



Cultivating Complexity with AI

Unearthing the Secrets of Crop Business

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BASF

We create chemistry



Conceptualize the crop business, list the major entities and impacting factors, outline the relationships, impact and dependencies in relation to current market trends.



Certainly! Let's embark on a journey through the verdant field of agro-economics, where every seed sown is a potential harvest, and every spreadsheet hides a cornucopia of data. As we delve into the heart of crop business, let's remember that behind every bushel of wheat lies a saga of sunrises, soil microbes, and stubborn weeds.

The Simplicity Illusion

At first glance, the crop business seems straightforward. You plant seeds, water them, and voilà – crops sprout out like eager interns at a job fair. But my friends, beneath this bucolic façade lies a complexity rivaled only by deciphering IKEA assembly instructions. Let's peel back the layers like onions in a farmer's stew.

The Key Entities

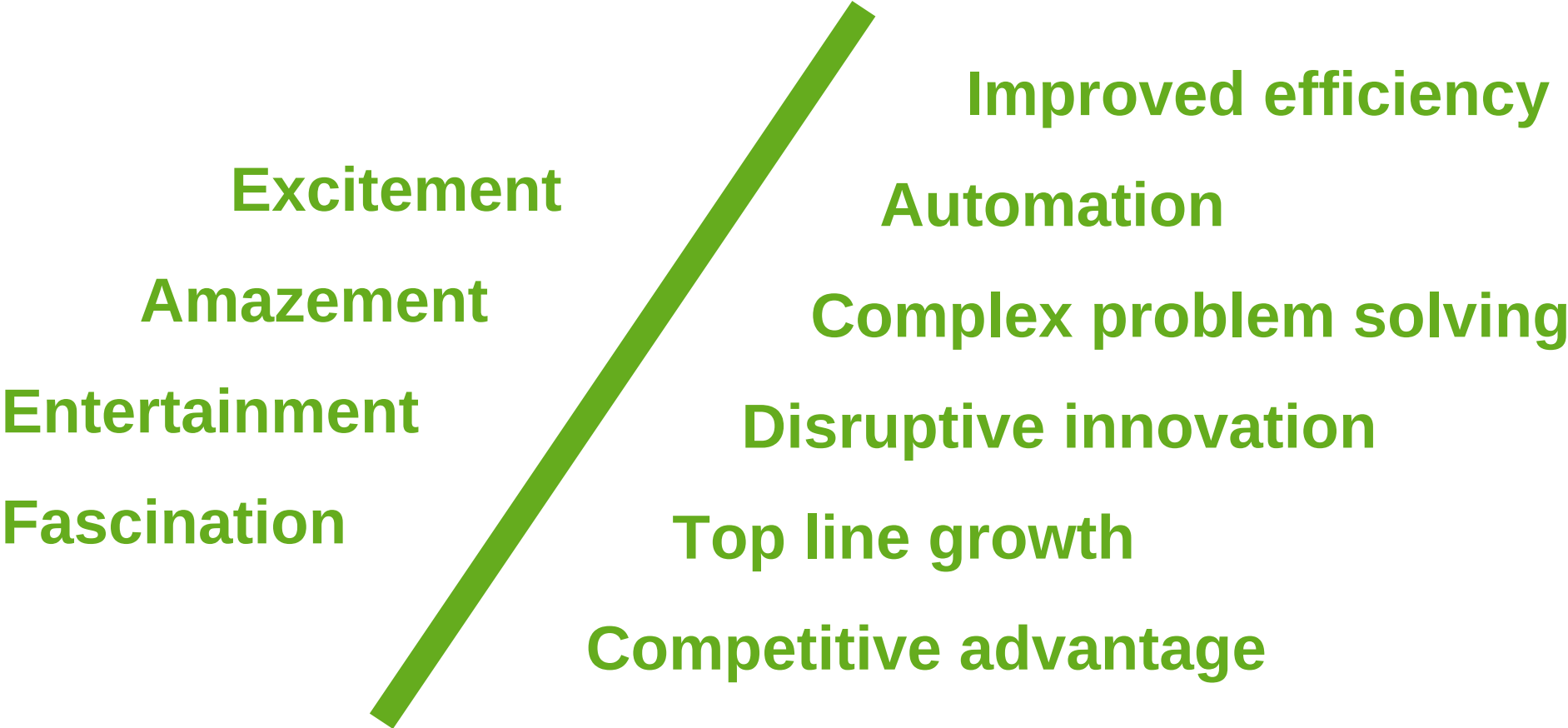
- **Farmers and Growers** – our unsung heroes, tilling soil and negotiating with weather gods
- **Agrochemical Companies** – the alchemists brewing the magic potion for growth and protection
- **Seed Companies** – crafting seeds like master chefs, each variety a secret recipe
- **Distributors and Retailers** – the matchmakers connecting seeds to soil

A masterpiece of complexity where every seed holds a universe

The crop business is a quilt stitched with threads of science, economics, and a dash of stubbornness. It's a symphony where soil pH harmonizes with market demand, and pests perform their own version of "Swan Lake". Let's embrace it, let's decode the soil's whispers, dance with data, and cultivate success, one kernel at a time.

... generated by AI

Mission: close the gap between the fascinating technological advancements and realization of tangible business value



How does BASF approach the mission?

A multi-year journey ...

- Statistical Analysis, Optimization, Prediction
- Machine Learning, Deep Learning
- Graph Neural Networks
- Generative AI
- ... Agentic AI

Empowering the Organization

- Data & AI Academy to broaden the awareness and provide learning journeys for upskilling
- Hiring key talent
- Key Digital Capability Program to drive adoption and validation

Governance and Diligence

- Intellectual Property
- Data Privacy
- Information Security
- Legal and regulatory Compliance



Trustworthy and Responsible AI



According to the EU guidelines* trustworthy AI should be:

1. **Lawful** - respecting all applicable laws and regulations
2. **Ethical** - respecting ethical principles and values
3. **Robust** – in terms of technology and social environment

Important capabilities for trustworthy AI

Transparency & Explainability

- both verify that model decisions match
- our values (ethical)
 - our expert knowledge (robustness)

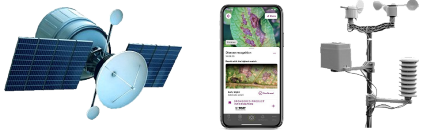
7 Principles for Trustworthy AI

1. Human agency and oversight
2. Technical robustness and safety
3. Privacy and data governance
4. Transparency & explainability
5. Diversity, non-discrimination and fairness
6. Societal and environmental well-being
7. Accountability

*Ethics Guidelines for Trustworthy Artificial Intelligence, compiled by the High-Level Expert Group on AI (8 April 2019)

AI Digital Platform Example

Globally provide leading edge, unique digital technology solutions to support farmers to improve and automate crop production in a sustainable way regardless of farm size



Mobile Apps / Sensors

Understand what is and will be happening on your fields



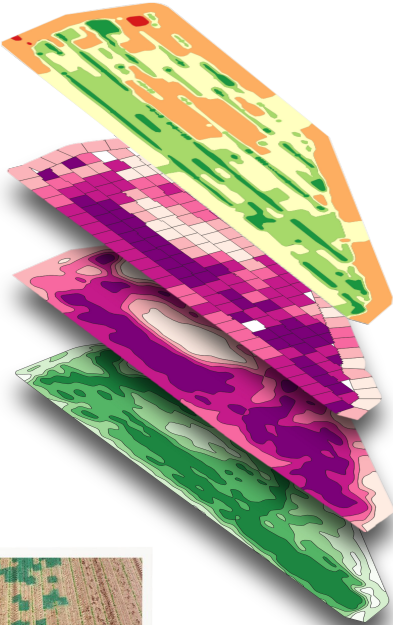
Agronomic Decision Engine

Automatic analysis and recommendations by agronomic models



Optimized Crop Production

Implement the optimal dose per field zone at the best time.



The xarvio portfolio



Simply Smarter Crop Production



Optimized Crop Protection
Leaf Health Guaranteed



The Fastest Connection Between xarvio and Your Machines



ONE SMART SPRAY
(Joint Venture of Bosch and BASF)



Protein Engineering

- Rapidly growing field with potential contribution to many industries and applications

Business Demand

- Insecticidal Proteins
- Designer Enzymes
- Biocatalysis

Developments at BASF

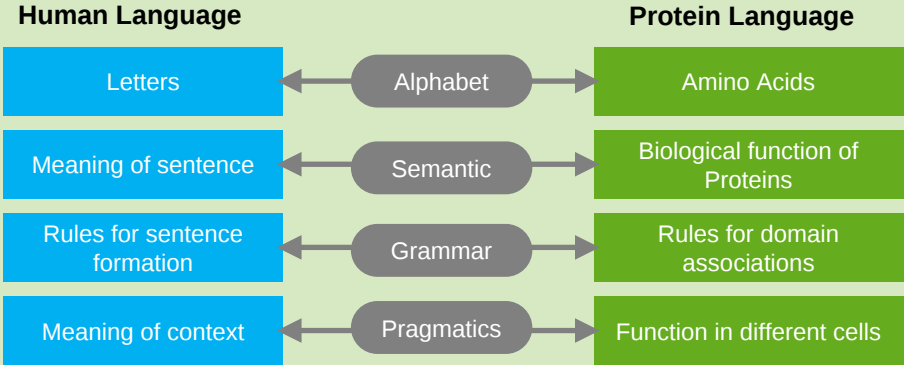
- Innovation: new methods combining ML/Data Science with NLP and protein language models
- Intellectual Property
- Apps and libraries for R&D

- Protein Engineering in Crop Improvement
 - Improving crop yields
 - Increasing resistance to pests and diseases
 - Enhancing the nutritional value of crops (biofortification)

NLP and Generative AI

Application of language models to biological data (language of life)

- generating new protein sequences
- predicting the properties of new protein sequences



Inspired by *Protein linguistics — a grammar for modular protein assembly?*
Nature Reviews Molecular Cell Biology volume 7 (2006)

Where can Generative AI add value to business and R&D?

- **Virtual agent systems extending our ability to handle key challenges**
 - master complexity and beyond limits of today
 - advanced simulations
 - leverage the generative potential
- **Intelligent Process Automation (IPA)**
- **Automated software and robotics development**
- **Dedicated/personalized content creation**
 - where this creates real business value
- **Chatbots and enhanced search applications**
- **Automation of mostly repetitive/routine tasks (RPA)**
- **Personal productivity tools**



Image generated by AI

Research Topic: Smart Agents / Agentic AI

Can we build agent systems that are able to solve complex and even novel tasks?

Research Topic: Smart Agents / Agentic AI

Can LLMs Reason and Plan?

<https://arxiv.org/abs/2403.04121>

Large Language Models
Small Specialized Models

Functions+Plugins
Knowledge Graphs
Graph Neural Networks

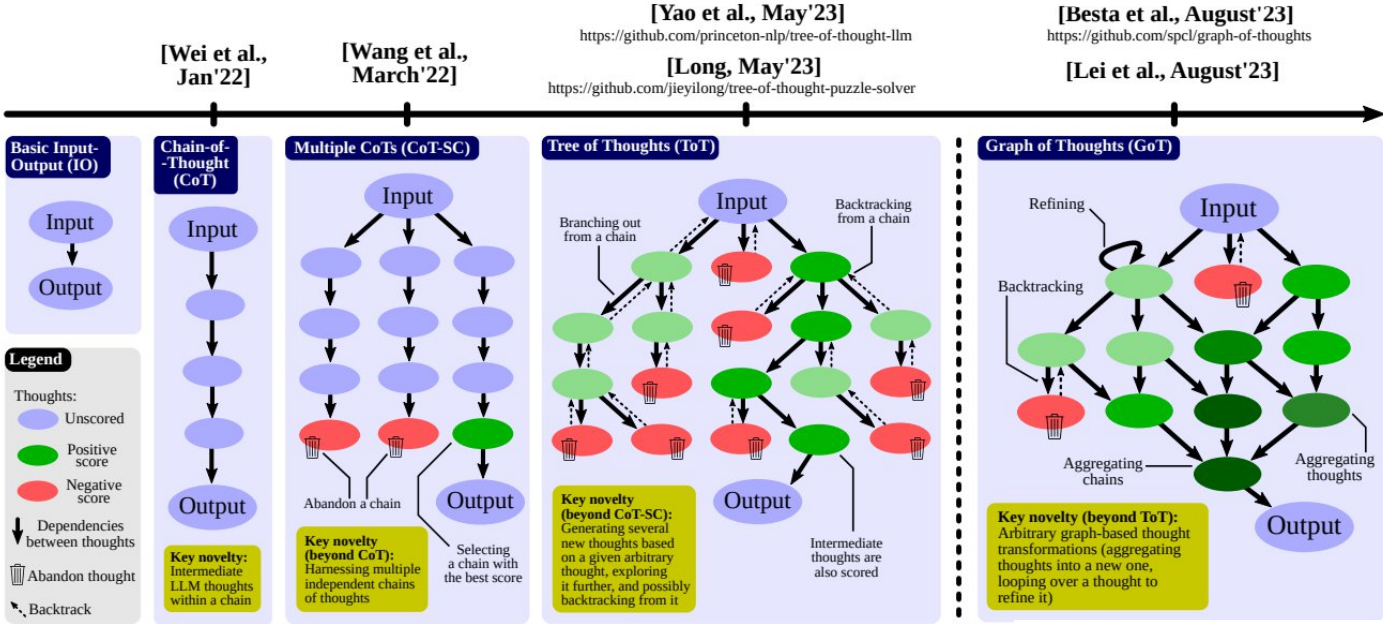


Fig. 1: Evolution of reasoning topologies used in prompting schemes. <https://arxiv.org/pdf/2401.14295.pdf>

Graph of Thoughts

Memory of Thoughts

Closing remarks

- No evidence for a slowdown in AI
- It's easy to get lost in the waves of sensation
- Turn fascination and amazement into creativity and action for business performance
- Try it out bottom-up! It helps to get started and to win people, but don't forget there is more to it
- Real transformation requires leadership understanding the potential and setting the course
- Most crucial prerequisite: have your data prepared!
- Don't wait! ... there's a lot of hype and barkers, but the change is happening



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