

Jene van der Heide  
Wageningen University & Research  
[jene.vanderheide@wur.nl](mailto:jene.vanderheide@wur.nl)



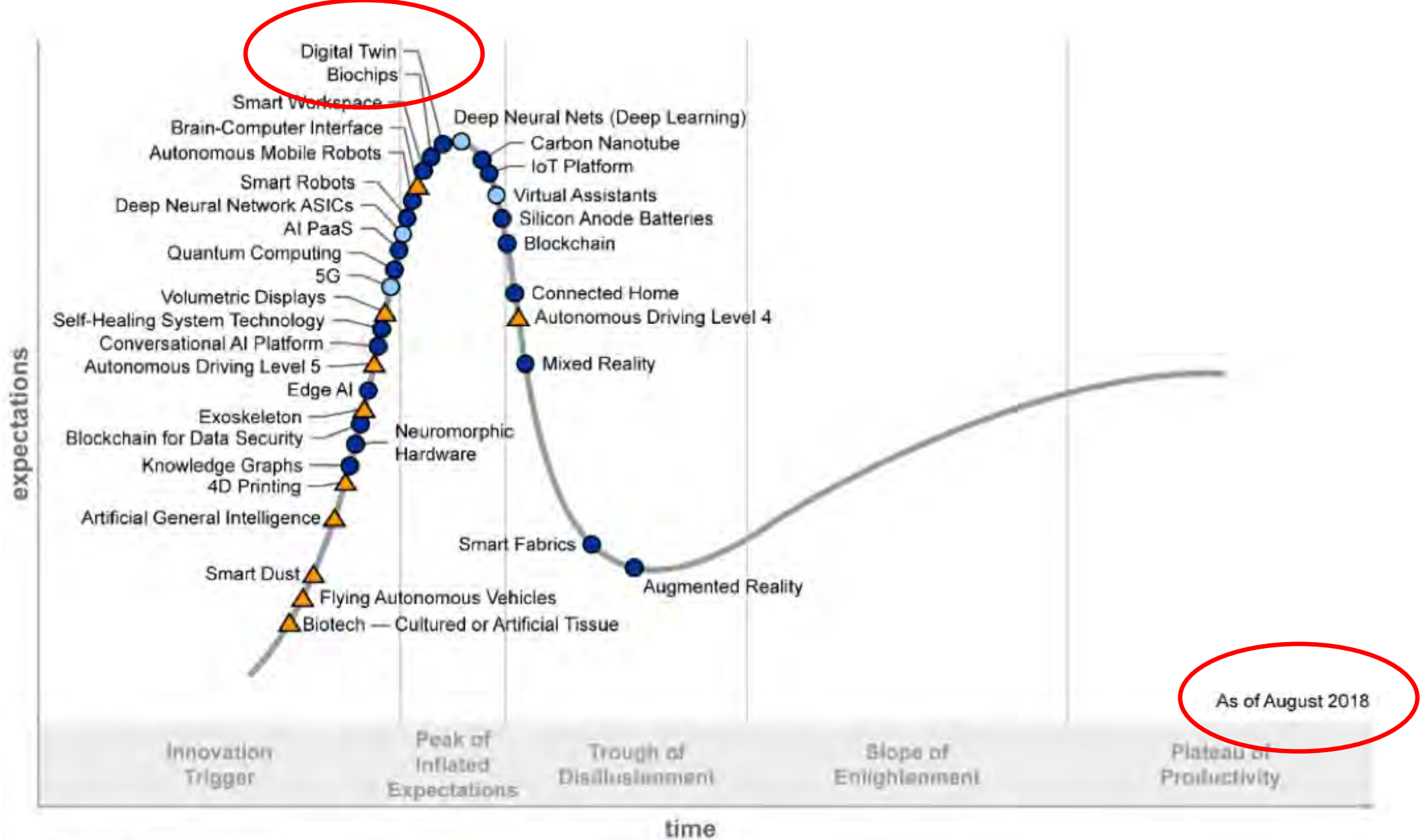
Programma Directeur DDHT en DT  
Chair AI Taskforce  
Chair Wageningen Modelling Group

...









Plateau will be reached:

○ less than 2 years   ● 2 to 5 years   ● 5 to 10 years   ▲ more than 10 years   ⊗ obsolete before plateau

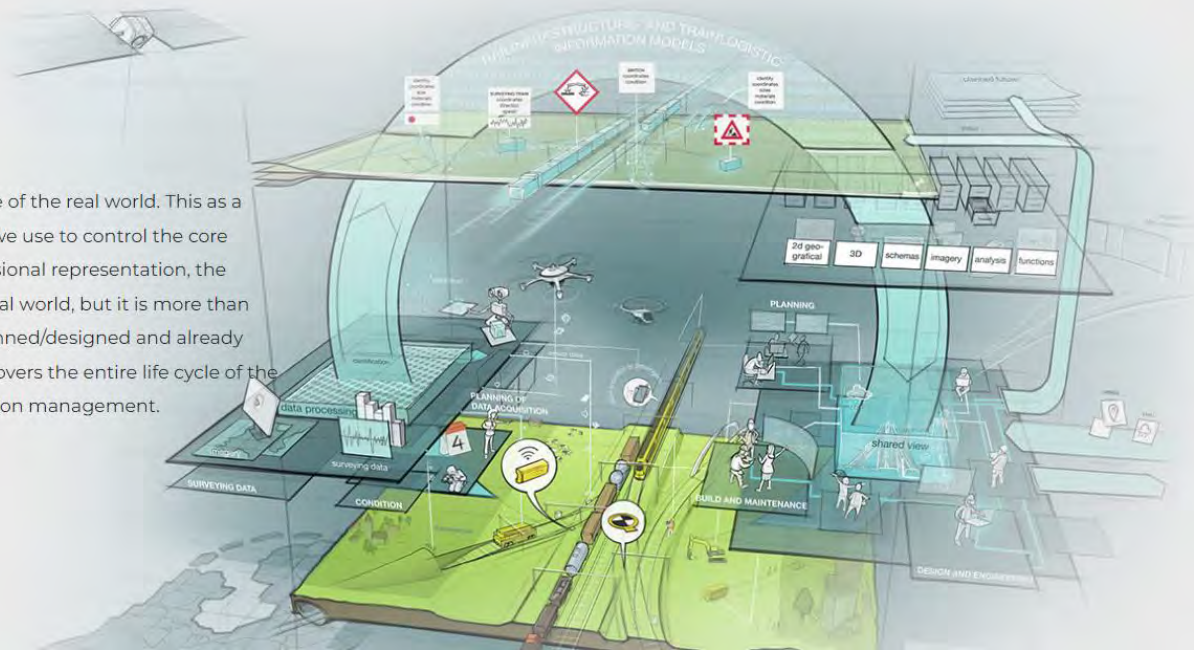


# City in transition

5D

## DIGITAL TWIN

The Virtual Twin is a digital representative of the real world. This as a basis for the information systems which we use to control the core processes of ProRail. Due to the 3-dimensional representation, the digital variant is first of all a copy of the real world, but it is more than that. The Digital Twin also represents planned/designed and already disappeared objects. This means that it covers the entire life cycle of the object structure and associated information management.



## IAM Nxt Gen

Digital Twin voor de toekomst

22-12-2021

inspraak

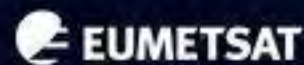
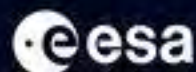


# DESTINATION EARTH



## A DIGITAL REPLICA OF OUR PLANET

Destination Earth (**DestinE**) aims to develop a highly accurate digital model of Earth to monitor the effects of natural and human activity on our planet, anticipate extreme events and adapt policies to climate-related challenges.





# DESTINATION EARTH

THE MOVIE



Destination

Earth

the movie



# Farming Simulator

[BLOG](#) | [GAMES](#) | [MEDIA](#) | [DLC](#) | [MODS](#) | [TUTORIALS](#)

[BUY NOW](#)

Simulator 22

## Farm Pro Pack Pre-order







▲ Akkerbouwer Hendrik Jan Ten Cate: „Het is heel erg opletten” © Joris Knapen

## Aardappelziekte grijpt om zich heen: ‘Als we niet oppassen, hebben we in september geen oogst’

De aardappelziekte phytophthora grijpt dit jaar uitzonderlijk vroeg om zich heen. Akkerbouwers maken zich grote zorgen om de vroege infecties en het feit dat de schimmel op kletsnatte akkers moeilijk is te bestrijden. „Als we niet oppassen, hebben we in september geen aardappelen meer om te oogsten”, zegt Geert Pinxterhuis van de brancheorganisatie BO Akkerbouw.

Edwin Timmer 11-06-24, 20:00

Laatste update: 20:17

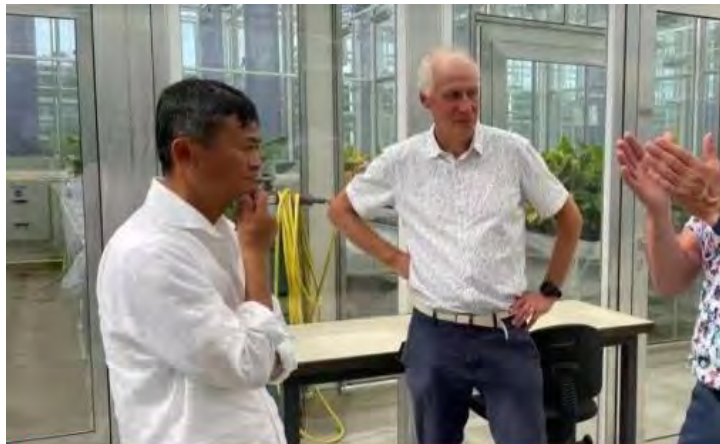






We embark on  
the next phase  
in our journey . . .





News

## Jack Ma visits WUR to learn about sustainable food production

July 5, 2022

Jack Ma, founder of Jack Ma Foundation and co-founder and former executive chairman of Alibaba Group, visited WUR on July 2nd 2022. He was interested in how to increase food production in a sustainable way. Ma mentioned he would like to come again in order to gain even more insights.

The aim of Ma's visit to Wageningen was to gain insight into the possibilities of sustainable livestock farming and fisheries, since Mr. Ma 'would like to fully devote his time and efforts to agriculture and food sustainability, including in the Gobi desert'.



Research

Our research ▾

Programs & events ▾

Connect & learn ▾

About ▾

Register: Research Forum

< [Research for Industry](#)

## FarmBeats: AI, Edge Computing for Agriculture

[Learn](#) / [Azure](#) / [Data Manager for Agriculture](#) /

## Generative AI in Azure Data Manager for Agriculture

Article • 04/02/2024 • 2 contributors

[Feedback](#)

### In this article

[Prerequisites](#)

[High-level architecture](#)

[Use cases for farm operations](#)

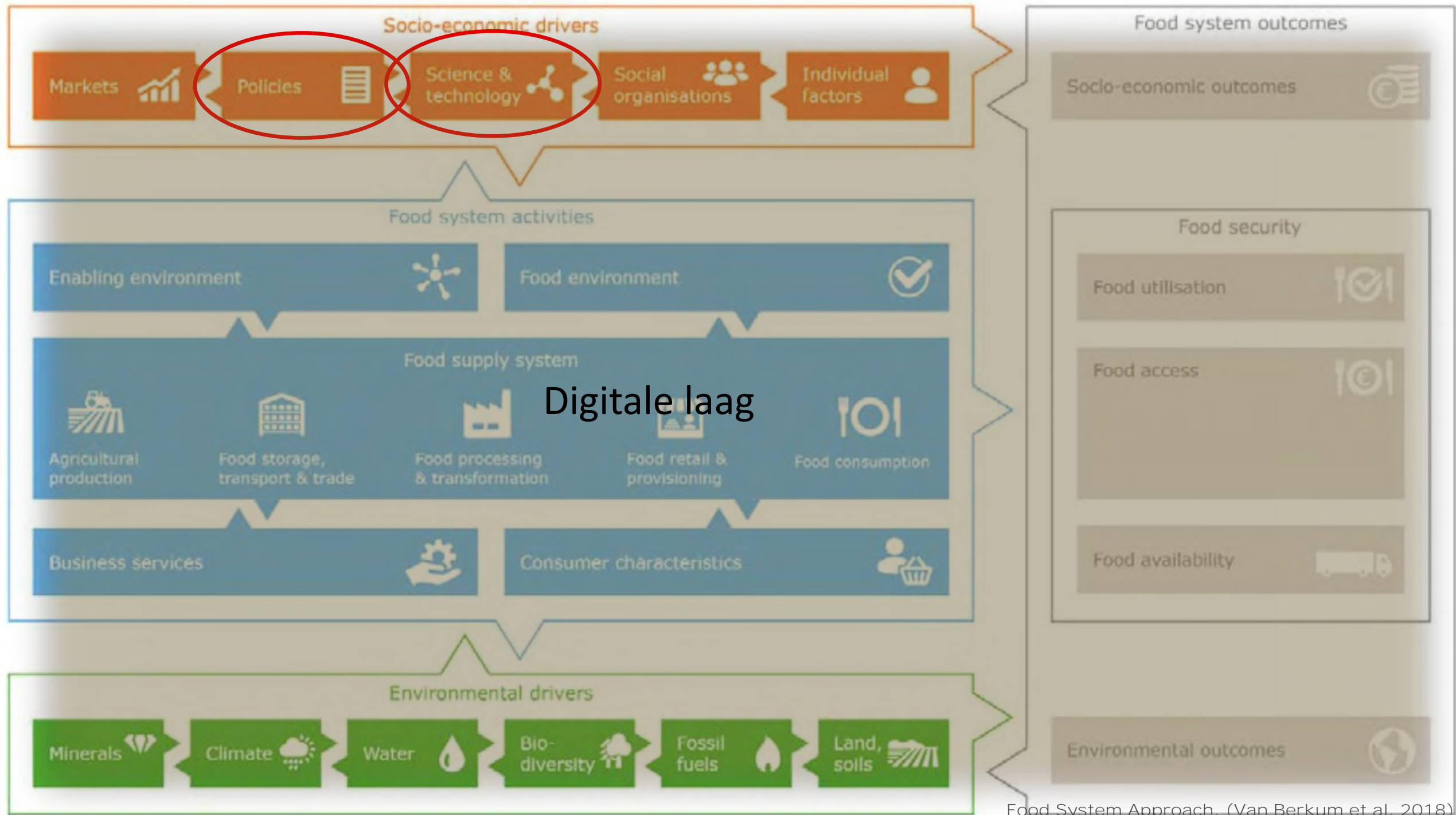
[Next steps](#)

Microsoft copilot templates empower organizations to build agriculture copilots. Our copilot templates enable seamless retrieval of data stored in Azure Data Manager for Agriculture so that farming-related context and insights can be queried in a conversational context.

Many customers have proprietary data outside Azure Data Manager for Agriculture; for example, agronomy PDFs or market price data. These customers can benefit from an orchestration framework

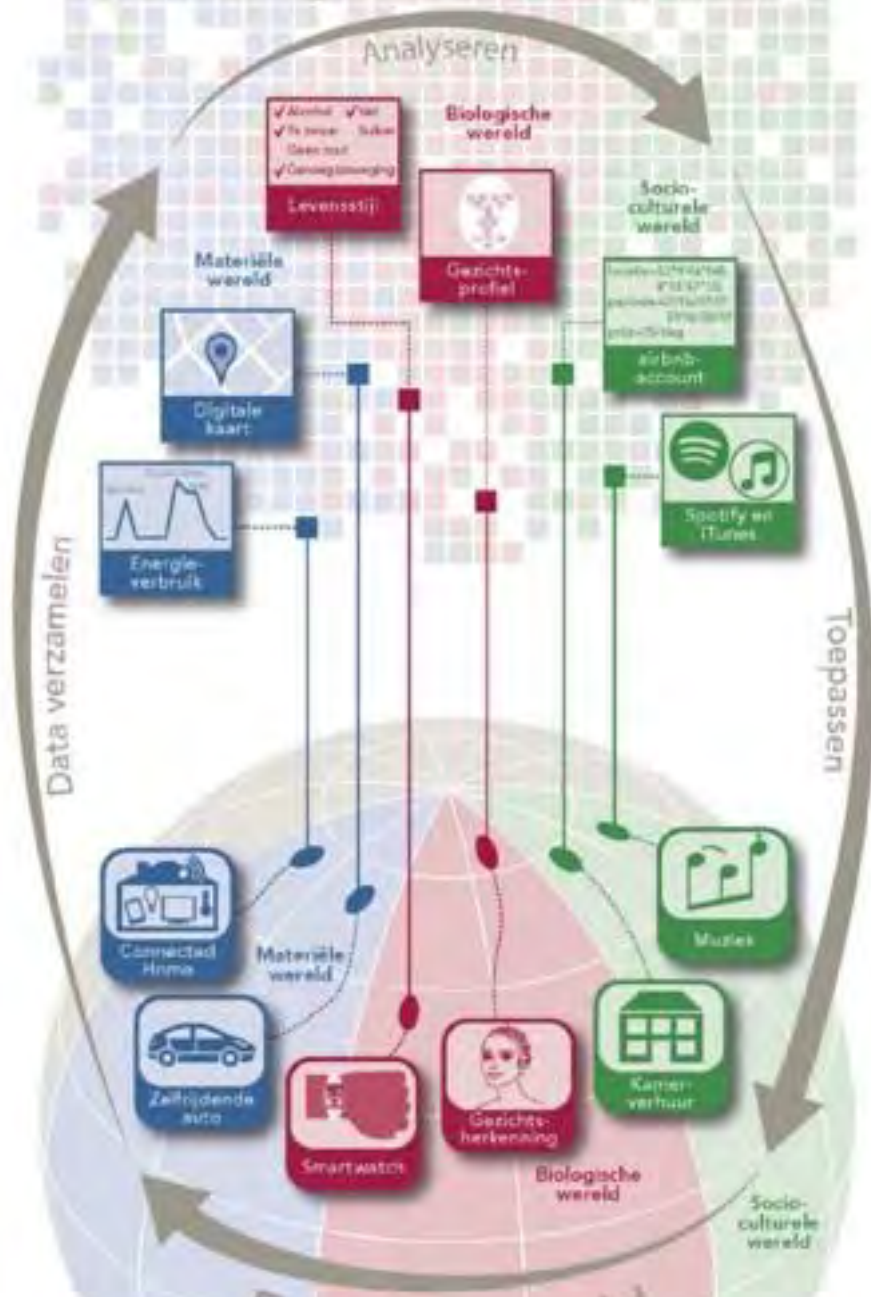








# Digitale wereld






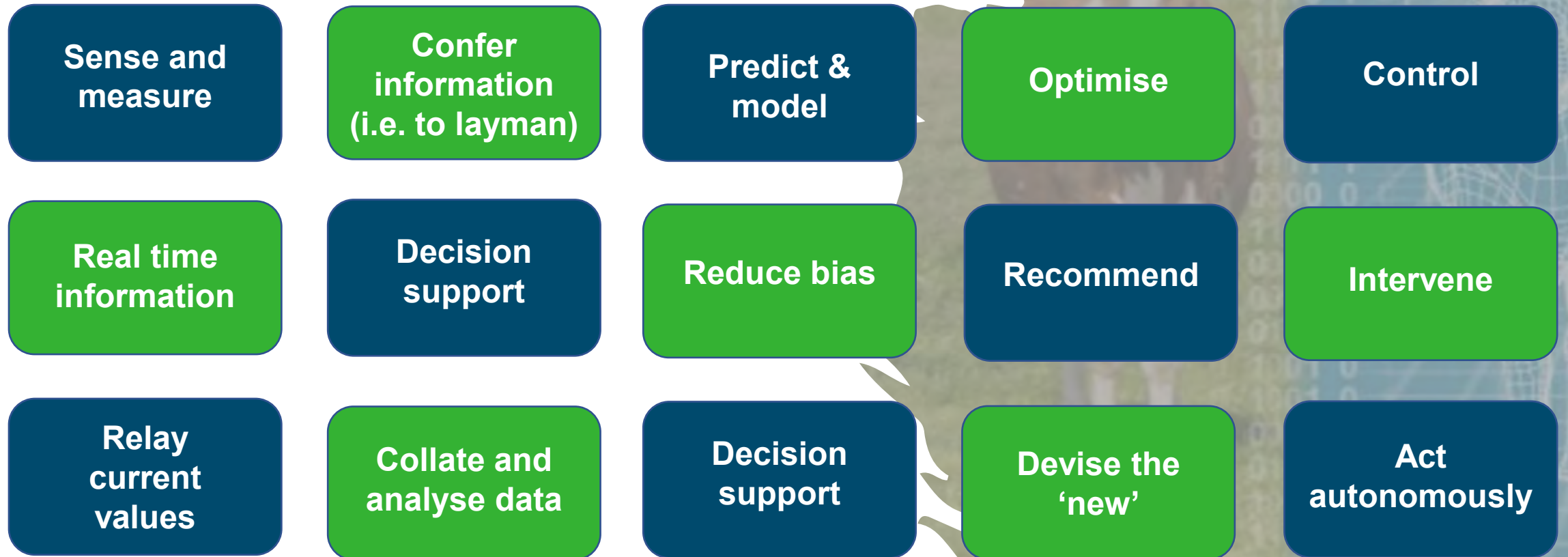
1. Waarom heb ik een digitale tweeling nodig?





# Why a Digital Twin?

*From left to right...*  *Increasing complexity (from sensing, to processing, to optimising).  
Doing more tasks associated with humans.*





Hey ChatGPT4.o

Give me ten reasons why I, as a farmer, need a digital twin?

Sure, here are ten reasons why you, as a farmer, could benefit from using a digital twin:

**1.Optimized Crop Management:** Digital twins can simulate crop growth under various conditions, allowing you to optimize planting schedules, irrigation, and fertilization for maximum yield.

**2.Predictive Maintenance:** For machinery and equipment, digital twins can predict failures before they occur, minimizing downtime and maintaining productivity.

**3.Resource Efficiency:** By analyzing data on water usage, pesticides, reducing costs and environmental impact.

**4.Enhanced Decision Making:** Real-time data and simulations can aid in decisions regarding pest control, and harvest timing.

**5.Risk Management:** Digital twins can model the impact of weather events, market changes, and other risks, allowing you to develop more effective contingency plans.

**6.Traceability and Compliance:** Digital twins can track and document the lifecycle of crops, helping you meet regulatory requirements and provide transparency to consumers.

**7.Yield Forecasting:** Accurate yield predictions can help you plan for storage, logistics, and sales, improving overall farm management.

**8.Cost Savings:** By identifying inefficiencies and predicting maintenance needs, digital twins can help reduce operational costs.

**9.Sustainability:** Monitoring and optimizing resource usage can contribute to more sustainable farming practices, aligning with environmental goals and consumer preferences.

**10.Integration with IoT:** Digital twins can integrate with IoT devices on your farm, providing a comprehensive view of operations and enabling automated responses to real-time data.

**Implementing a digital twin in your farming operations can lead to increased productivity, reduced costs, and improved sustainability, ultimately enhancing the profitability and resilience of your farm.**

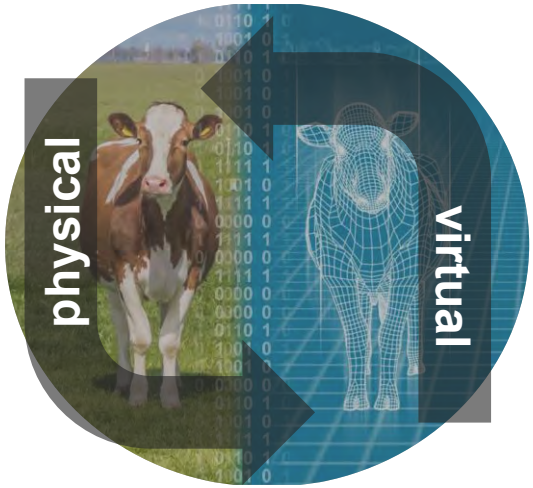


## 2. Wat is een digitale tweeling eigenlijk?





# What is a Digital Twin?



**“A Digital Twin is a digital equivalent to a real-life object of which it mirrors its behaviour and states over its lifetime in a virtual space.”**

(Natasja Ariesen-verschuur, Cor Verdouw, Bedir Tekinerdogan (2022), Digital Twins in greenhouse horticulture: a review, Computers and Electronics in Agriculture)

[TED Talk to watch.](#)

**“Digital Twins are computational representations of both living and non-living entities and processes, which can be used to analyse and simulate interventions in these entities and processes.”**

(Simone van der Burg, Sanneke Kloppenburg, Esther J. Kok & Mariska van der Voort (2021) Digital twins in agri-food : Societal and ethical themes and questions for further research, NJAS: Impact in Agricultural and Life Sciences, 93:1, 98-125)

**“Digital twins are digital representations of systems or processes with three specific characteristics distinguishing them from other representations such as data sets or simulation models. First, they represent one specific instance of a system or process, which is duplicated by the twin. Second, this instance is regularly monitored, and the resulting data are used to update the twin so that instance and twin are kept synchronized. Third, a twin allows user interaction to investigate its hypothetical time evolution under different scenarios.”**

(Willem Jan Knibbe, Lydia Afman, Sjoerd Boersma, Marc-Jeroen Bogaardt, Jochem Evers, Frits van Evert, Jene van der Heide, Idse Hoving, Simon van Mourik, Dick de Ridder & Allard de Wit (2022) Digital twins in the green life sciences, NJAS: Impact in Agricultural and Life Sciences, 94:1, 249-279)





Devices / sensoren

Connectivity

5D

Dashboard

Data

Modellen



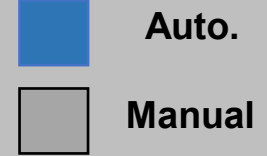
*Real world thing..*

*...its Digital Twin*

**Key**



**Component**



Modifications (e.g., new greenhouse; new sensors)

Improved design

Control strategies

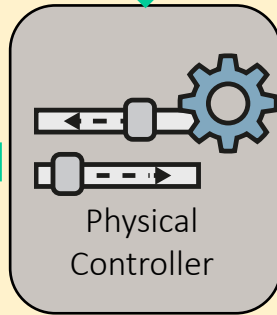
Visualisation /  
Decision making

Models & processes

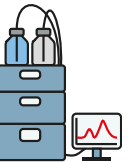
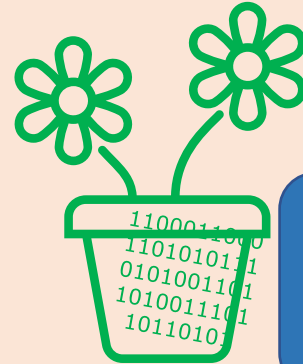
Data  
processing

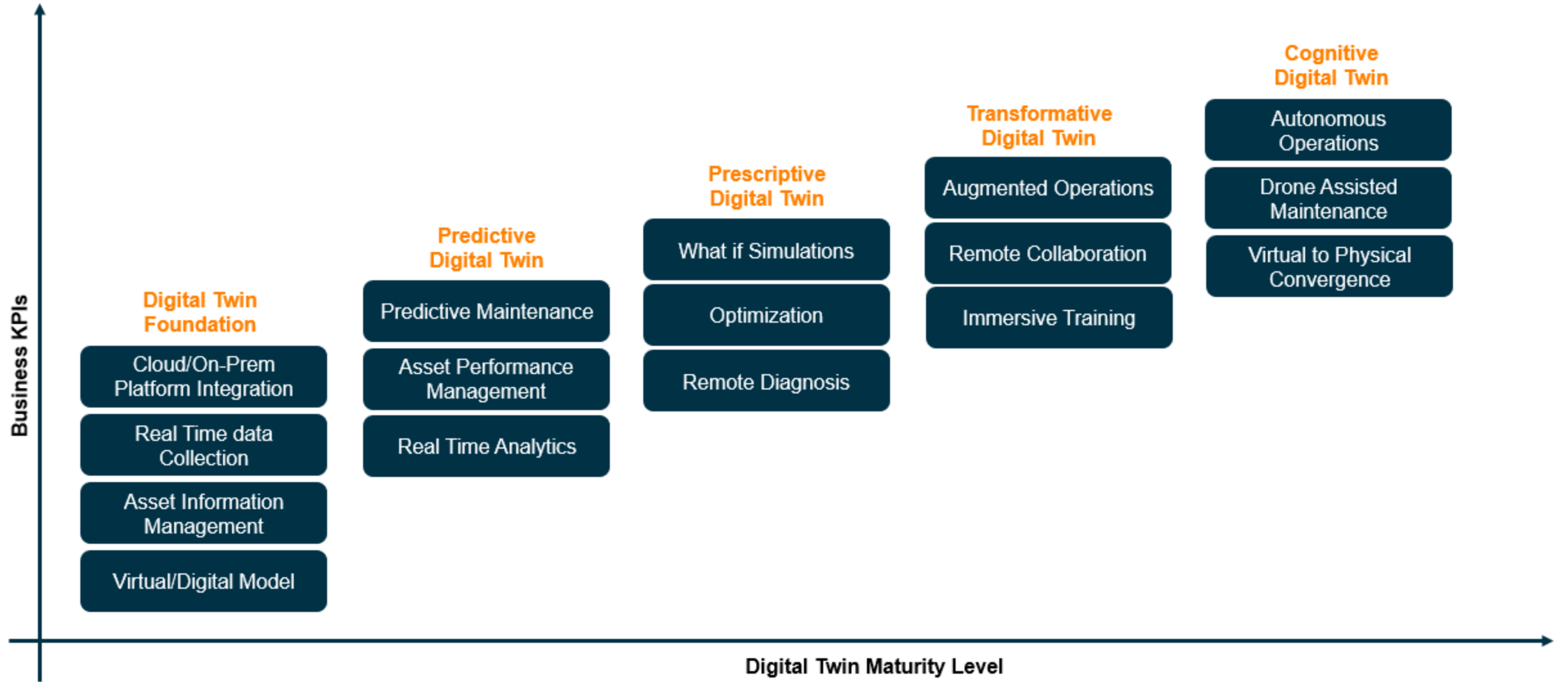
Data  
repository

Historic and  
External data



Sensing:  
Sensors,  
observations,  
measurements

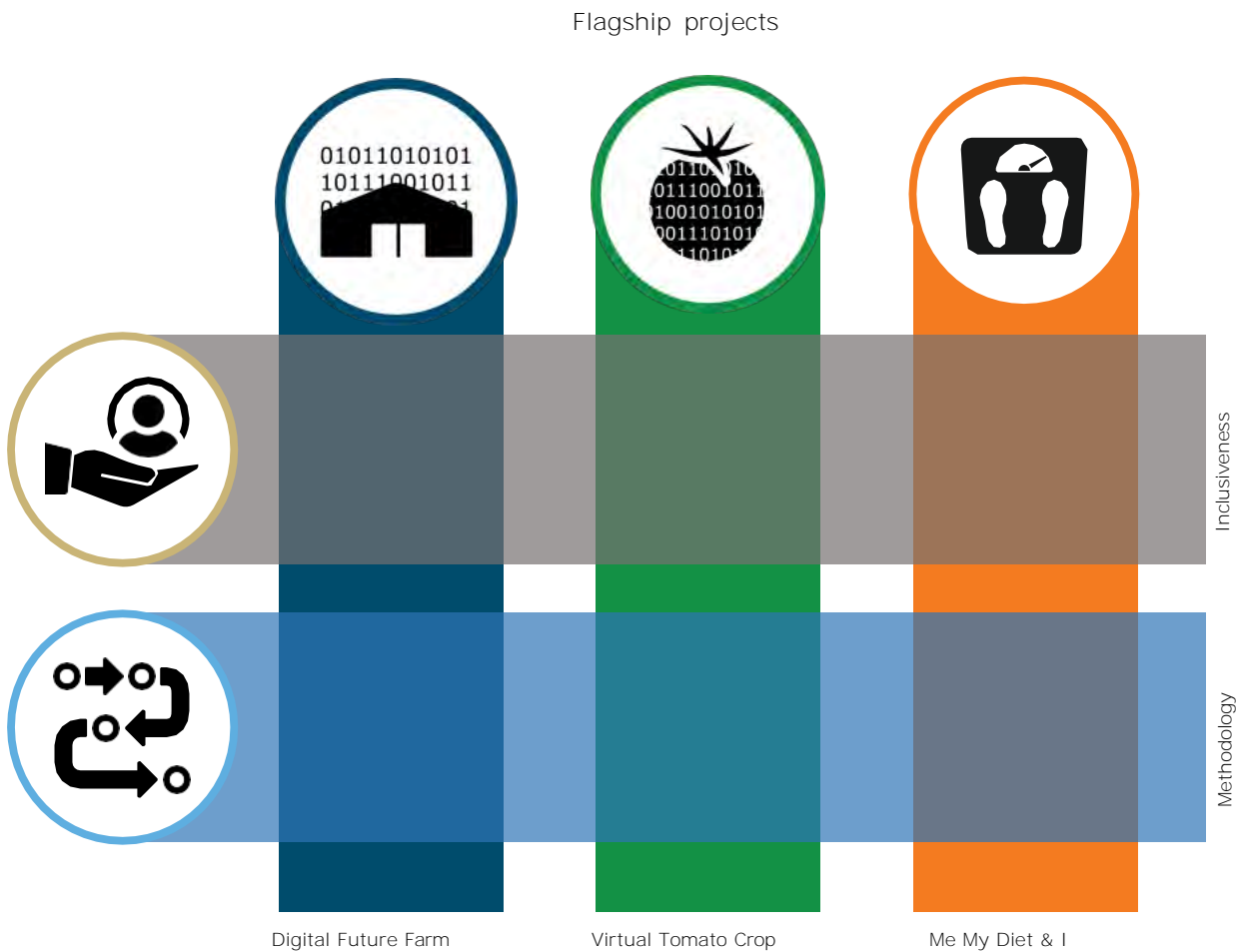






# Maturity Levels

	ML0 No Twin	ML1 Status	ML2 Informative	ML3 (a and b) Predictive		ML4 (a and b) Optimisation		ML5 Autonomous	
<b>Data</b> Collection of values that represent the properties of an asset	User performs task	Twin performs task							<i>Collects data</i>
<b>Information</b> Structuring data into a coherent organised format									<i>Context (datastorage, historic data)</i>
<b>Knowledge</b> Processing of structured data using previous experience				Machine learning	Process-physical models				<i>Models + predictions</i>
<b>Understanding</b> Scenario analysis through exploring if then situations						i.e., presents different scenarios			<i>Exploration (scenario testing, interaction)</i>
<b>Insight</b> Optimisation and developing new relationships							i.e., chooses best scenario		<i>Optimisation</i>
<b>Wisdom</b> Feedback, control of the system based upon understanding									<i>Autonomous</i>





Virtual tomato crops



# Mijn boodschap vandaag:

Weet **waarom** je een Digital Twin wilt.

Weet **welk soort** Digital Twin je nodig hebt.

Weet welke componenten daarvoor nodig zijn.

Regel het belangrijkste ingrediënt: **de data**

De gedragscode Datagebruik is niet genoeg;  
om de big tech te bedwingen

Een EU Agricultural Data Act is beter, samen met o.a. de AI Act  
en de EU Agricultural Data Space.

**Staar je niet blind op de technologische verhalen, plaatjes en mogelijkheden.**



Gedragscode Datagebruik Akkerbouw



Lijst met bedrijven die de Gedragscode onderschrijven

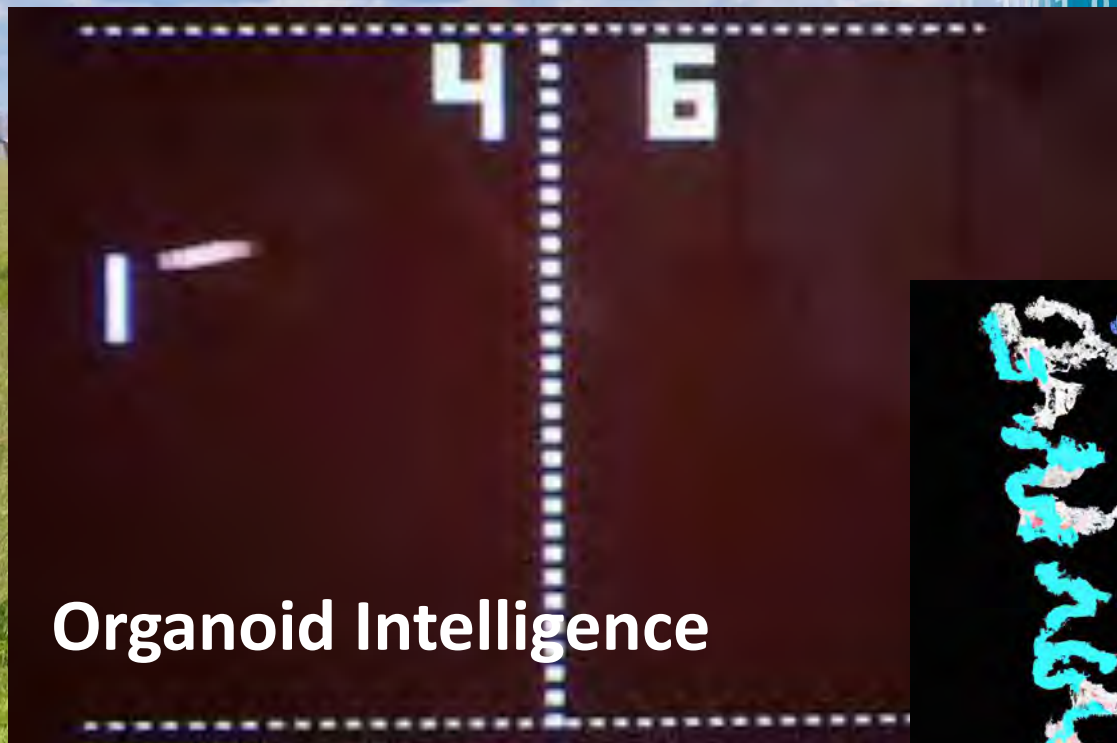
## Gedragscode in het kort

- De rechten op de data van het teeltbedrijf zijn in handen van de teler. De teler is eigenaar.
- Omdat de kwaliteit van de data de waarde ervan bepaalt, staat de teler in voor de juistheid en de volledigheid van de data.
- De afnemer van de data moet vooraf het gebruiksdoel van de data melden aan de teler. Deze beslist of zijn data mogen worden gedeeld voor dit doel.

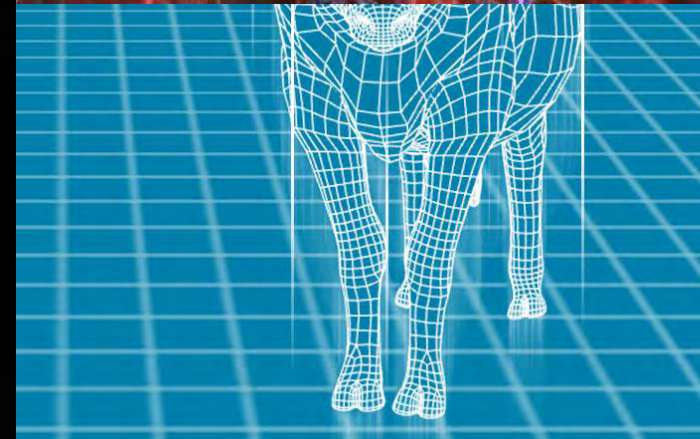
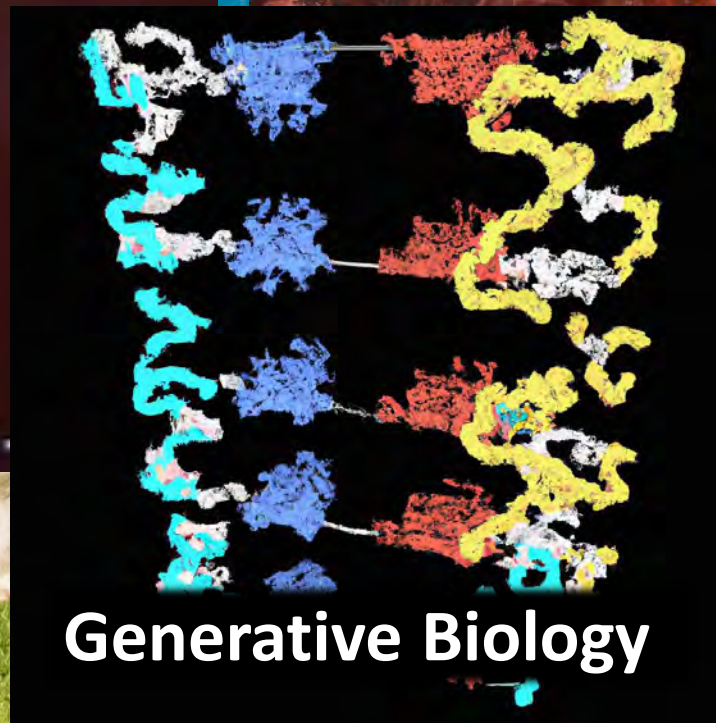
## ‘Dataruimte agrifood’

- De afnemer mag de data alleen gebruiken voor het overeengekomen gebruiksdoel.
- De afnemer van de data gaat zorgvuldig om met de data. Dit betekent dat de afnemer de data zo goed mogelijk beveiligt tegen verlies, diefstal en onbevoegde toegang en dat hij regelmatig back-ups maakt om dataverlies te voorkomen.





Data in DNA



Jene van der Heide  
Wageningen University & Research  
[jene.vanderheide@wur.nl](mailto:jene.vanderheide@wur.nl)



Programma Directeur DDHT en DT  
Chair AI Taskforce  
Chair Wageningen Modelling Group

...

<https://www.sciencedirect.com/science/article/pii/S0168169920331471?via%3Dihub>

<https://www.agrimetrics.co.uk/news/10-things-about-digital-twins-in-agriculture>

[https://youtu.be/5uLSDbh6M\\_U?si=evn7XZHmPnqcRmBU](https://youtu.be/5uLSDbh6M_U?si=evn7XZHmPnqcRmBU)