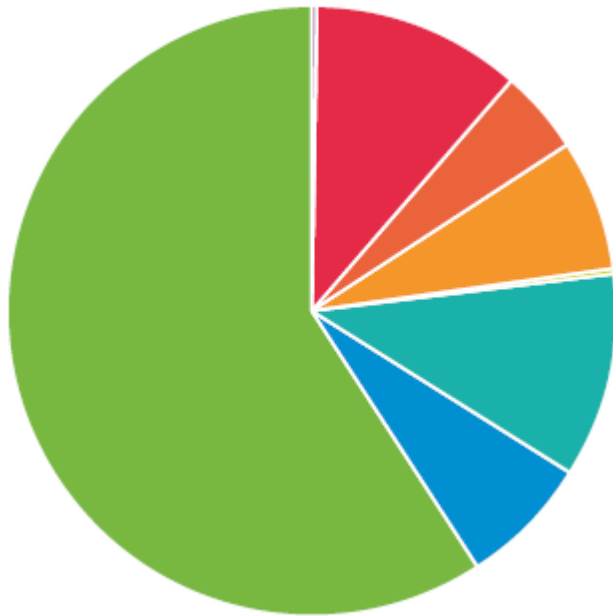
LCA data

product	cradle to end-of-life			cradle to retail		
	kg CO2eq/kg incl Land Use Change	kg CO2eq/kg door Land Use Change	kg CO2eq/kg Excl Land Use Change	kg CO2eq/kg incl Land Use Change	kg CO2eq/kg door Land Use Change	kg CO2eq/kg Excl Land Use Change
alaska pollock fish	9,7	0,1	9,7	7,7	< 0,01	7,7
apple with skin	0,4	< 0,01	0,4	0,3	< 0,01	0,3
banana	0,9	< 0,01	0,9	0,6	< 0,01	0,6
brown beans (glass/can)	1,9	0,0	1,9	1,5	0,0	1,5
brown rice	1,7	< 0,01	1,7	2,9	< 0,01	2,9
butter (unsalted)	16,3	1,9	14,4	15,5	1,8	13,7
carrots	0,8	0,0	0,8	0,3	< 0,01	0,3
cauliflower	1,4	0,0	1,3	0,7	< 0,01	0,7
cheese Gouda 48+	12,9	1,5	11,4	12,2	1,4	10,8
chicken (with skin)	13,4	5,6	7,8	7,6	3,6	4,0
cod fish	7,5	0,1	7,5	5,7	< 0,01	5,7
eggs	5,1	2,1	3,0	4,0	1,9	2,1
herring (soused)	3,0	< 0,01	3,0	2,6	< 0,01	2,6
mackerel	2,9	< 0,01	2,9	1,7	< 0,01	1,7
minced beef meat (35% beef cattle: 65% dairy cattle)	30,7	2,8	27,9	24,2	2,3	22,0
orange	1,1	< 0,01	1,1	0,6	< 0,01	0,6
pork	14,3	3,2	11,1	8,3	2,0	6,3
potatoes	0,8	< 0,01	0,8	0,4	< 0,01	0,4
rye bread	1,3	< 0,01	1,3	1,0	< 0,01	1,0
salmon fillet (aquacultured)	8,0	1,8	6,2	6,3	1,6	4,7
semi-skimmed milk	1,9	0,2	1,7	1,8	0,2	1,6
skimmed milk	1,8	0,2	1,6	1,7	0,2	1,5
steak (100 % beef cattle)	57,9	5,0	53,0	42,7	3,7	39,1
tofu	5,8	2,2	3,4	4,1	1,9	2,2
vegetarian burger (avarage)	4,1	1,0	3,2	2,6	0,8	1,8
white bread	1,3	0,0	1,3	1,1	0,0	1,1
white rice	2,0	< 0,01	2,0	3,4	< 0,01	3,4
whole grain bread	1,1	< 0,01	1,1	1,0	0,0	1,0
whole milk	2,0	0,2	1,8	1,8	0,2	1,6

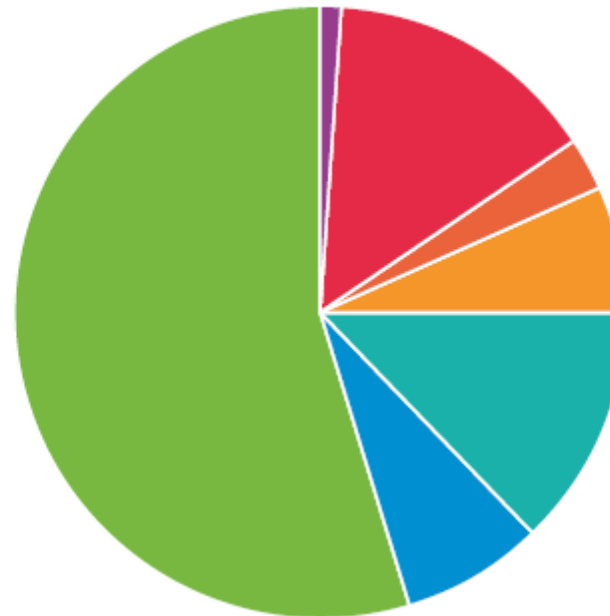
Eating for 2 degrees

Results adult plate 2030

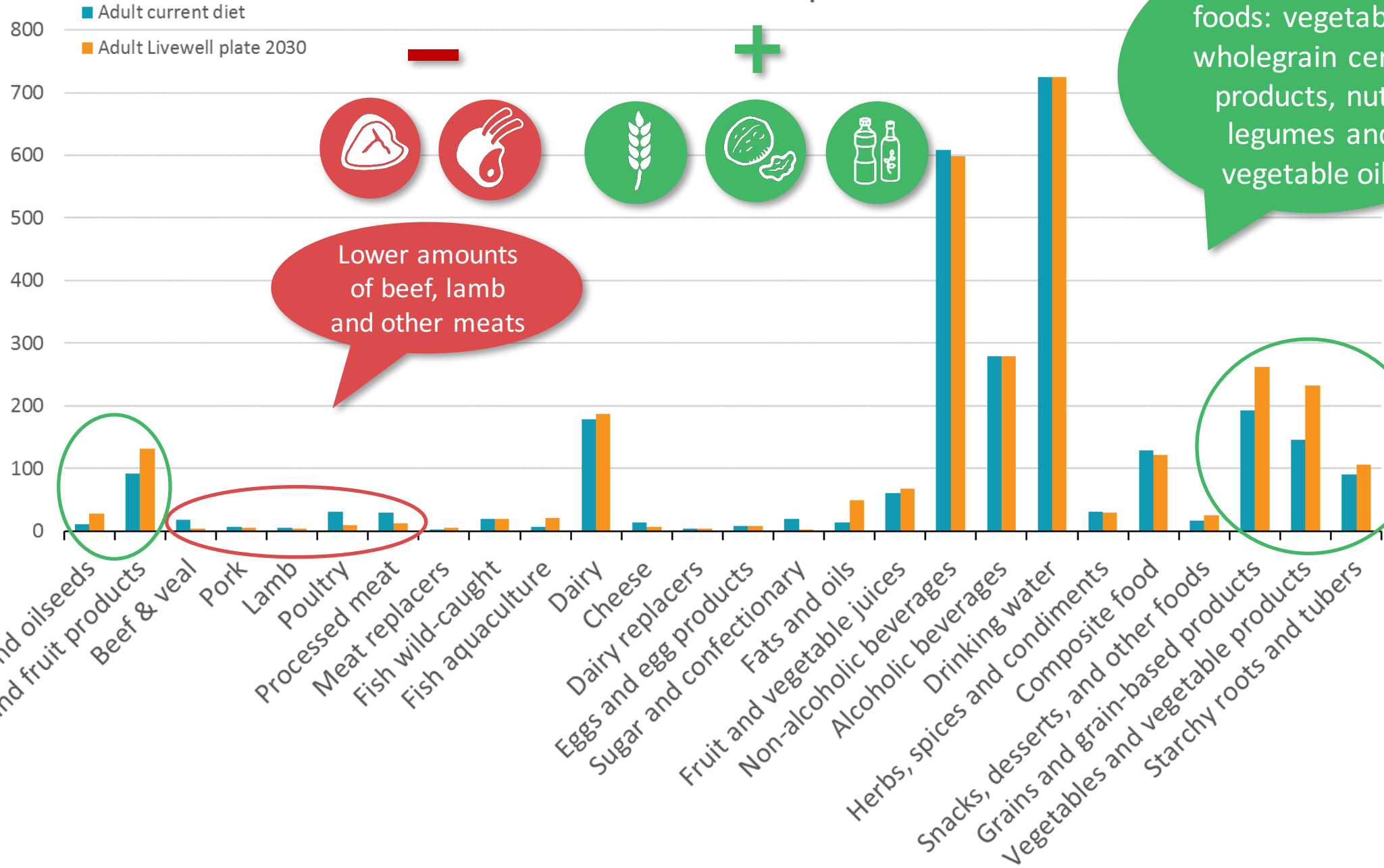
CURRENT



ADULT 2030



Detailed results adult plate 2030



Eating for 2 degrees

Conclusions



Using optimisation:

It is possible to come to robust Livewell plates that respect national climate change mitigation commitments.



The new Livewell plates respect all nutritional boundaries for a healthy diet.

Environmental impact of dairy substitution

The question

Question:

“Does dairy substitution lead to a reduced dietary environmental impact in the Netherlands?”

Environmental impact of dairy substitution

Starting point optimisation

Current diet:

Dutch dietary food consumption survey 2007-2010

Nutritional properties of food products:

Dutch Nutrient table (NEVO)

Environmental properties of food products:

Life Cycle Assessments (LCAs) by Blonk Consultants

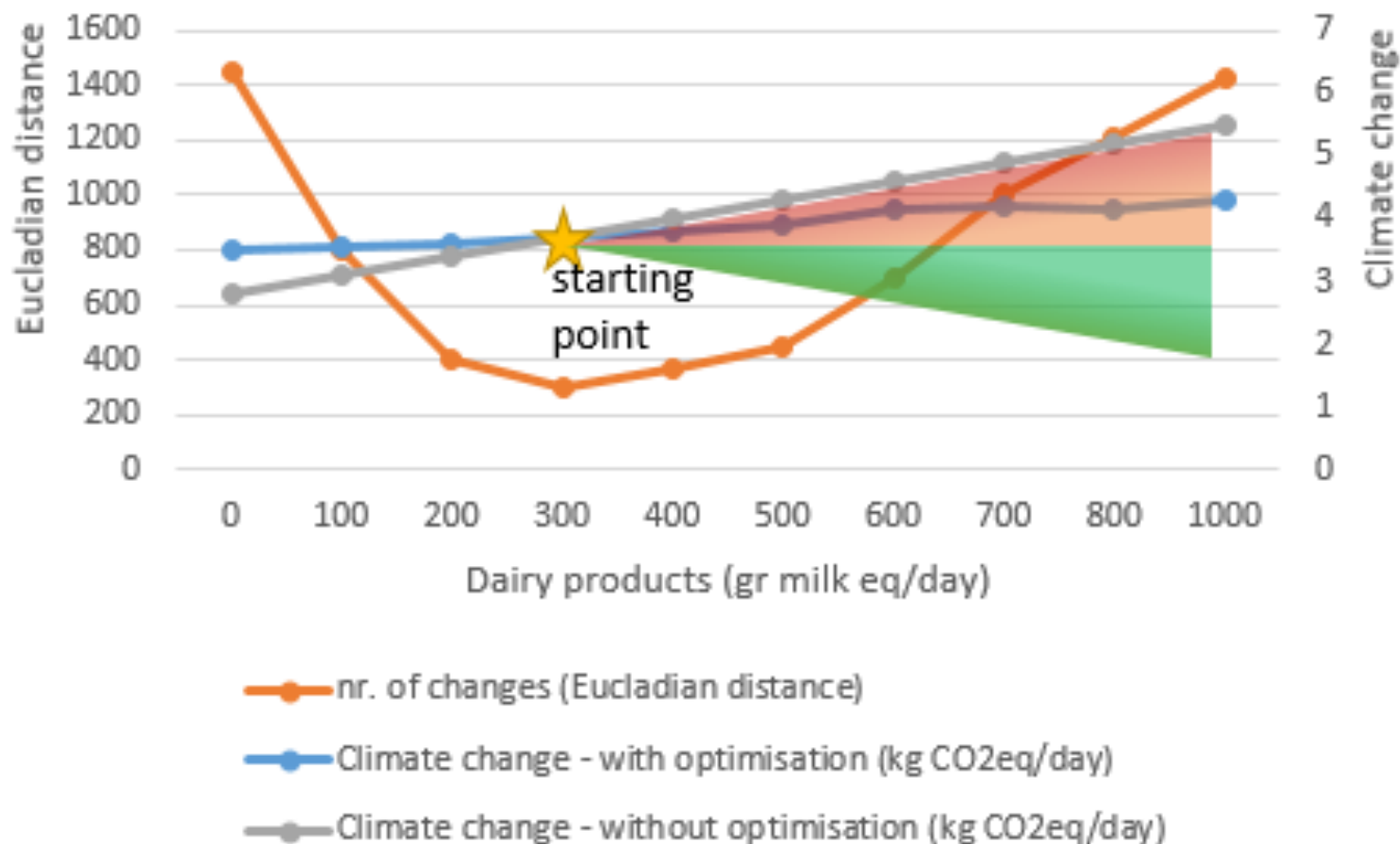
**Applying
stepwise
optimisation**

Varying dairy
products from 0% to
300% of the current
diet.

Optimising at every
step

Environmental impact of dairy substitution

Results



Environmental impact of dairy substitution

Conclusions



Replacing dairy products with alternative products (in the product basket of the current diet) provides little environmental benefit while many changes are needed.



As a source of useful nutrients dairy products are just as environmentally efficient as the products used to replace them.

Conclusion

what is the expected impact?

- IT tools will empower growers to manage productivity and sustainability impact simultaneously
- IT tools will empower public bodies and industries to help defining future proof diets and products
- However what about the consumer
 - Together with WWF UK and Imperial College we started a pilot for developing a consumer app → empowerment of the consumer
- Smart IT solutions emerge everywhere



References

- www.optimeal.nl/news/publications/

Thank you! Any Questions?

Reach out to us!

Hans Blonk

Director Blonk Consultants

www.optimeal.nl | www.blonkconsultants.nl | hans@blonkconsultants.nl

+31-182-579970