



Disruptive futures?

Promising technologies for agriculture in different scenarios

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Large Farm Management 4.0, Kiev Ukraine



About STT

- **Founded in 1968**
- **8-10 staff**
- **Public-private funding**

STT Netherlands
Study Centre for
Technology Trends



SIER



NPM CAPITAL



rivm



W Wuppermann



Ministerie van Onderwijs, Cultuur en
Wetenschap

e-on



Ministerie van Economische Zaken



McKinsey & Company



IBM



T-Mobile

PHILIPS pwc

NWO



SIEMENS



alliander



NXP



Core business

- **Exploring the future, no predictions!**
- **Together with stakeholders**
- **Technology in society**
- **Science based, with a creative twist**



My main message:

Disruptive futures? Promising technologies in agriculture in different scenarios

- Future of the (global) food- and agriculture-system is complex and uncertain
 - ‘Grand Societal Challenges’
 - Technological trends (‘signals for change’)
 - Agriculture-trends
 - Societal, Economic, Ecologic, Political and Demographic Trends
- Alternative future scenarios need to be considered for better decisionmaking

We draw on insights from the following foresight-projects:

- STT: Horizonscan 2050
- STT: Future of technologies in agriculture



STT Horizonscan 2050 (2014)

- Inventory of main 'Grand Societal Challenges'
- Scan for 'signals of change'
- Create stories and visions of the future to inspire and start a public debate

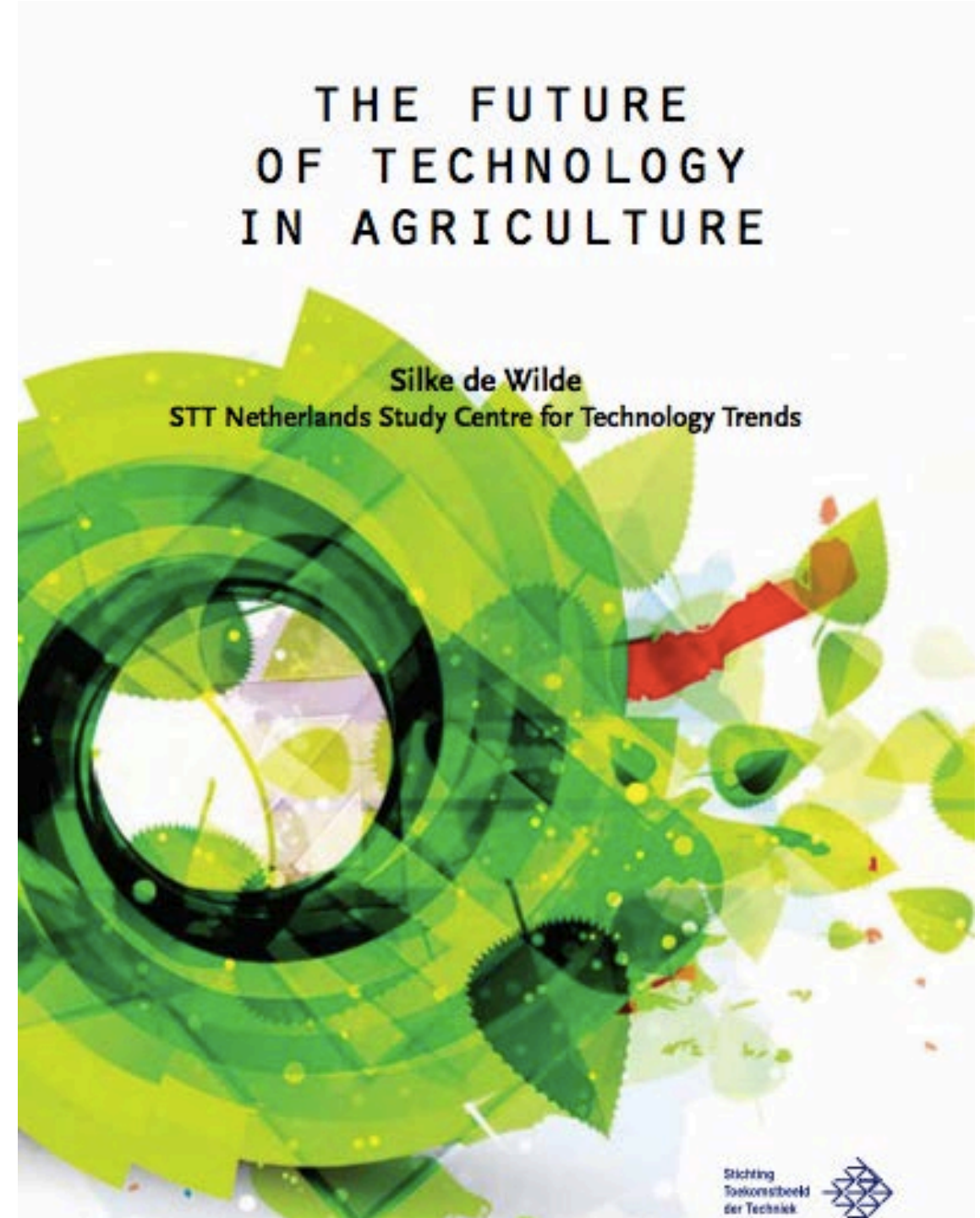
<http://bit.ly/2jP1A72>



STT Future of technologies in agriculture (2015)

- Inventory of possible breakthrough technologies with high impact on agro-food
- Cross technologies with societal, economic, demographic trends
- Create stories and visions of the future to inspire and start a public debate

<http://bit.ly/2k6Nj9j>



EP/STOA Future of precision Agriculture in Europe

- Inventory of relevant future issues, concerns and opportunities related to rise of PA
- Build future scenarios
- Pinpoint relevant ethical and political issues for debate

<https://epthinktank.eu/2016/12/24/what-can-european-farming-expect-from-new-technologies/>



Precision agriculture and the future of farming in Europe

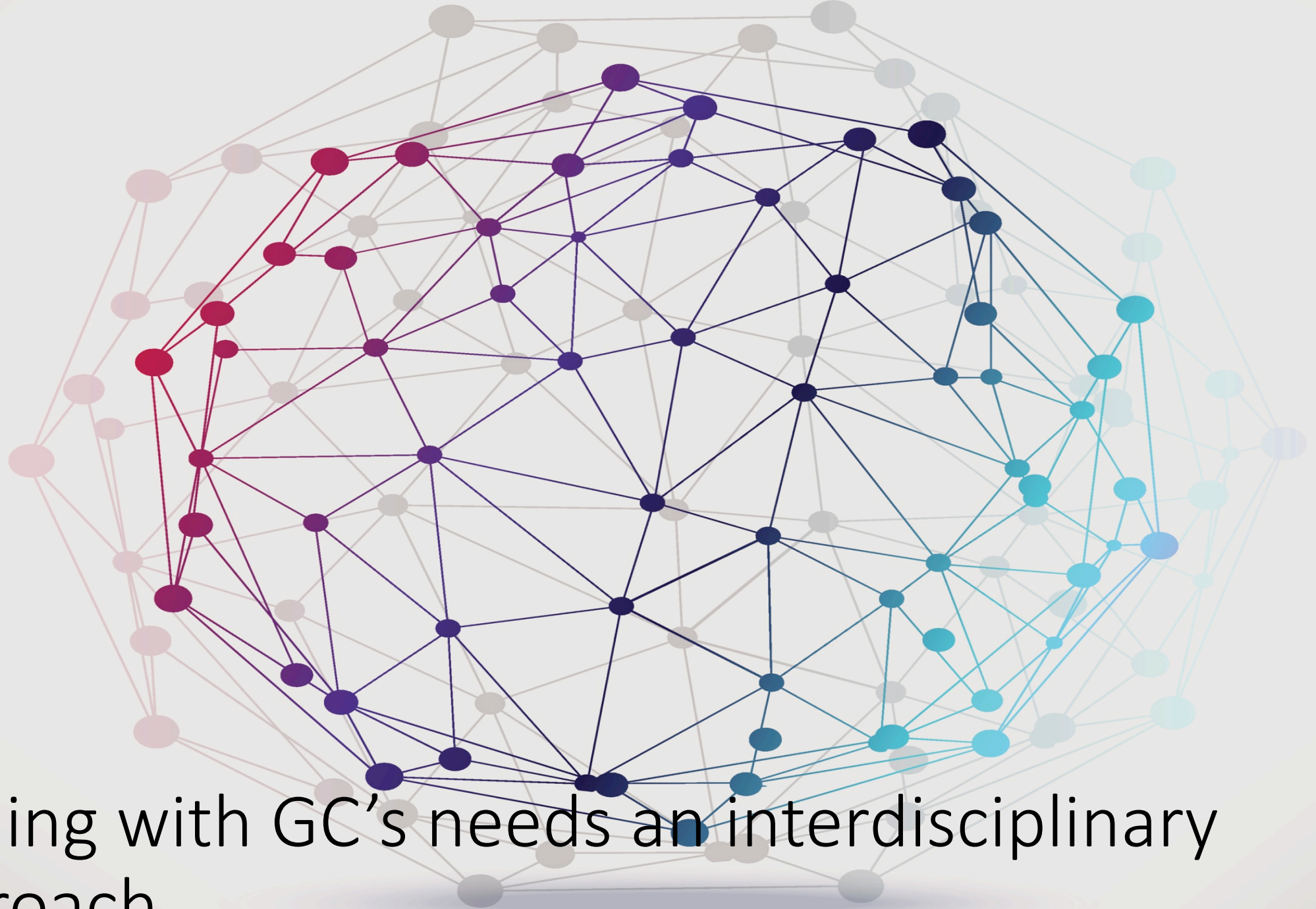
Scientific Foresight Study




Scarcity
Climate change
Demographic change
Longer life
Global power shifts
New connectivity



Grand Societal Challenges

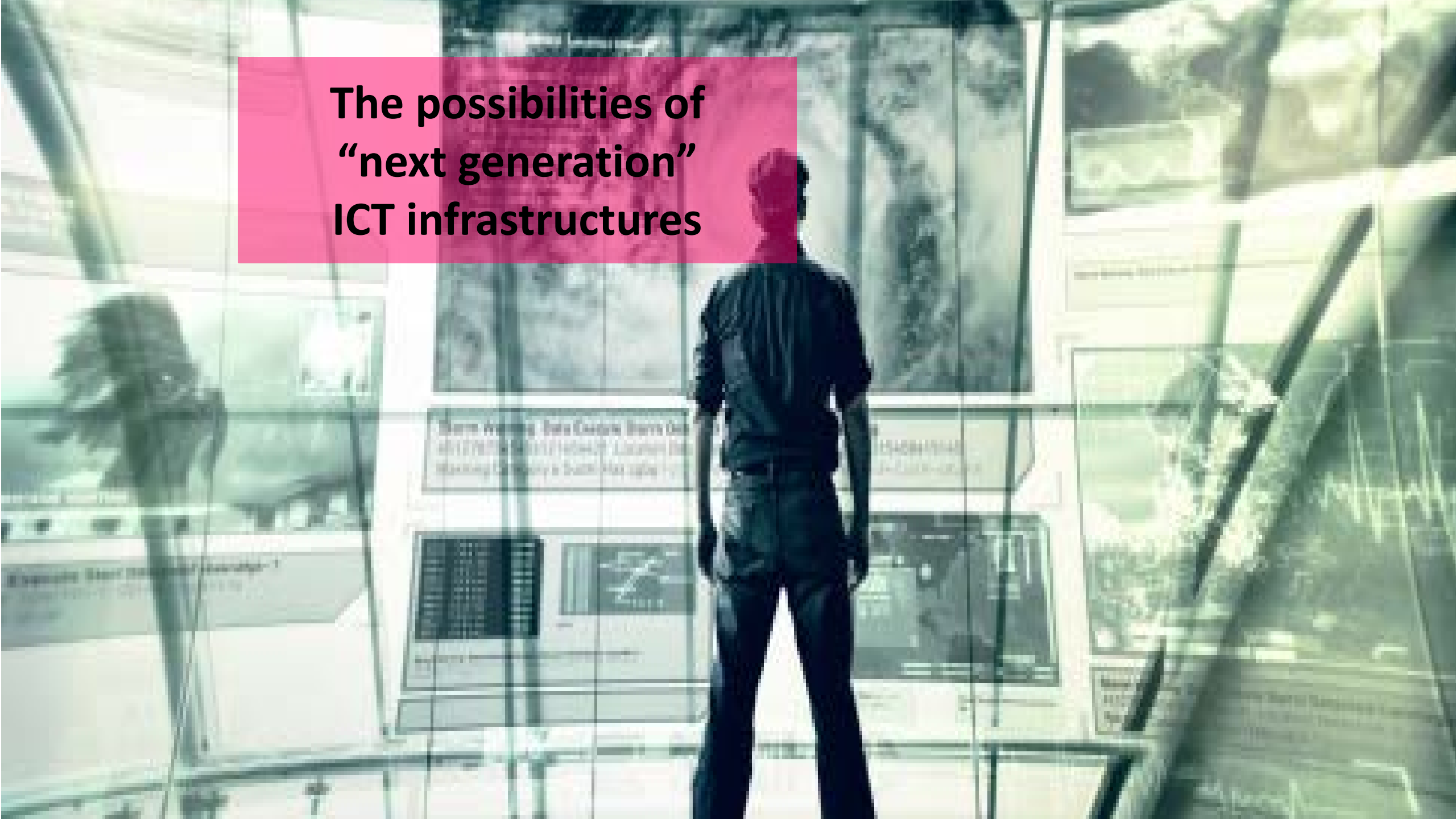


Dealing with GC's needs an interdisciplinary approach



**Robots will be better
with everyday life tasks
than humans.**





**The possibilities of
“next generation”
ICT infrastructures**

A drone (autonomous flying vehicle) on every driveway





**Analyzing Big Data leads to
predicting human behaviour.**

Are people in the right places?

Is the ageing population a burden or a blessing?

2050

What will the labor market be like?

Will we have more conflicts?



Is it technology or is it sociology?



1 3D printing

2 4D printing

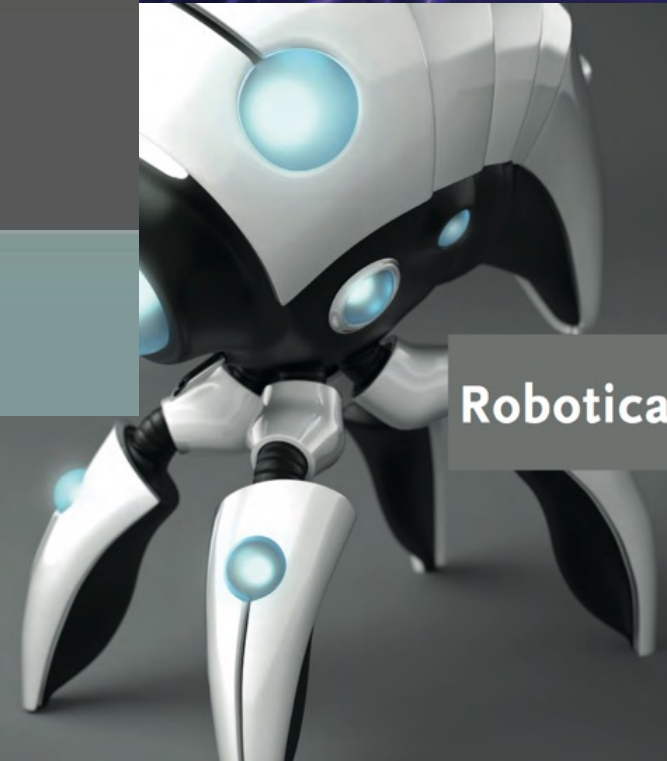
3 Smart materials

4 Robotics

Slimme
materialen



4D-printen



Robotica



5 Autonomous microrobots



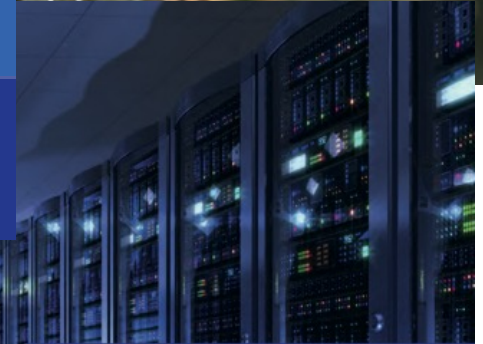
Sensor-
technologie

6 Sensor technology

7 Information technology and IT infrastructures



8 Bioinformatics



Bioinformatica

Informatietechnologie
en IT-infrastructuren





9 Smart farming



Hernieuwbare energie

10 Renewable energy



11 Biorefinery and biofuels

12 Genetics

Bioraffinage
en biobrandstoffen



Gen-
technologi





13 Synthetic biology

14 Protein transition

15 Food design

16 Aquaculture



Eiwittransitie

Aquacultuur



17 Vertical agriculture



**Transport-
technologie**

18 Conservation technology

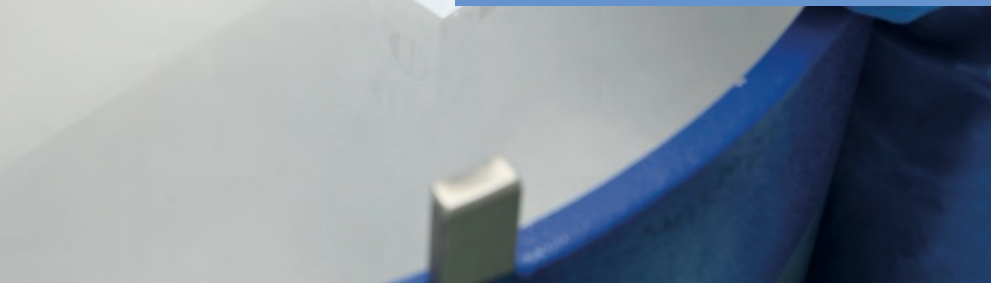


19 Transport technology



Weersbeïnvloeding

20 Weather modification



Scenario's based on archetypical storylines

ECONOMIC OPTIMISM



REFORMED MARKETS



GLOBAL SUSTAINABLE DEVELOPMENT



REGIONAL COMPETITION



REGIONAL SUSTAINABLE DEVELOPMENT



Key uncertainties:

- Economic growth?
 - Demographic change?
 - Technological developments?
 - Trade?
 - Policy?
-
- Future scenarios are instruments for a strategic conversation, not predictions!

Scenario archetype	Economic Optimism	Reformed Markets	Global sustainable development	Regional competition	Regional sustainable development	Business-as-usual
Drivers						
Main objective	Economic growth	Various goals	Global sustainability	Security	Local sustainability	Not defined
Economic development	Very rapid	Rapid	Ranging from slow to rapid	Slow	Ranging from mid to rapid	Medium (globalisation)
Population growth	Low	Low	Low	High	Medium	Medium
Technology development	Rapid	Rapid	Ranging from mid to rapid	Slow	Ranging from slow to rapid	Medium
Trade	Globalisation	Globalisation	Globalisation	Trade barriers	Trade barriers	Weak globalisation
Policies and institutions	Policies create open market	Policies reduce market failures	Strong global governance	Strong national governments	Local steering: local actors	Mixed
Food security outcomes	Positive	Very positive	Very positive	Very negative	?	Slightly positive

Figure 1. Archetypal scenarios from 'A Review of Global Food Security Scenario and Assessment Studies: Results, Gaps and Research Priorities' by Wageningen University (2012).

Scenarios based on archetypal storylines

ECONOMIC OPTIMISM



REFORMED MARKETS



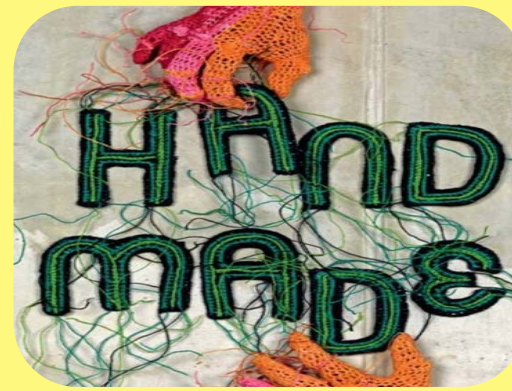
GLOBAL SUSTAINABLE DEVELOPMENT

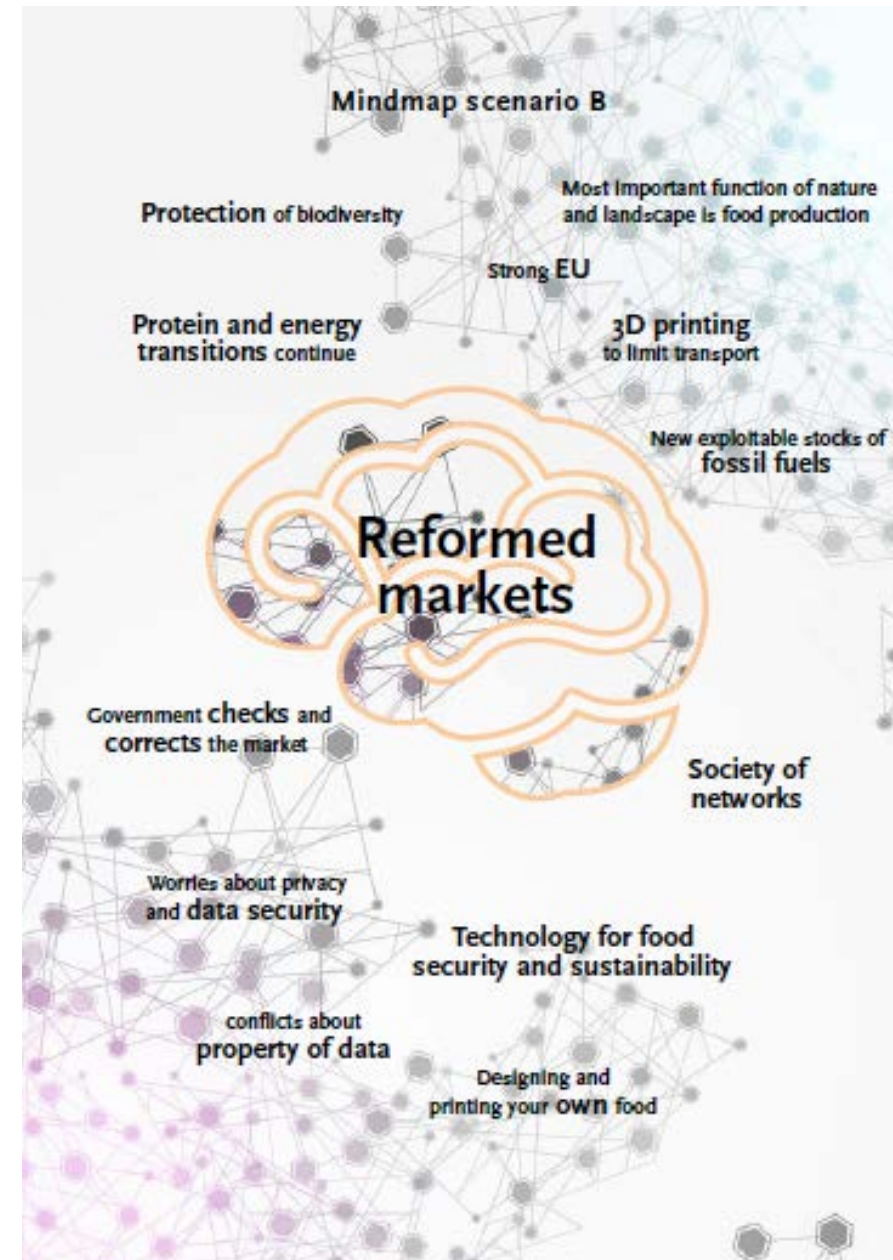


REGIONAL COMPETITION



REGIONAL SUSTAINABLE DEVELOPMENT

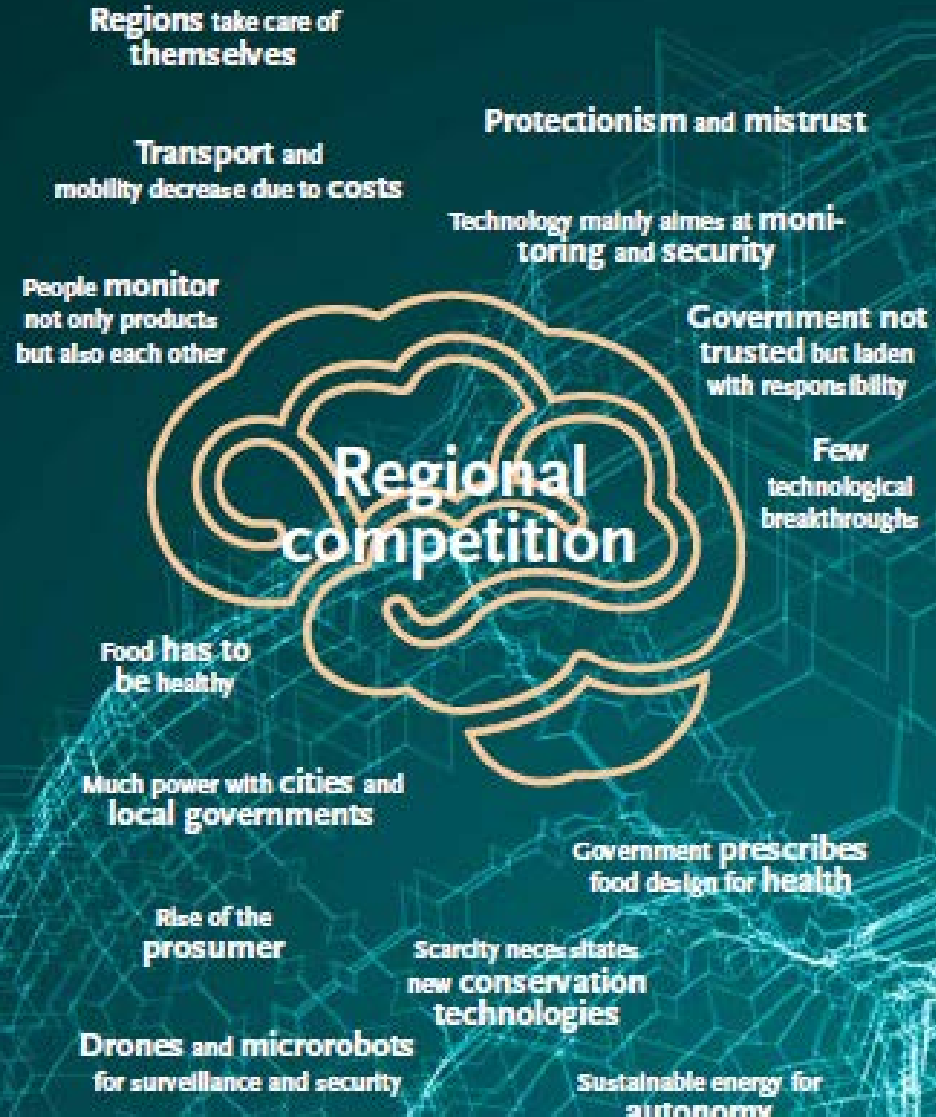




Mindmap scenario C



Mindmap scenario D



Mindmap scenario E

Self-organisation and self-sufficiency at the regional level

The ambition is sustainability

Bartering is the norm

While robots do the work, humans go for the higher aim'

We do things together

Rise of sharing economy

Regional sustainable development

Sustainability and animal welfare

Depopulation, with people living in close-knit, self-sufficient communities

Circular economy is the norm

Less transport

People themselves decide which information to share

Rather crowdfunding than a bank loan

Large interregional differences in income and access to technology

Concluding remarks (1)



- Much is to be expected from **cross-overs** between the agro&food-sector and other industries.
- Besides technological innovation, **social innovation** and **acceptance** of new technologies will be vital.
- Decisions about the adoption of new technologies should be taken in the context of **potential risks**, including the potential risk of **not** applying the new technology.
- The (technological) solution for a problem or challenge may generate new and unforeseen challenges. The sector will have to consider the '**rebound effects**'.

Concluding remarks (2)



- The sector should not lose sight of the dark side (risks) of new technologies. **Good communication** will be essential, because food quality alone is not enough. The **welfare of animals and plants** may become the dominant factor.
- It is unrealistic to suppose that a single new technology will solve all the issues facing us. The sector will have to shop in **multiple** domains of science and technology, and start an **interactive** debate with creative thinkers, legal experts and human factors specialists to do justice to the role of social innovation.
- Food will be important, but **natural resources and emissions** will be too. It is not just the demand that will increase. So will the diversification of the demand. The role of technology will be crucial, but social acceptance will determine whether it will break through or not. The **sector** will need a **strategy**. The parties able to deal with change best will be the ones to survive.