



# Presentations

5<sup>th</sup> NJF Agromek EurAgEng joint Seminar

## Advances and Innovations in Agricultural Engineering

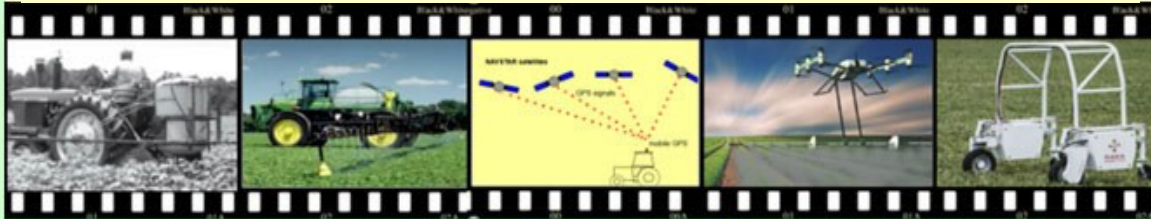
26-27 November 2024, Herning, Denmark



Nils Bjugstad  
REALTEK, NMBU, Norway

# Advances and Innovations in Agricultural Engineering

Innovation	Sensors	Robotics	Precision agriculture	Smart farming	Environment				
Design	<b>Advances and Innovations in Agricultural Engineering</b> <b>The 5<sup>th</sup> NJF – EurAgEng - Agromek joint Seminar</b> November 26 <sup>th</sup> to 27 <sup>th</sup> 2024, Herning, Denmark				Climate neutral				
Ergonomics					Circular economy				
Soil compaction					Plant protection				
Safety					Post harvest				
Big data					Artificial intelligence				
Data Science					Imaging				
Drones					GIS Mapping				
Navigation					SD Goals				
Logistics					Advisory service	Management	Education	Networking	Horizon Europe



<https://www.nmbu.no/en/research/seminar-agromek>



# Welcome to Agromek 2024

Visit us:

Tue. 26 Nov. 9:00 AM to 5:00 PM

Wed. 27 Nov. 9:00 AM to 8:00 PM

Thu. 28 Nov. 9:00 AM to 5:00 PM

Fri. 29 Nov. 8:00 AM to 5:00 PM

In MCH Messecenter Herning

Get your free ticket

## Visit Agromek - the meeting place for agriculture

Discover the future of agriculture at Agromek 2024, bringing together the industry's best in innovation and technology. Dive into







## Advances and Innovations in Agricultural Engineering: The 5th NJF - EurAgEng - Agromek Joint Seminar

In conjunction with Agromek 2024, Agromek will once again host an international conference in collaboration with the Nordic Association of Agricultural Scientists and EurAgEng.

# Organizing committee

- Nils Bjugstad (NO) - chairman. Faculty of Science and Technology, Norwegian University of Life Sciences, Ås
- Claus Hermansen (DK). CEO for Agromek & Danish Agroindustry
- Claus Sørensen (DK). Former president of the EurAgEng, Department of Engineering, Aarhus University
- Alastair James Ward, (DK) Department of Engineering, Aarhus University
- Antti Lajunen, (FI) University of Helsinki, Department of Agricultural Sciences, Helsinki
- Sven Bernesson, (SE) Swedish University of Agricultural Sciences, Department of Energy and Technology, Uppsala
- Vitalijs Osadcuks , (LV) Latvia University of Agriculture, Faculty of Engineering, Jelgava
- Kęstutis Venslauskas, (LT) Vytautas Magnus University, Department of Mechanical, Energy and Biotechnology Engineering
- Oliver Sada, (EST) Institute of Technology, Estonian University of Life Sciences, Tartu

**Maibritt Kindberg, MCH Agromek**

# PROGRAM

## Tuesday 26<sup>th</sup> November 2024

Bus to Agromek leaves outside DGI Hotel, Herning. Time for departure will be announced in the reception.

People who do not show up in time are expected to go to the Agromek conference venue on their own.

Venue: Sydsalen, Entrance Agromek West Registration from 09.00 to 11.00

Time	Presentations	Speakers
09.00 -11.00	Registration / networking/ visit Agromek on your own	
11.10 -11.30	Introduction and welcome	Nils Bjugstad, NMBU, N
	What is EurAgEng?	Claus Aage Sørensen, AU, DK
	What is NJF?	Nils Bjugstad, NMBU, N
	<i>Chair of session: Nils Bjugstad</i>	
11.30 – 12.10	Knowledge hub for digitalization in agriculture, <i>keynote</i>	Per Frankelius, LiU, SE
12.10 - 12.30	UAV sprayers in Switzerland, teams presentation, <i>keynote</i>	Thomas Anken , Agroscope, CH
12.30 - 12.50	UAV sprayers and drift measurements in Norway	Nils Bjugstad, NMBU, N
12.50 – 13.50	LUNCH	
	<i>Chair of session: Hannu Haapala</i>	
13.50-14.00	Smart Farming Sustainable Arena and projects, an overview	Nils Bjugstad, NMBU, N
14.00-14.20	Robotic and AI solutions for field phenotyping	Sahameh Shafiee, NMBU, N
14.20-14.40	Wheat head counting using robots	Mathias Johan Dyrén, NMBU, N
14.40-15.00	Adaptive Sensing in Agri-Food	Weria Khaksar, NMBU, N
15.00-15.20	Image processing in fruit and berries	Siv Fagertun Remberg, NMBU, N
15.20 -16.00	Coffee & Tea break. incl. brief intro about AGROMEK and poster session	Claus Hermansen, AGROMEK, DK Konsta Sarvela, JAMK, FI
16.00-17.30	Visit Agromek on your own	
Ca. 17.30	Bus to Agromek dinner in Herning City (updated times during seminar)	
18.00-23.00	Agromek dinner	

## Wednesday 27<sup>th</sup> November

Bus to Agromek leaves outside DGI Hotel, Heining. Time for departure will be announced in the reception.

People who do not show up in time are expected to go to the Agromek conference venue on their own.

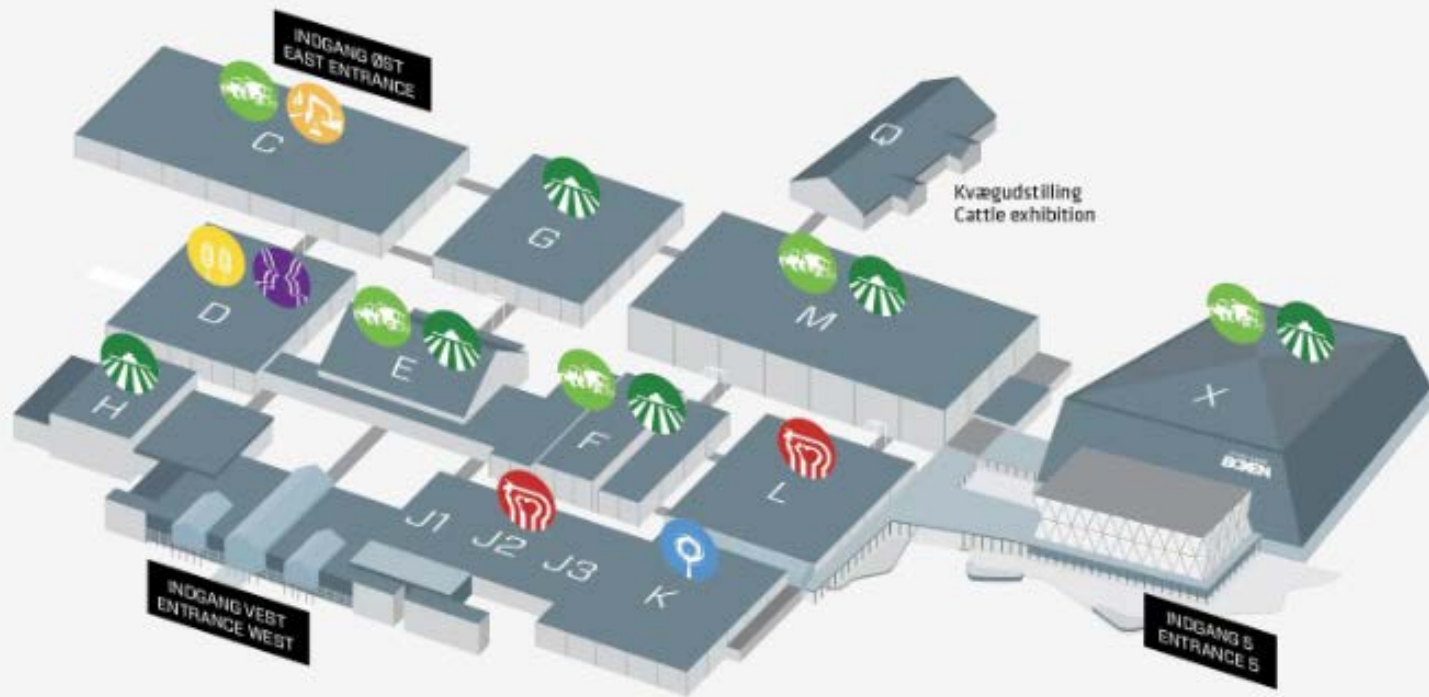
Venue: Sydsalen, Entrance Agromek West

Time	Presentations	Speakers
09.00-10.00	Short visit of Agromek on your own / Venue Sydsalen open & coffee <i>Chair of session: Weria Khaksar</i>	
10.00-10.40	Challenges and experiences from the Hands-Free Farm project <i>keynote</i>	Kit Franklin, Harper Adams Univ., UK.
10.40-11.00	Enhanced precision weeding for robust early crop detection and organic precision spraying trials.	Rasmus Nyholm Jorgensen, AU, DK.
11.00-11.20	Interpreting and Adapting Regulatory Standards for Compliance of Disruptive Agricultural Technologies: A Case Study on High-Precision Herbicide Spraying Robot	Aleksander Sendrowicz and Andres Moan, Kilter, N
11.20-11.40	UAV-Based Vegetation Biomass Analysis with RGB, Thermal and Multispectral Imagery	Mikael Anakkala, UiH, FI
11.40-12.00	Coffee & Tea break	
12.00-12.20	Development of a low-cost telematics system for smart farming operations	Niila-Sakari Keijälä, UiH, FI
12.20-12.40	Innovating Smart Agriculture: How Finnish Future Farm is Shaping the Future of Farming	Hannu Haapala, JAMK, FI
12.40-13.00	Energy conservation in agriculture and smart farming	Sven Bernsson, SLU, SE
13.00-13.20	AgriSun – cooperation between solar power and grain production	Ingunn Burud, NMBU, N
13.20-13.40	Smart Farming Research at AU	Claus Aage Sorensen, AU, DK
13.40-13.50	Closing session	Nils Bjugstad, NMBU, N
13.50-14.30	LUNCH	
14.30-15.30	Walkaround to selected exhibitors & activities at the fare	
15.30-20.00	Visit Agromek on your own. Agromek closes 20.00	

Frequently shuttle buses from Agromek fare to Billund airport.



# Haloversigt Hall overview



**Traktorer og høstmaskiner**  
Tractors and combine harvesters



**Kornhåndtering**  
Crop management



**Energi**  
Energy



**Viden og service**  
Knowledge and service



**Markredskaber**  
Agricultural machinery



**Staldmekanisering**  
Livestock machinery



**Entreprenør, vej & park**  
Construction, roads and parks



Thomas Anken, Agroscope, Switzerland



Spray drones – challenges and potential in agriculture



Kit Franklin, Harper Adams University, UK



Hands Free Farm – totally autonomous farming





# Knowledge hub for digitalization in agriculture

Per Frankelius, LiU, Sweden



Karolina Muhrman, LiU, Sweden









*Prof. Claus Grøn Sørensen*  
*Aarhus University, Denmark*

Past President 2016-2018, EurAgEng  
Current Executive, Council member  
Current President CIGR

## The European Society of Agricultural Engineers



*The European Society of Agricultural Engineers (EurAgEng) exists to promote the profession of Agricultural and Biosystems Engineering and the people who serve it.*

*The Society is particularly active in Conferences, Working Groups, Publications, Networking and International lobbying.*

*EurAgEng is the European member of CIGR, the world wide agricultural engineering organization (International Commission of Agricultural and Biosystems Engineering)*





Founded in the 1980s. Network with over 2000 members of national societies from 23 countries.

Biennial agricultural engineering conference (AgEng2018, Wageningen, AgEng2020, Evora, AgEng2022, Berlin, AgEng2024, Athens,etc.)

Partnering with German National Society, VDI-MEG, for the biennial Land.Technik-AgEng before Agritechnica in Hannover

Partnering with CIGR for joint conferences (e.g. in Turin, 2026)

"Biosystems Engineering" – the official scientific journal of EurAgEng  
Supports groups (Agricultural Engineering and Technology) and  
projects (Agriculture and Energy Efficiency; Smart-AKIS, etc).

Standardization and harmonization of engineering curricula and  
student initiatives (Field Robot Event)

Nine Fields of interest are identified. Eighteen Working Groups  
(WGs) within these fields of interest

Institutional network: "European Network for Advanced Engineering  
in Agriculture and Environment" (ENGAGE)



# CONFERENCES

- *AgEng 2018, Wageningen, Netherlands*
- *Feb 2019: AXEMA-EurAgEng-SIMA Paris* “Sustainable agriculture : An opportunity for innovation in machinery and systems”
- *Land.Technik AgEng 2019, Hannover (Agritechnica)*
- *AgEng 2020, Evora, Portugal*
- *Land.Technik AgEng 2021, Hannover (Agritechnica)*
- *AgEng 2022, Germany*
- *Land.Technik AgEng 20223, Hannover (Agritechnica)*
- *AgEng 2024, Athens, Greece*
- *LandTechnik 2024, Osnabruck*
- *AgEng/CIGR conference, Turin, Italy, 2026*

## Current key topics in EurAgEng:

- sustain the connection between academia and industry
- apply the system approach to the field Biosystems engineering
- work with multi-disciplinarity
- attract young researchers/members (Young Professionals Network)
-

<https://eurageng.eu/>

The logo for EurAgEng features the text "EurAgEng" in a bold, light blue, sans-serif font. The text is centered within a dark blue rectangular box. This box is surrounded by a circular arrangement of twelve yellow five-pointed stars, similar to the flag of the European Union.

**EurAgEng**

**The European Society of Agricultural Engineers**



AARHUS  
UNIVERSITY  
DEPARTMENT OF ELECTRICAL AND COMPUTER  
ENGINEERING

5TH NJF-AGROMEK-EURAGENG SEMINAR  
26 NOVEMBER 2024

CLAUSAAGEGRØN SØRENSEN  
PROFESSOR





## **Nordic & Baltic Association of Agricultural Scientists**

Nils Bjugstad, REALTEK, NMBU





- NJF is Non-governmental organization
- About 1,500 members
- Non-profit organization
- Nordic and Baltic countries
- 6 sections:  
Plants, animals, environment, economics, reindeer husbandry and  
TECHNOLOGY & INNOVATION



## MAIN ACTIVITIES

- NJF congress
- Seminars & Workshops
- Active working group meetings
- Section board meetings
- National board meetings
- President – Jarkko Niemi, LUKE, Finland





*In seminars working habits differ according to needs*

*Key issues in NJF functions are interaction, networking & meeting persons sharing the same interests*





# NJF Seminar: World Soil Day 05.12

Jorrdagen 2024 på Ås, 5.12 kl. 10-15

To bolker om jordhelse og økosystemtjenester

- Jordkarbon og jordhelse
- Lunsj
- Soil and water conservation (engelsk bolke)

Sted: NIBIOs auditorium i Sagabygget (O43) og Teams



**NIBIO**

NORSK INSTITUTT FOR  
BIOØKONOMI



Norges miljø- og  
biovitenskapelige  
universitet



The logo for the Nordic Association of Agricultural Science (NJF) features a stylized green emblem on the left, composed of three overlapping circles or petals. To the right of the emblem, the letters "NJF" are written in a bold, green, sans-serif font.

# NJF MEMBERSHIP

- Want to join NJF and be a member?
- Costs about 30 € per year (some variation between countries)
- Join us now: visit <https://nordicagriculture.eu/>



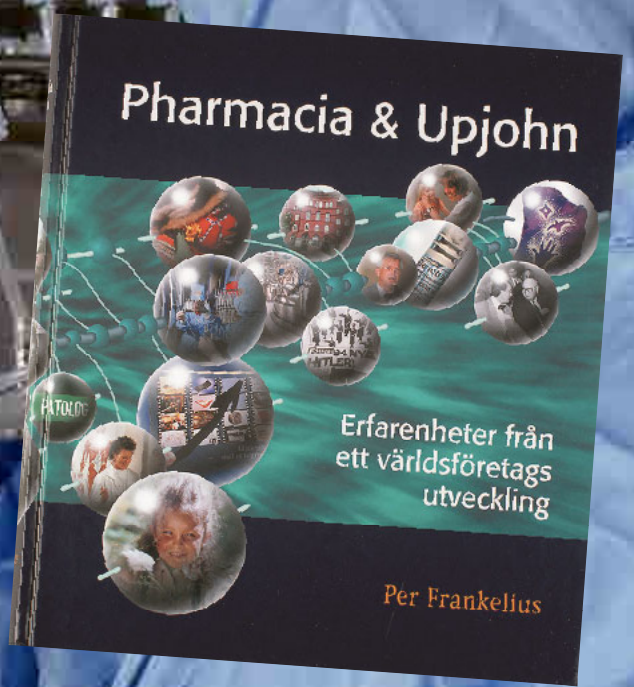












Pharmacia & Upjohn

Erfarenheter från ett världsföretags utveckling

Per Frankelius





# Towards a knowledge hub for digital technology in agriculture

Per Frankelius • Karolina Muhrman





Karolina  
Muhrman sends  
her regards  
to you!

A background image of a clear blue sky with several small, white, fluffy clouds scattered across it. The text is centered horizontally and vertically on the page.

Why do we need digitalization agri-hubs?





19th century:  
4,200 minutes  
per ton

Today:  
2 minutes  
per ton



Stackcruiser  
1977





Daniavision  
1987

Mainframe  
computers  
for animal data  
EMIL in Hållsta  
1962



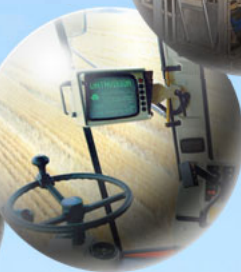
Electronics  
Dickey-John  
1966



Stransponders  
Alfa Laval  
1977



Computers  
onboard  
Stackcruiser  
1977



VMS  
DeLaval  
1998



Computer screens  
Daniavision  
1987



Auto steering  
GreenStar  
Autotrac  
2002



E-Services  
Väderstad  
2013





Drought



Flood



Phase out fossil energy



Roules hassle



Soil health



Low profitability



Animal welfare



Crop protection



Working environment

More  
production to  
feed the world



Bring down  
emissions



Expand  
biodiversity







Foto: Ilya Dmitryachev/TT

19 november





Mario Draghi



The background of the slide is a photograph of a clear blue sky with several small, wispy white clouds scattered across it. The text is centered in the middle of the image.

# Theoretical perspectives



A photograph of a forest path with three distinct sections. The path starts on the left with a cobblestone surface, transitions to a gravel surface in the middle, and ends on the right with a dirt surface. The path is flanked by tall, thin trees and lush green grass. Three white rectangular boxes with black text are overlaid on the path, labeled 1. Tradition, 2. Imitation, and 3. Innovation.

1. Tradition

2. Imitation

3. Innovation



A gravel path leads through a dense forest of tall green trees. The path is made of light-colored gravel and is flanked by lush green grass and foliage. The trees are tall and thin, with their leaves creating a canopy overhead. The lighting is bright, suggesting a sunny day, with shadows cast on the path. The overall scene is peaceful and natural.

# 1. Tradition





**WEBINAR: ROTATIONAL NO-TILL  
SERIES, PART 2: LET'S TALK  
ABOUT NO-TILL "REGENERATIVE"  
AGRICULTURE (LIVE Q&A)**

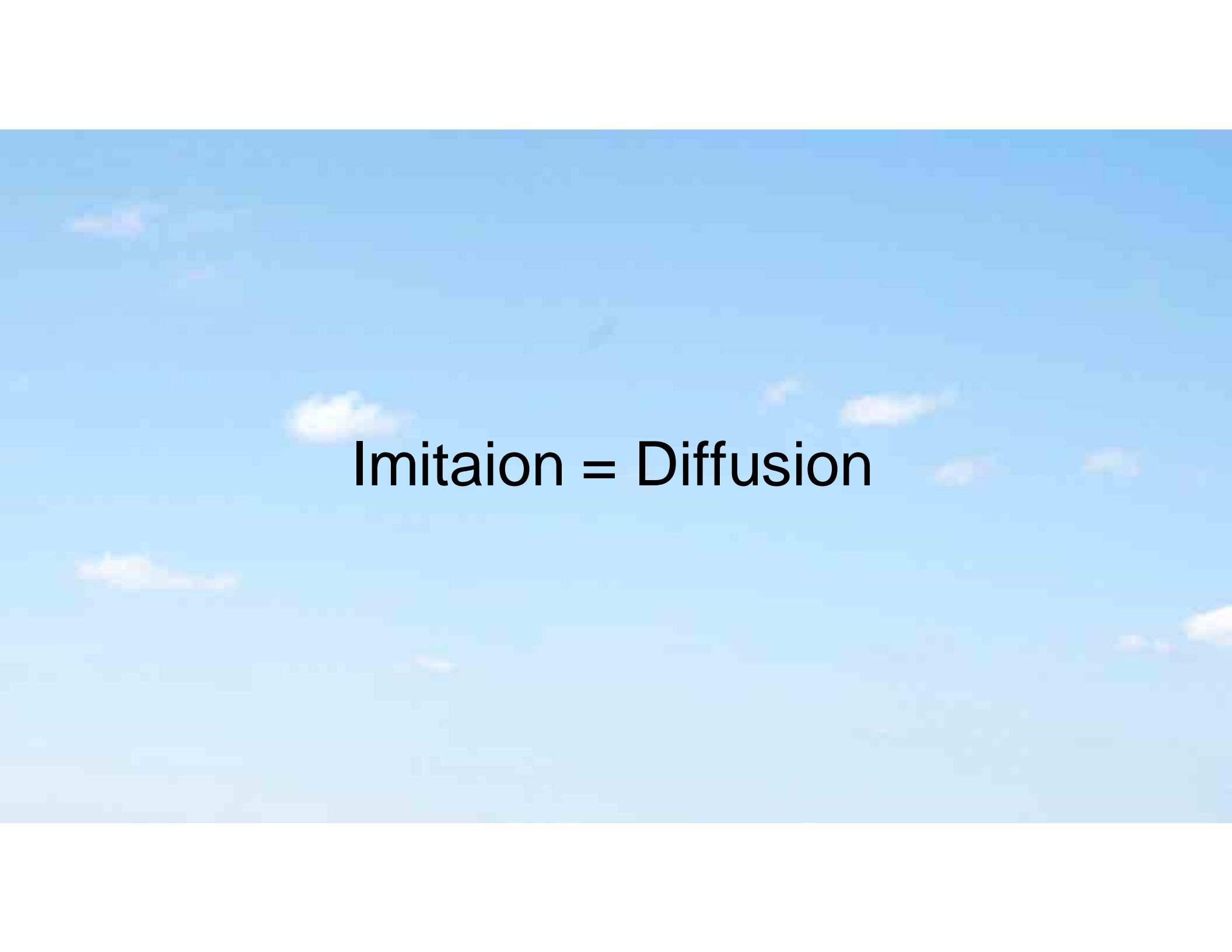




2. Imitation



**“Begin with something that  
someone else already had done  
relatively recently”**

A background image of a clear blue sky with several small, white, fluffy clouds scattered across it. The text is centered in the middle of the image.

Imitation = Diffusion







Bryce Ryan och Neal Gross  
“The Diffusion of Hybrid Seed  
Corn in Two Iowa Communities”  
1943



Gabriel Tarde  
“Les lois de l’imitation”  
1890

Percentage of farmers

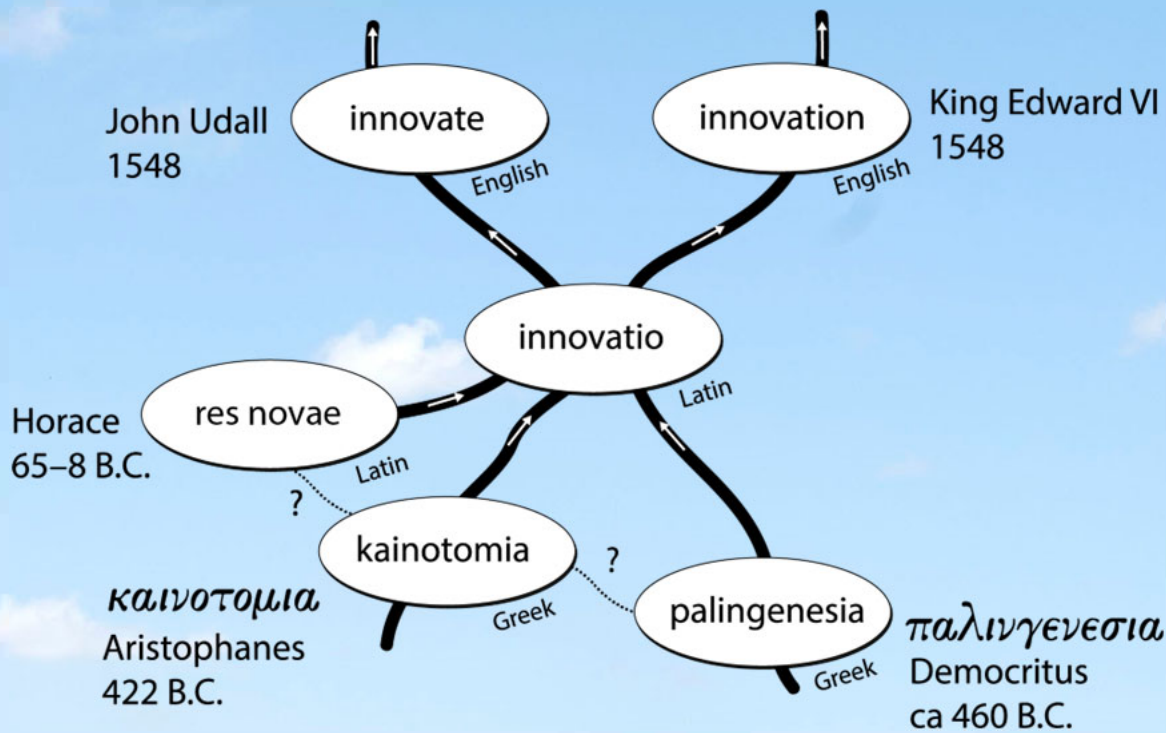






3. Innovation





“Something principally new that obtains a foothold in society”

## 15 Brilliant combinations of art and nature

Learning points from the world of opera and classical music

Per Frankelius

### Introduction

An opera arena right in the middle of nature – in a large old limestone quarry? Margareta Dellefors got this idea, believed in it and promoted her vision. The vision came true, and several hundred thousand people have enjoyed its magic. It became an injection for Dalarna's regional brand as well as for Sweden. The music has flowed. The scene has been crackling with activity. People have enjoyed the new combination of nature and art. But huge amounts of energy were used to realize the dream.


### Perspective, aim and method

The research presented here is not about the 'nature of art' such as the nature of different paintings, which is a common theme in existing literature. Neither is this research about the 'art of nature' in the sense of art describing nature (compare Martin, 2011). The focus here is creation processes resulting in *hybrids* between nature and art. I will try to describe how such a process can occur and evolve – and what it can lead to.

In order to access the inner being of art-nature processes, in-depth studies at the *micro level* are required. It also requires *process perspectives* in the sense of studying a series of events over time – not just processes in the sense that 'A leads to B' (compare Frankelius, 1999).

But the creative process is just part of the core of this chapter. I will foremost analyse an example of *results* from such a process and discuss the related concepts of culture, art and nature, and conclude with a model, which has been named 'The Dalhalla Concept'.

One aim of the chapter is to discuss building blocks for a theoretical model, or framework, for future research of development processes on the boundary between nature and art. Normatively speaking, the aim is to carve *useful perspectives* that can be strategic tools for both enthusiasts and policy-makers interested in art and/or regional development. It also aims to bring forward an analysis of how the concepts of culture, art and nature relate to each other.



Theorie  
der wirtschaftlichen  
Entwicklung.

Von

Dr. Joseph Schumpeter.

Hypothese von 1890.



Leipzig,  
Verlag von Duncker & Humblot.  
1912.





“You can make as many improvements  
as you wish of this...”

...but you will never get this





A photograph of a clear blue sky with several small, fluffy white clouds scattered across it. The clouds are soft and appear to be drifting. The overall tone is bright and airy.

**Originality!**



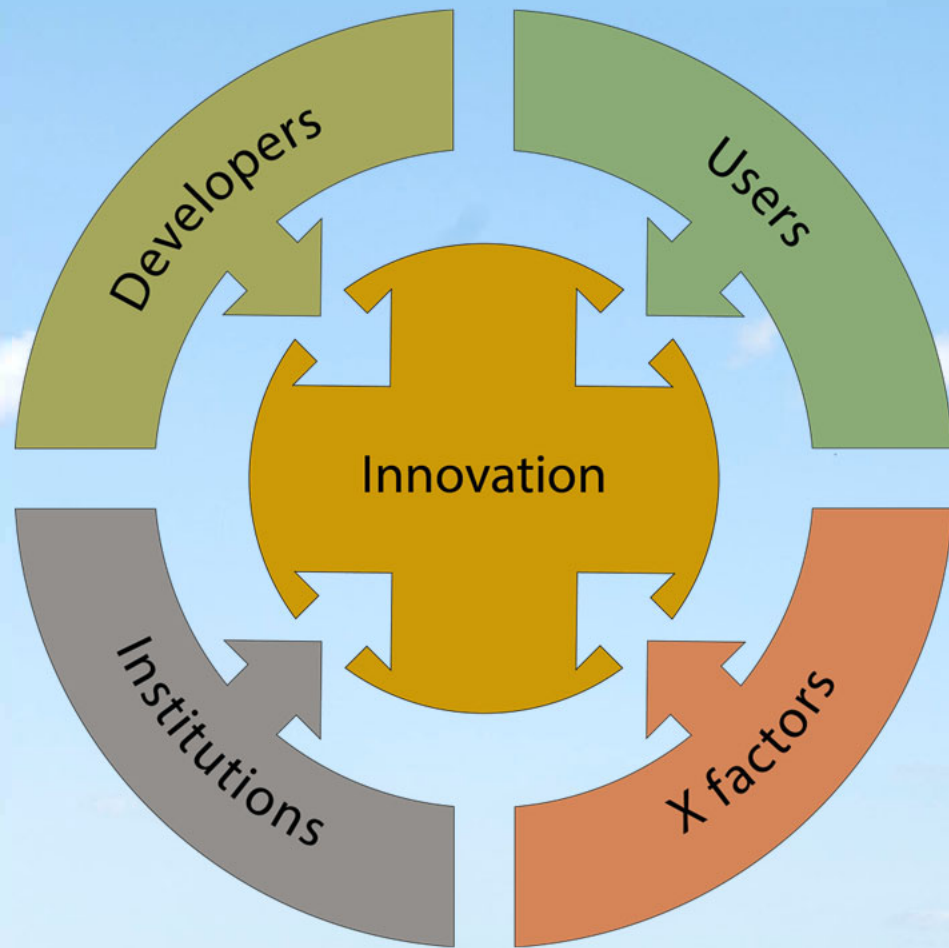



"New combinations"

A background image of a clear blue sky with several small, white, fluffy clouds scattered across it. The text is centered in the middle of the image.

# 4 factors affecting innovation







# The context of the knowledge hub for digitalization in agriculture





**li.u** LINKÖPING  
UNIVERSITY

4 campuses (Linköping, US, Norrköping, Lidingö)

135 educational programs (of which 26 are international), 650 independent courses

40 000 students

Exchange agreements with 400 universities in 50 countries

4100 employees

1200 doctoral students, 150 doctoral degrees/year



Outstanding engineering educations  
Interdisciplinary  
Problem-based learning





AI, Robotics  
The supercomputer Arrhenius  
One of the world's sharpest scanning  
transmission electron microscopes  
Self-driving vehicles



# Agtech Sweden

VINNOVA

li.u LINKÖPING  
UNIVERSITY



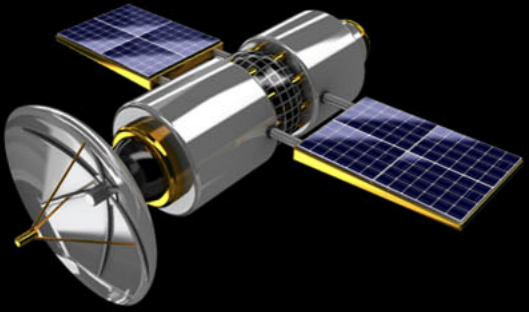
Region  
Östergötland





MEDIUM





Compaction  
Prevention System  
(CPS)  
Lovang Lantbrukskonsult  
Tofefors  
Elvestad Södergård  
Linköpings universitet



Photo: Rickard Bergkvist



### Spray With Care

Tolefors Gård,  
A-Electronix,  
Lovang  
Lantbrukskonsult,  
Kårstad Gård och  
Linköpings universitet





Smart machines  
(Väderstad, Lovang  
Lantbrukskonsult,  
Linköping University  
and RISE)





Äggcellent  
Dyno Robotics Vreta  
utbildningscentrum,  
Tolefors gård  
Svenska Ägg  
and  
Linköpings University

## A proposal to rethink agriculture in the climate calculations

# Articles and books

### Correspondence

Per Frankelius, Department of Management and Engineering, Linköping University, SE-581 83, Linköping, Sweden.  
Email: per.frankelius@liu.se

(CFC is a main source of... empirical facts but also, like all research, on certain perspectives or paradigms including assumptions and subjective choices of system boundaries for analysis. Greenhouse gases in relation to agriculture are often presented in diagrams showing, for example, arrows of emissions from soil, cattle, tractors, and manure storage. However, the fundament of agriculture is the photosynthesis. Carbon dioxide ( $\text{CO}_2$ ) is caught by crops that, in turn, produce oxygen ( $\text{O}_2$ ) and at the same time binds carbon (C) in roots and shoots. One part of this C transforms into soil organic C, and that is sometimes discussed in research, the public debate, and by IPCC. But the main part transforms into harvested crops, that is, cereals like wheat (*Triticum aestivum* L.), and other carbohydrate products like pea (*Pisum sativum* L.) or oilseed. This last-mentioned photosynthesis effect is not, in the IPCC calculations, considered as a positive climate contribution from the agricultural sector. The consequence of this might be that policymakers will not understand the whole picture of agriculture in relation to climate effects; and therefore make decisions that affect food production, climate change, and biodiversity in a not optimal way from a holistic sustainability viewpoint.

### 1 | INTRODUCTION

The year 2020 might be remembered mostly for the coronavirus pandemic. But when observers in January 2020 reflected back on the year 2019 many concluded that climate concern had been one of the main issues in research and public debate. One example of this is that the *Time Magazine* chose the then 16-yr-old Swedish climate activist Greta Thunberg as "person of the year" and had a photo of her on the front page of the 23–31 December issue.

During recent years an increasing stream of research has been published on climate effects in relation to different sectors, not the least agriculture. One example

is studies on greenhouse gas emissions and C footprint in relation to specific agricultural methods on specific types of soils in specific climate zones (e.g., Wang et al., 2020). Another example is studies on greenhouse effects derived from manure composting (e.g., Bai et al., 2020).

So, the climate discussion in society is, fortunately, intensive, and decision makers, who for example want to understand how different sectors affect the climate through greenhouse gases, try to interpret the huge amounts of information on the subject. Unfortunately, there are reasons to believe a paradigm-related skewness has made a foothold in policy-related research that also is mirrored in the public debate. It is about the climate effects in relation to agricultural production of food, fibers, and fuel.

Abbreviation: IPCC, Intergovernmental Panel on Climate Change

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wileyonlinelibrary.com/journal/agj2 | 1

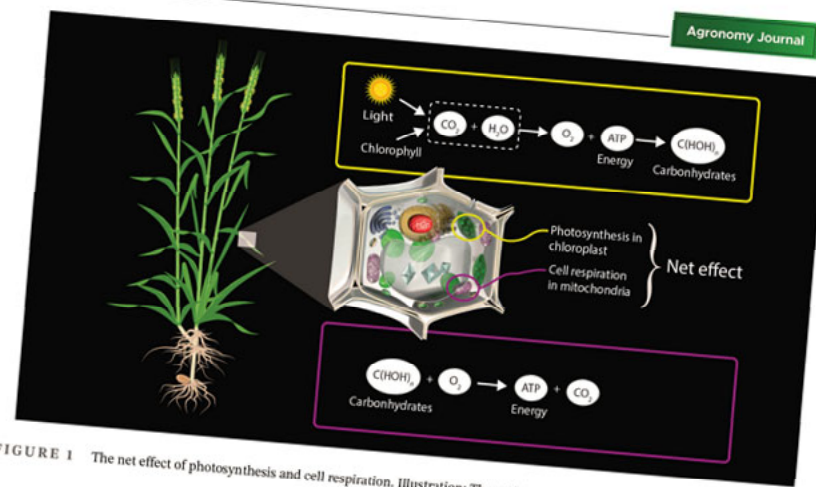


FIGURE 1 The net effect of photosynthesis and cell respiration. Illustration: The author and Depositphotos

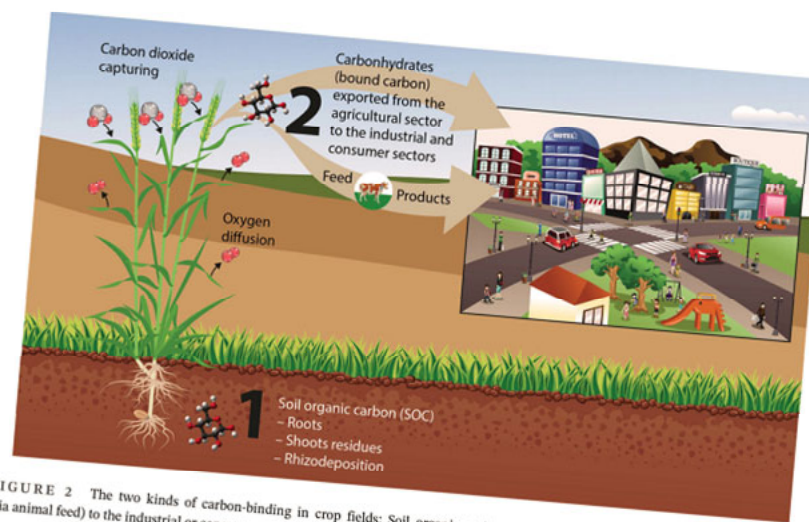


FIGURE 2 The two kinds of carbon-binding in crop fields: Soil organic carbon and carbohydrates exported directly or indirectly (via animal feed) to the industrial or consumer sector. Illustration: The author and Depositphotos





Round table with  
Missouri  
Governor  
2023



Victor  
Johansson  
South Korea  
3 April 2023





EU Commission  
7-8 December  
2023