Autonomous growing

the SMART way of growing …

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Agenda

- Introduction
- Two global developments
- The Autonomous Greenhouse Challenge
- The rise of smart autonomous growing

Introduction

- Background in Marketing
- More than 15 years experience in IT, Data and Digital business applications
- Passion: Translate innovations to robust business models
- Director at AgroEnergy; The Netherlands

Agro Energy

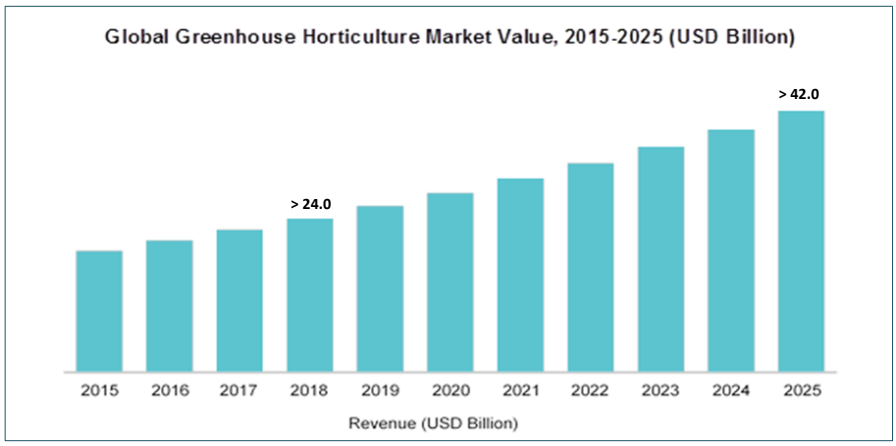
- Strong roots in Dutch Horticulture Greenhouse sector
- Focus on autonomous data driven energy management
- Now: starting a new company on autonomous greenhouse management

Market introduction of new company later this year

Will algorithms replace the ‘green fingers’ in greenhouse horticulture within the next 3 years?

Greenhouse horticulture grows with 8% per year

Greenhouse Horticulture Market will grow to hit $41.84 billion by 2025.



Source: https://www.adroitmarketresearch.com

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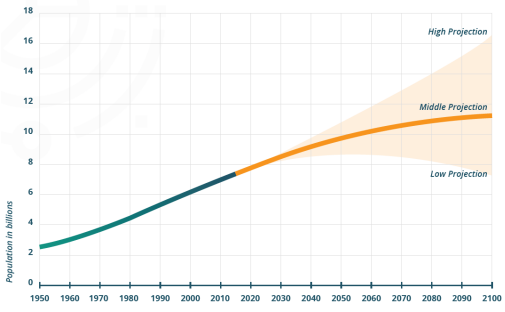
Greenhouse sector is growing strongly, but…

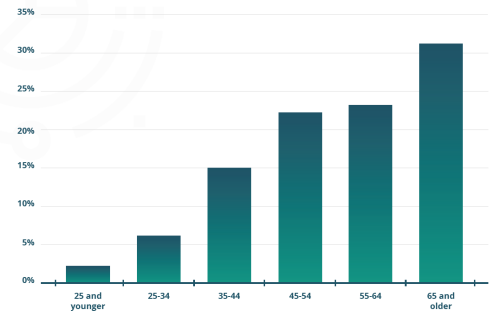
…Who will operate these greenhouses to feed 10 billion people?

PROJECTED WORLD POPULATION



Source: United Nations, 'World Population Prospects: 2015 Revision'

AGE DISTRIBUTION EU GROWERS



Source: Eurostat, 'Agriculture statistics - family farming in the EU'

Agro Energy

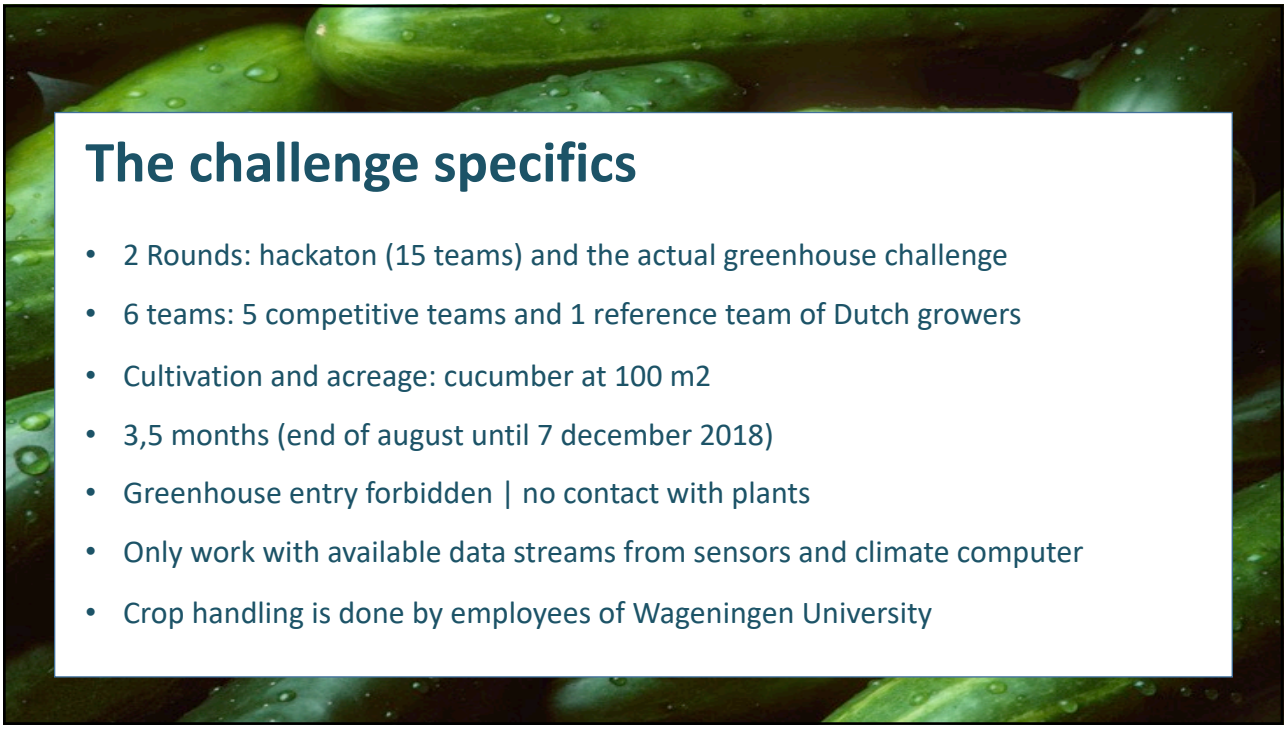

WAGENINGEN
UNIVERSITY & RESEARCH


Tencent 腾讯

the cropperators

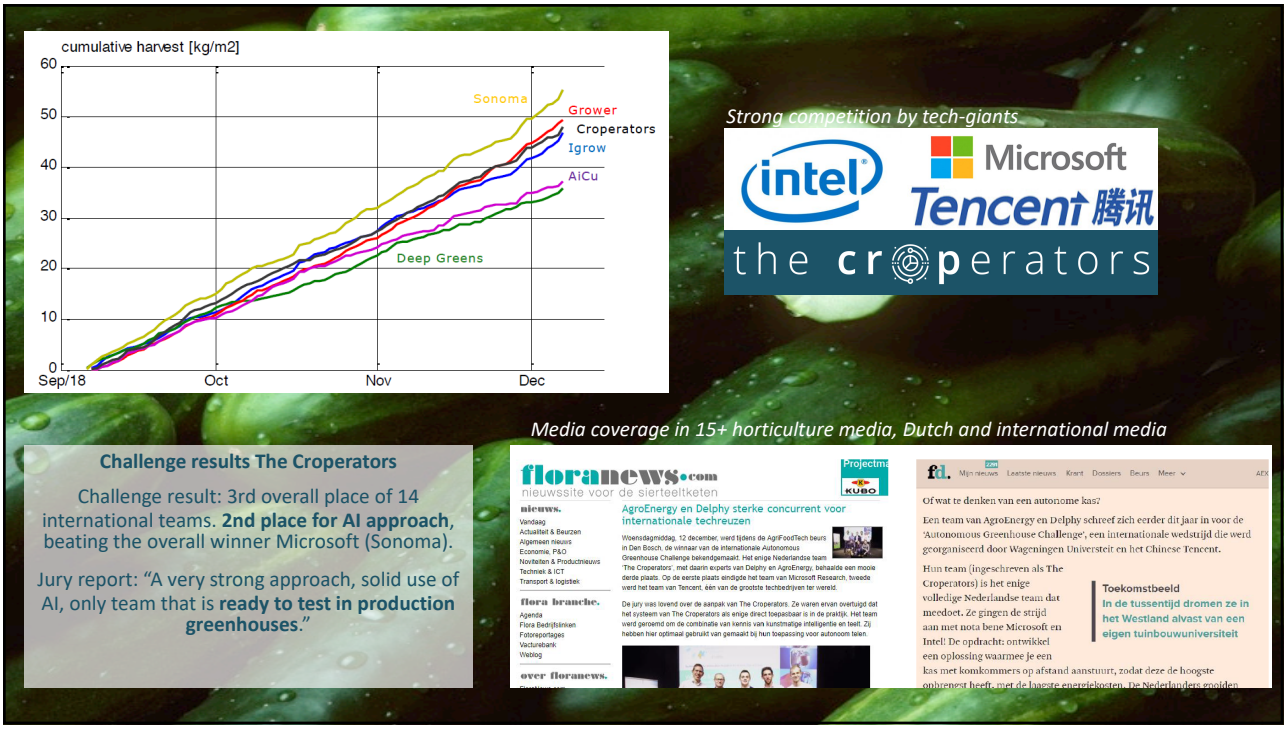
trusting autonomous growing

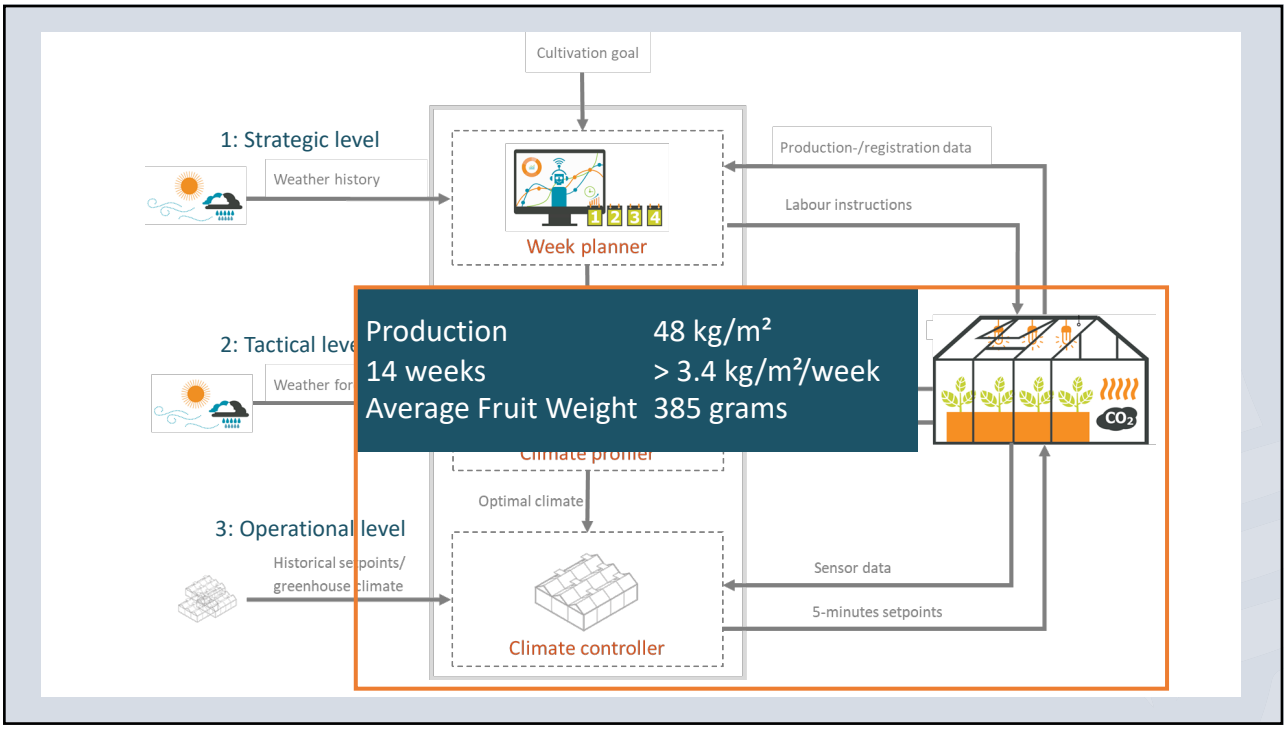
Agro Energy Delphy



The challenge specifics

- 2 Rounds: hackaton (15 teams) and the actual greenhouse challenge
- 6 teams: 5 competitive teams and 1 reference team of Dutch growers
- Cultivation and acreage: cucumber at 100 m2
- 3,5 months (end of august until 7 december 2018)
- Greenhouse entry forbidden | no contact with plants
- Only work with available data streams from sensors and climate computer
- Crop handling is done by employees of Wageningen University


cumulative harvest [kg/m2]
60
50
40
30
20
10
0
Sep/18
Oct
Nov
Dec
Sonoma
Grower
Croperators
Igrow
AiCu
Deep Greens
Strong competition by tech-giants
intel
Microsoft
Tencent 腾讯
the croperators
Challenge results The Croperators
Challenge result: 3rd overall place of 14 international teams. 2nd place for AI approach, beating the overall winner Microsoft (Sonoma).
Jury report: "A very strong approach, solid use of AI, only team that is ready to test in production greenhouses."
Media coverage in 15+ horticulture media, Dutch and international media
floranews.com
nieuwssite voor de sierteeltketen
AgroEnergy en Delphy sterke concurrent voor internationale techreuzen
fd.
Of wat te denken van een autonome kas?
Een team van AgroEnergy en Delphy schreef zich eerder dit jaar in voor de 'Autonomous Greenhouse Challenge', een internationale wedstrijd die werd georganiseerd door Wageningen Universiteit en het Chinese Tencent.
Toekomstbeeld
In de tussentijd dromen ze in het Westland alvast van een eigen tuinbouwuniversiteit


Cultivation goal
1: Strategic level
Weather history
Week planner
Production-/registration data
Labour instructions
2: Tactical level
Weather for
Production 48 kg/m²
14 weeks > 3.4 kg/m²/week
Average Fruit Weight 385 grams
Climate profiler
Optimal climate
3: Operational level
Historical setpoints/ greenhouse climate
Climate controller
Sensor data
5-minutes setpoints
CO2

The learnings of the challenge

Autonomous management of climate, irrigation, energy and crop is viable!

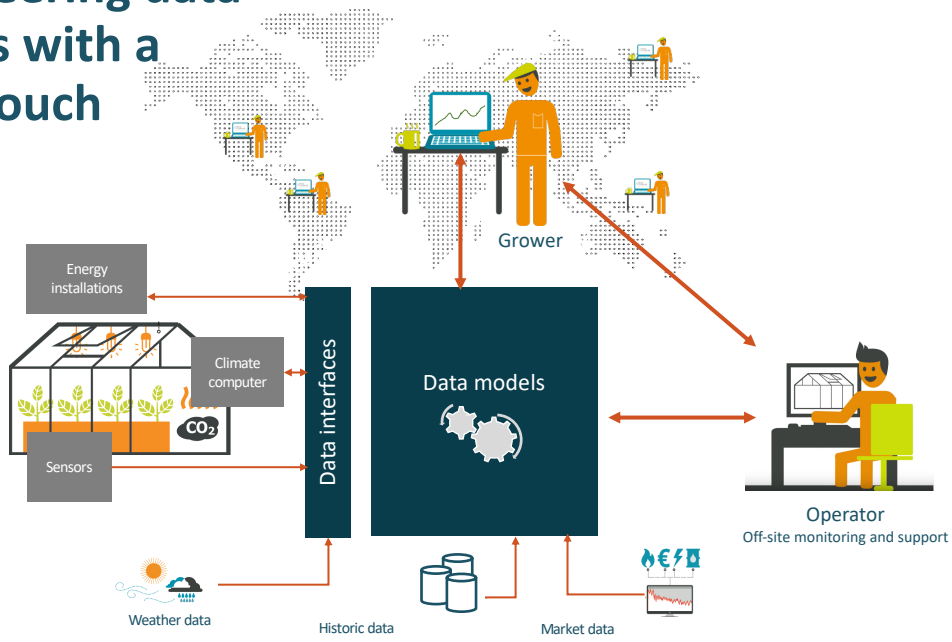
We can not deny any more that data driven growing is possible

Autonomous greenhouse management makes greenhouse operations scalable

Agro Energy

The rise of smart autonomous growing

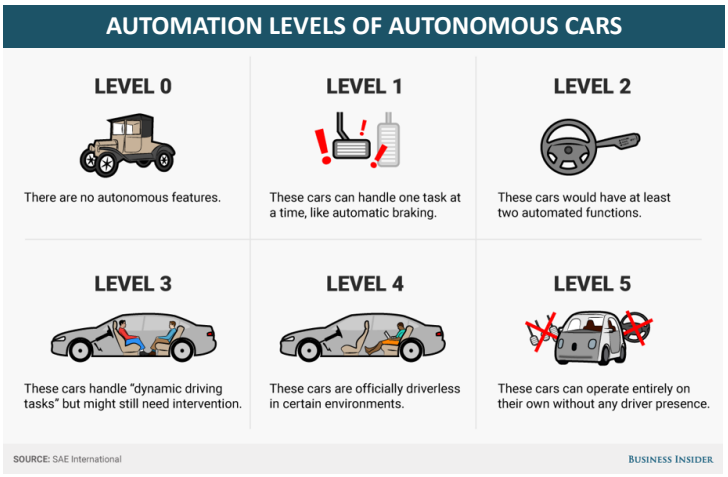
Smart steering data solutions with a human touch



Crop is leading

- Focus on plant balances to steer the plant towards a productive and healthy state
- Direct plant feedback to get direct response from the plant
- Continuous monitoring to adapt on changes, day and night
- Continuous scientific research is a necessity. Search for the best combination of sensors to 'let the plant speak'

Autonomy: The similarity between growing and driving your car



Tesla: 'a fully autonomous car is a fact next year'

Topman Elon Musk van Tesla belooft dat zijn auto's uiterlijk eind volgend jaar volledig autonoom vanaf een parkeerplaats naar een bestemming kunnen rijden. Hij spreekt over volledige autonomie, wat betekent dat de bestuurder intussen een dutje zou kunnen doen.

Niek Schenk / Tweakers 21-02-19, 12:07 Laatste update: 12:47

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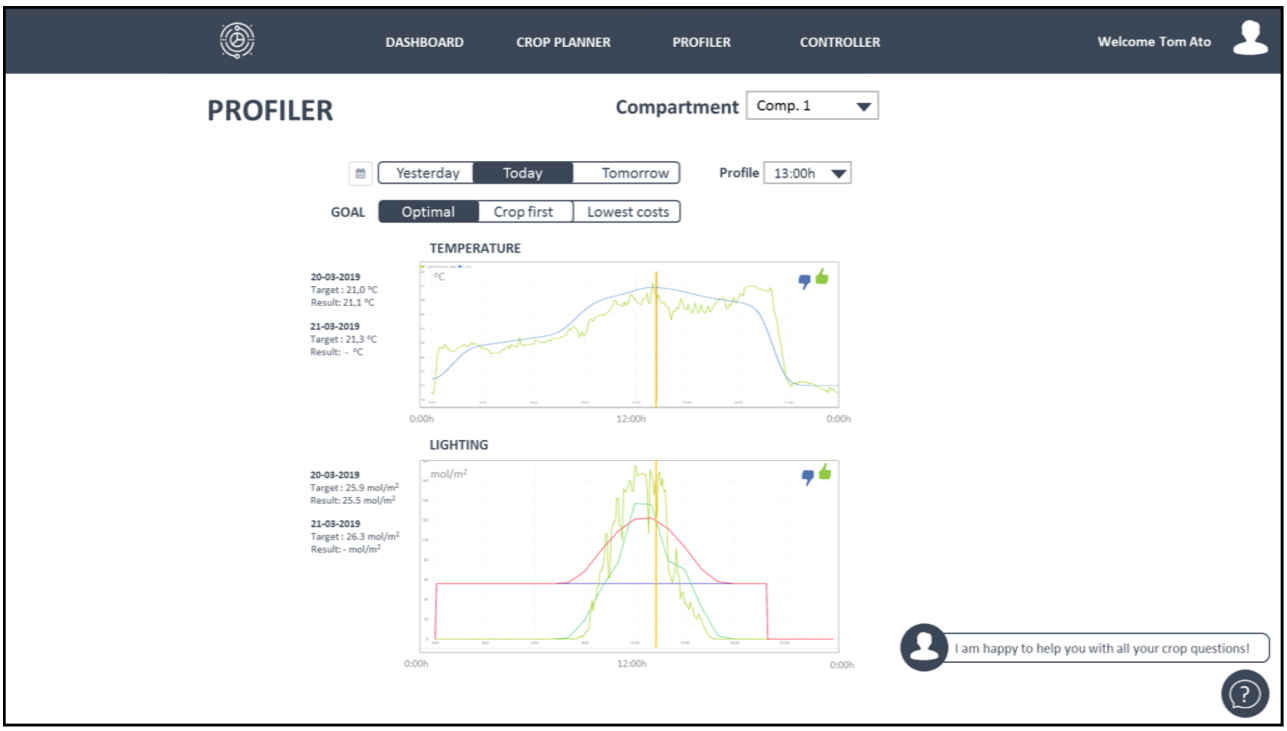
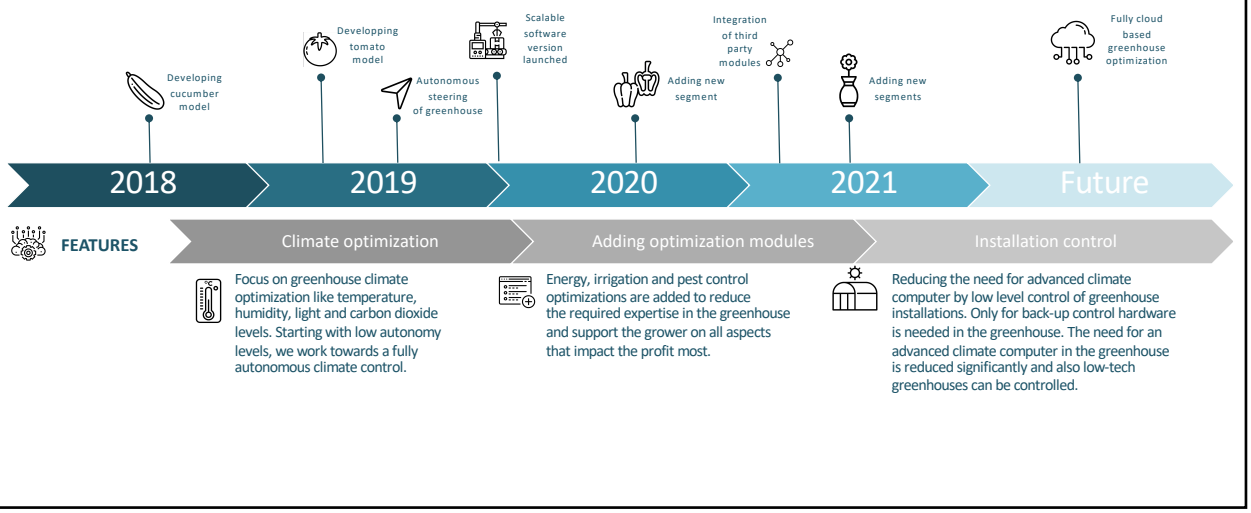
Autonomy levels greenhouse management

Level	Autonomous greenhouse management	Daily setpoint adjustments	Weekly setpoint adjustments	Proactive monitoring	Reactive response to alerts	Define crop strategy
0	The grower is settings the right setpoints manually in the climate computer based and monitors the effect.					
1	The grower controls most settings manually, but some specific functions are automated like a screen control system.					
2	Autonomous crop management can control a selected set of setpoints in the climate computer during normal circumstances. Other more complex settings are controlled by the grower. Also during extreme circumstances the grower must take over control.					
3	The greenhouse climate is fully controlled autonomously as long as no complex changes are required or extreme events occur. The grower has to check regularly for incidents and keeps an eye on the settings.					
4	The greenhouse climate is fully controlled autonomously in normal circumstances based on a defined crop target. Only in extreme cases the grower takes over control.					
5	The role of the grower is to set the crop targets. The greenhouse climate is controlled fully autonomously even during extreme situations.					

Trust & Value



Smart & autonomous growing is already possible today



Statements:

Algorithms will start replacing the 'green fingers' in greenhouse horticulture within the next 3 years!

Algorithms make greenhouse operations scalable and can feed the world!

The BIGGEST challenge

25 % Success is determined by 75 %

Technological innovation

Social innovation

Let's connect!

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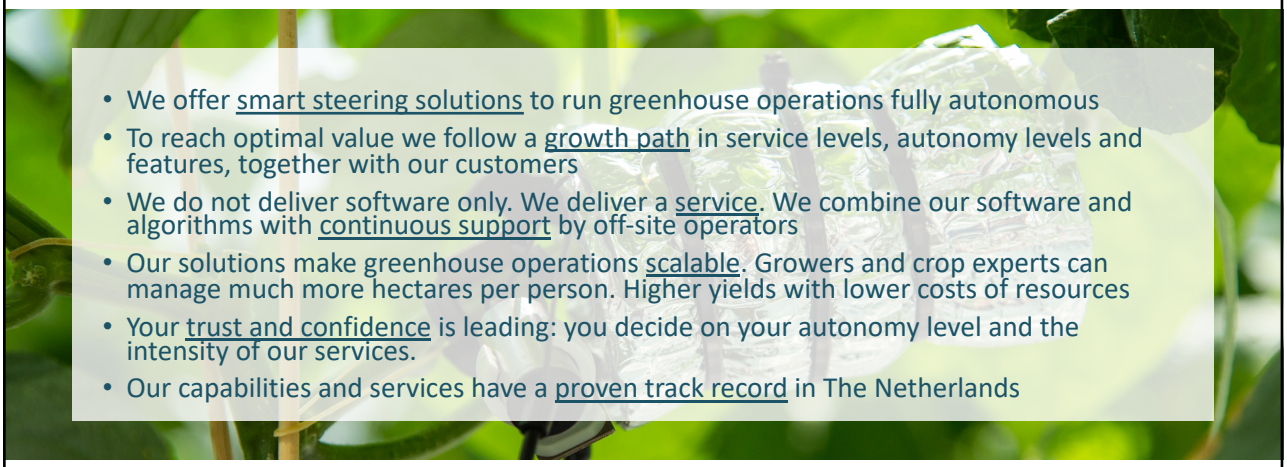
LinkedIn group: Autonomous Crop Management

In short



- We offer smart steering solutions to run greenhouse operations fully autonomous
- To reach optimal value we follow a growth path in service levels, autonomy levels and features, together with our customers
- We do not deliver software only. We deliver a service. We combine our software and algorithms with continuous support by off-site operators
- Our solutions make greenhouse operations scalable. Growers and crop experts can manage much more hectares per person. Higher yields with lower costs of resources
- Your trust and confidence is leading: you decide on your autonomy level and the intensity of our services.
- Our capabilities and services have a proven track record in The Netherlands