

# **How do we produce feed, food and energy for 10 billion people in 2050**

Henning Otte Hansen  
([hoh@ifro.ku.dk](mailto:hoh@ifro.ku.dk))  
Department of Food and Resource  
Economics

June 29, 2022

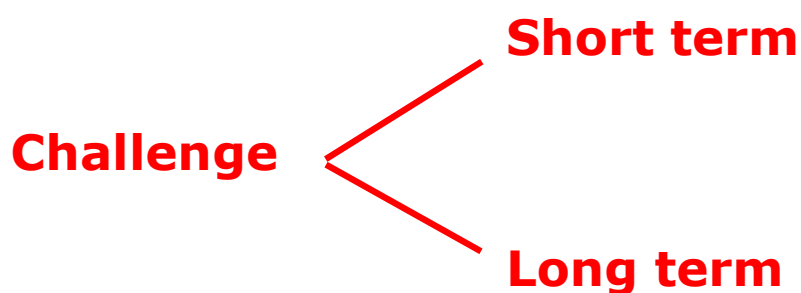
UNIVERSITY OF COPENHAGEN



## Agenda

- **The challenge**
  - **Short term present food crisis**
  - **Long term “how to feed the world”**
- **Drivers behind the food crisis**
- **Global challenges in food and agriculture**
- **Solutions and problems**





**Short term challenges need short term solutions**

**Long term challenges need long term solutions**

**Don't try to solve short term challenges  
with long term solutions . .**



## The challenge . . . .

### Short term

- **Food crisis**
- **Ukraine**
- **Price bubble**
- **Hunger**
- **Geopolitics**
- **Supply chain disruptions**
- **Post-covid problems**
- **Food aid**

### Long term

- **Climate**
- **Hunger**
- **Sustainability**
- **Resilient systems**
- **Plant based food**
- **Energy**
- **Food systems**

## The present food crisis

- Price bubble,
- Short term wave,
- Market will solve the imbalance

or:

- Wakeup call,
- Shift of paradigm,
- New level
- Strategic changes are needed



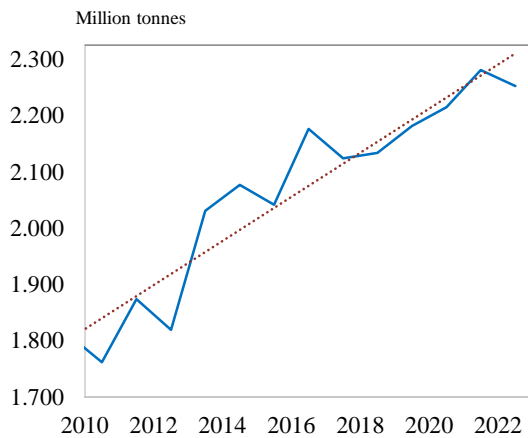
## Drivers behind the food crisis

- **Low production growth**
- **Small stocks**
- **Increasing oil prices**
- **Expensive fertilizer**
- **High freight costs**
- **Ukraine-Russia: War, sanctions etc.**

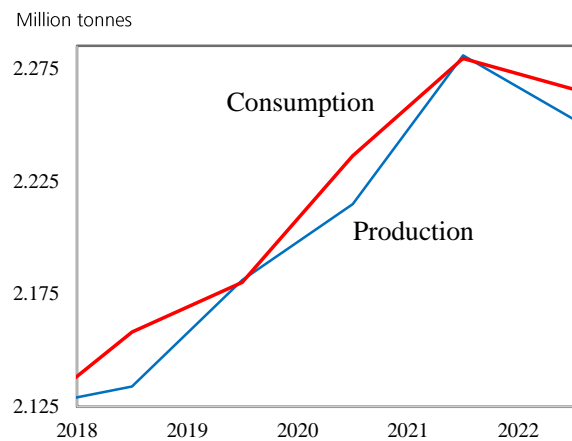


# Global grain market

## Production (world)



## Production and consumption



## Drivers behind the food crisis

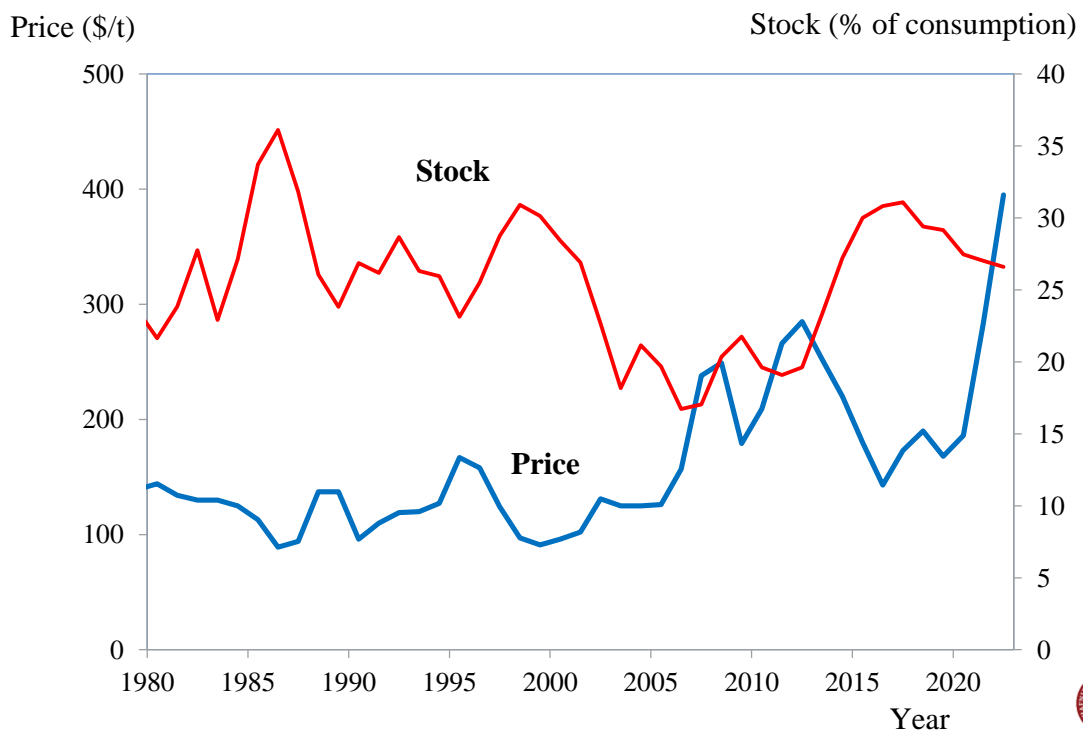
- Low production growth
- **Small stocks**
- Increasing oil prices
- Expensive fertilizer
- High freight costs
- Ukraine-Russia: War, sanctions etc.





UNIVERSITY OF COPENHAGEN

## Wheat: Stock and price

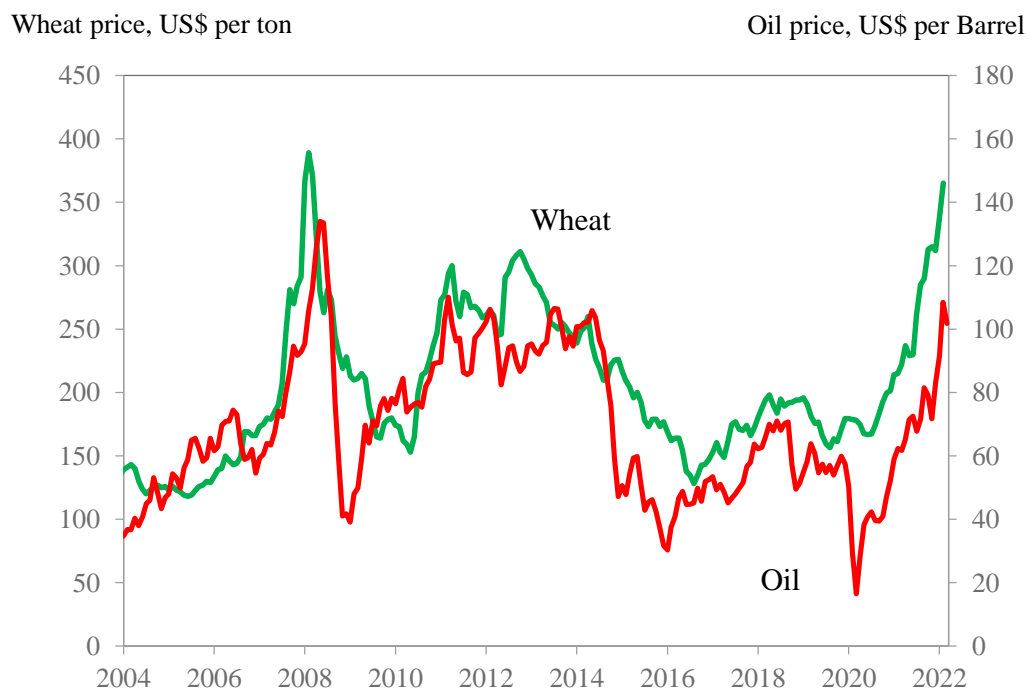


## Drivers behind the food crisis

- Low production growth
- Small stocks
- **Increasing oil prices**
- Expensive fertilizer
- High freight costs
- Ukraine-Russia: War, sanctions etc.



## Oil and wheat price



## Drivers behind the food crisis

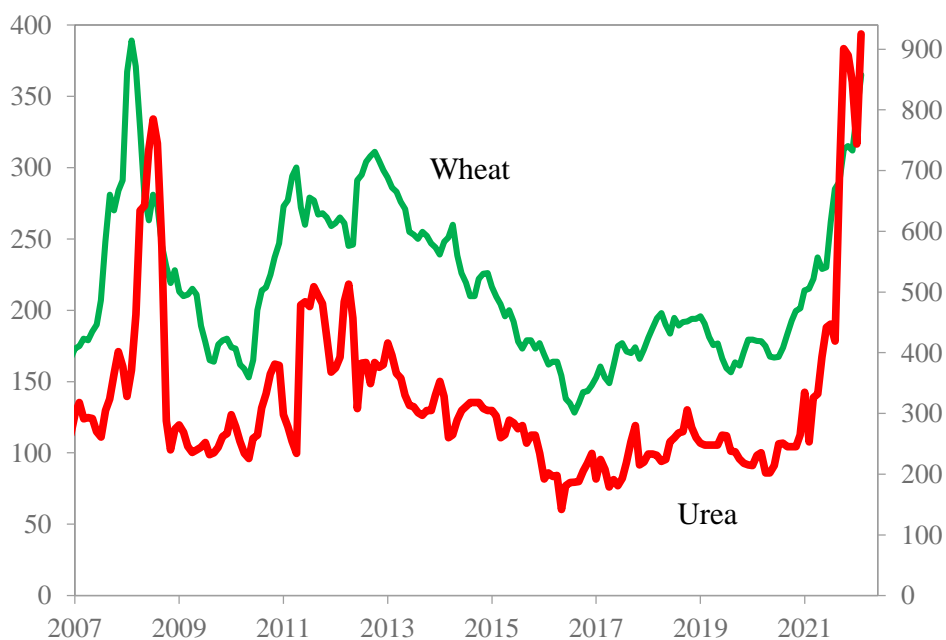
- Low production growth
- Small stocks
- Increasing oil prices
- **Expensive fertilizer**
- High freight costs
- Ukraine-Russia: War, sanctions etc.



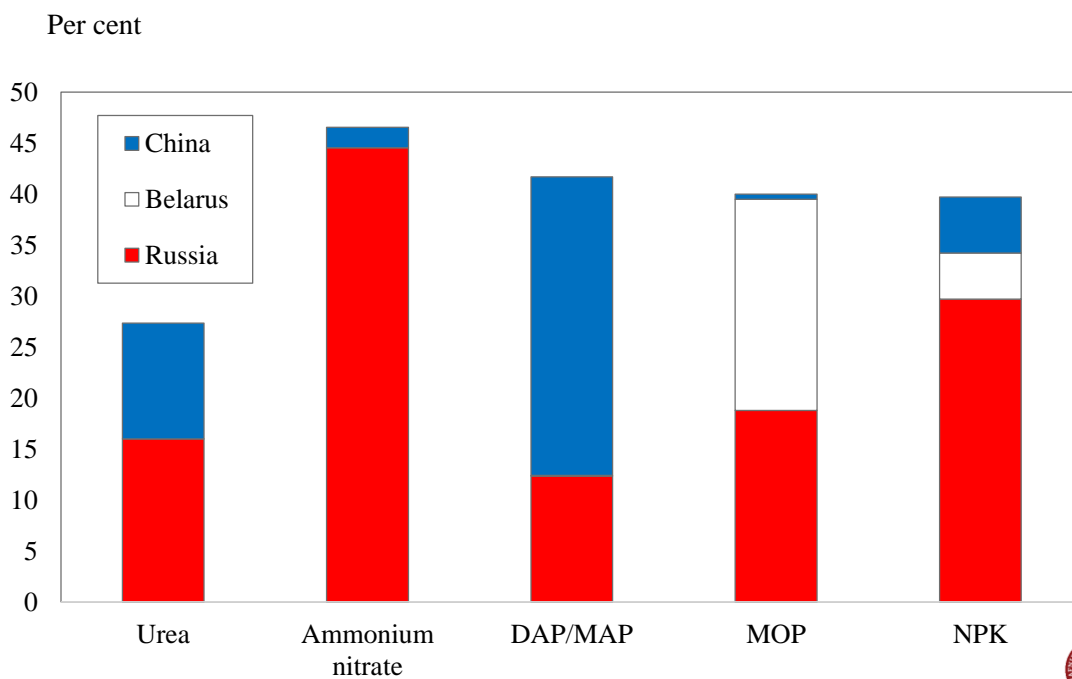
## Fertilizer and wheat price

Price of wheat, US\$ pr. ton

Price of urea, US\$ pr. ton



## Export of fertilizer: Share of world export (2019)



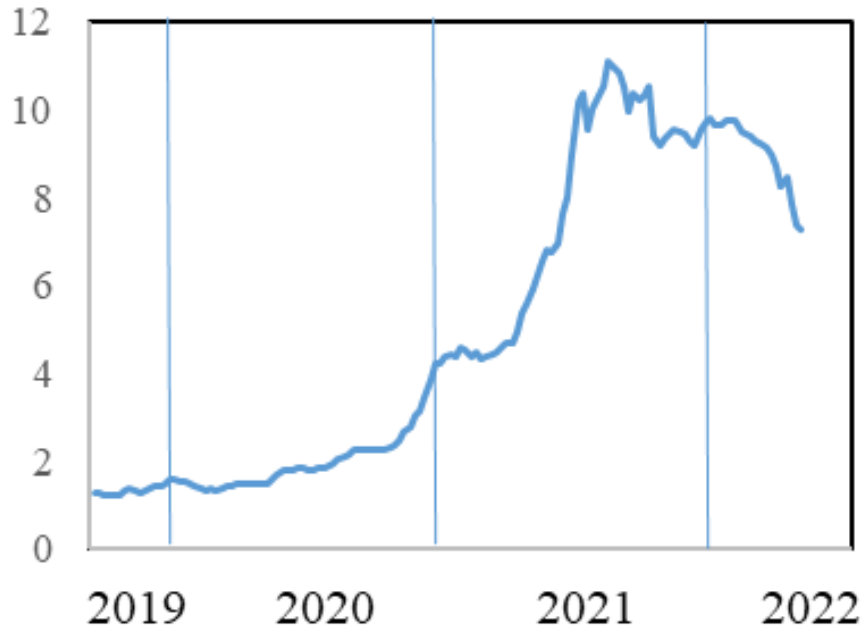
## Drivers behind the food crisis

- Low production growth
- Small stocks
- Increasing oil prices
- Expensive fertilizer
- **High freight costs**
- Ukraine-Russia: War, sanctions etc.



## Freight costs

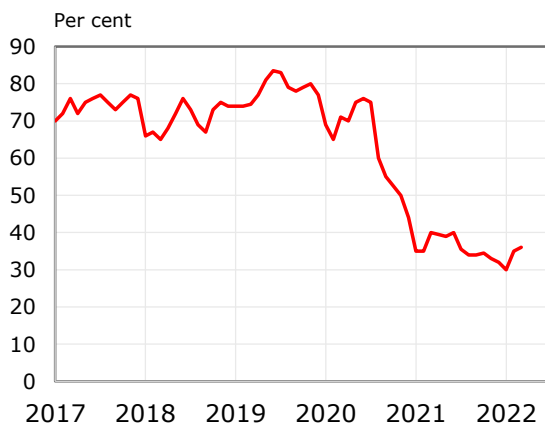
USD: Transport cost index



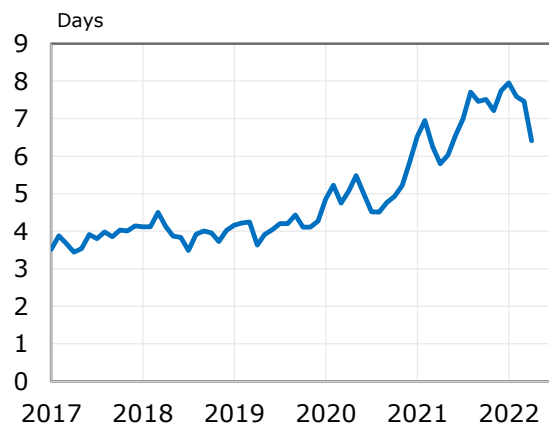


## Disrupted infra structure:

### Global schedule reliability



### Average delays

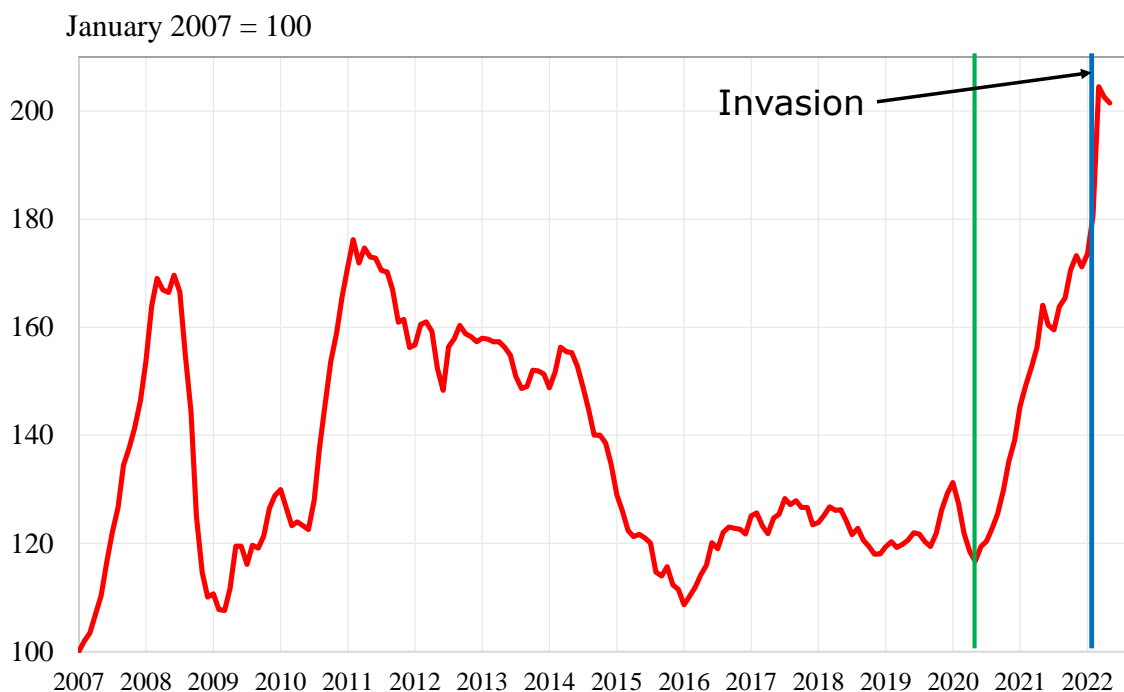


## Drivers behind the food crisis

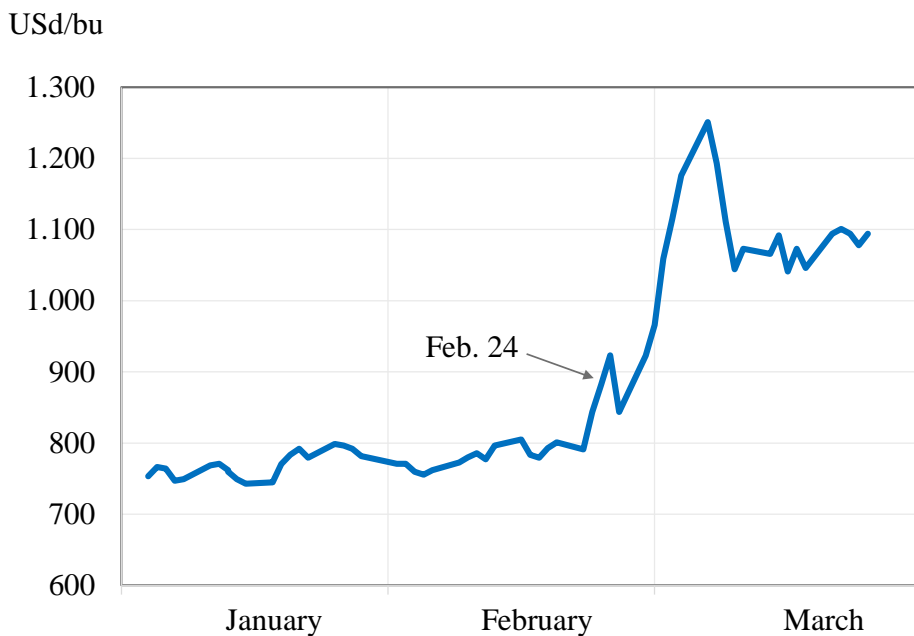
- Low production growth
- Small stocks
- Increasing oil prices
- Expensive fertilizer
- High freight costs
- **Ukraine-Russia: War, sanctions etc.**



## Price index of agricultural commodities, January 2007 to May 2022



## Price of wheat, Chicago Board of Trade , 2022



## Price of wheat, Chicago Board of Trade , 2022

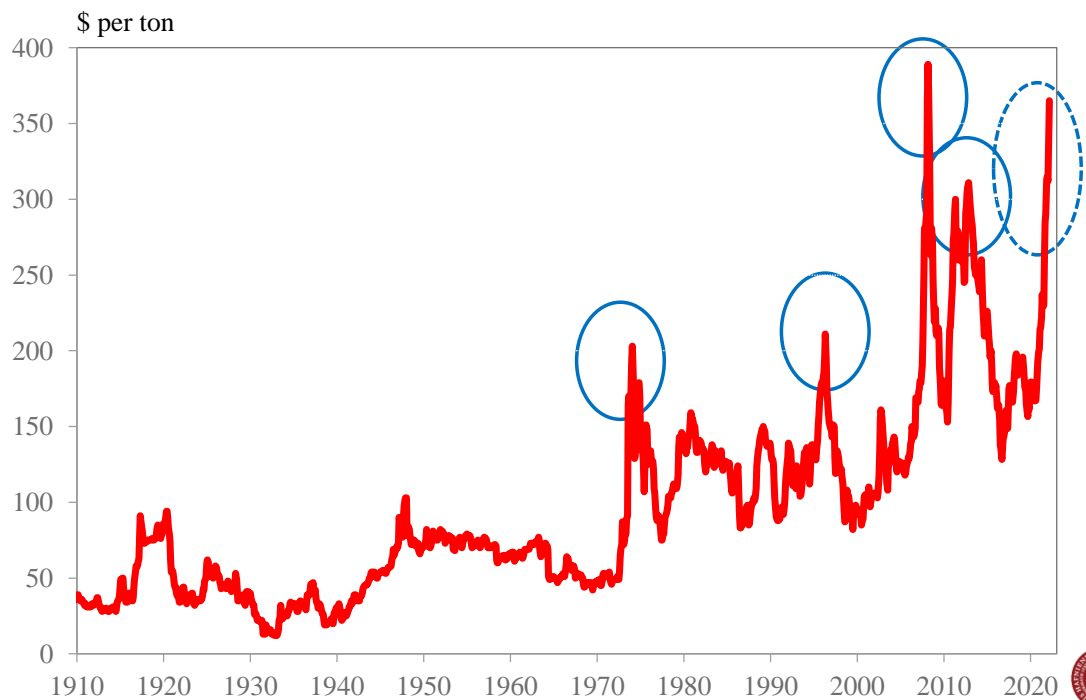


# Food crises - more and more frequent



UNIVERSITY OF COPENHAGEN

## Wheat: World market price



## Global challenges in food and agriculture

- **Double agr. production next 40 years**
- **Climate changes**
  - Africa under pressure
  - Agriculture a major player – problem and solution
  - Efficient transformation: Leakage etc.
- **The agricultural area will not be expanded**
- **Increasing yields, more efficient farmers**
- **Balances:**
  - Farming vs. nature
  - GMO vs. organic farming
  - Environment vs. increasing production
  - Food vs. fuel
- **More people in cities, less farmers. 10 bn in total**
- **2 bn. ha. agr. land are damaged or degraded**
- **Land grabbing - acquiring agr. land in Africa etc.**
- **Water will be a scarce resource (irrigation)**
- **Food shortage or "welfare" shortage?**

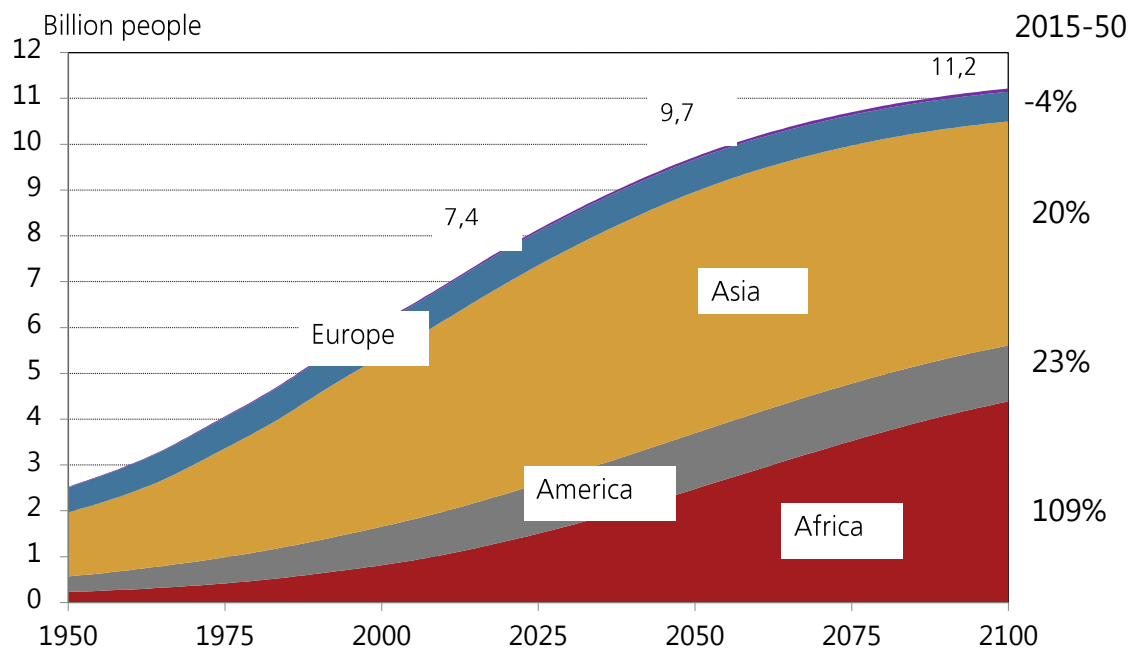




## Increasing population

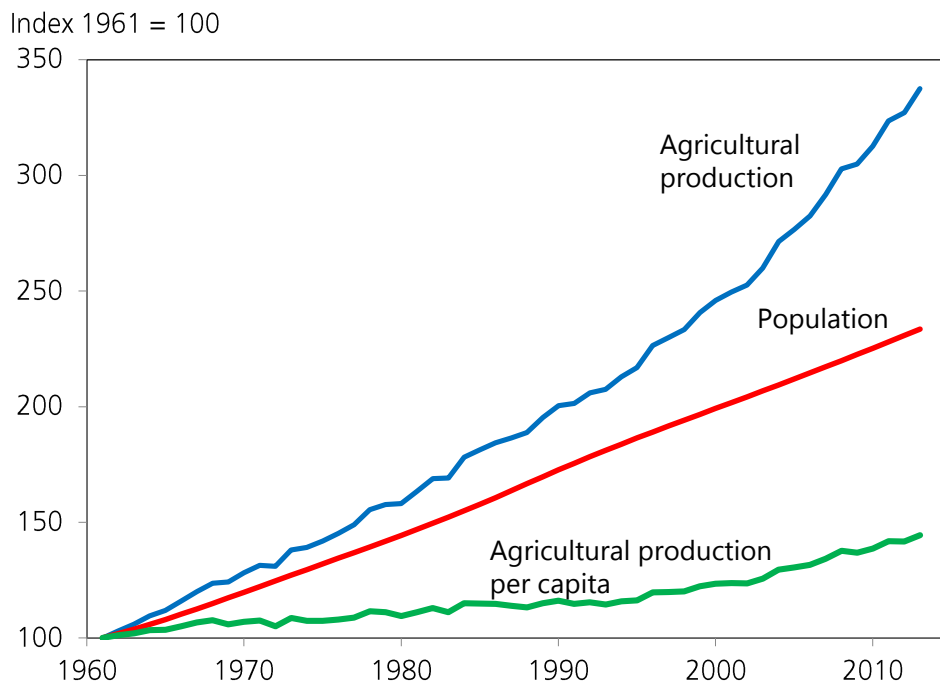


## World population, 1950-2100

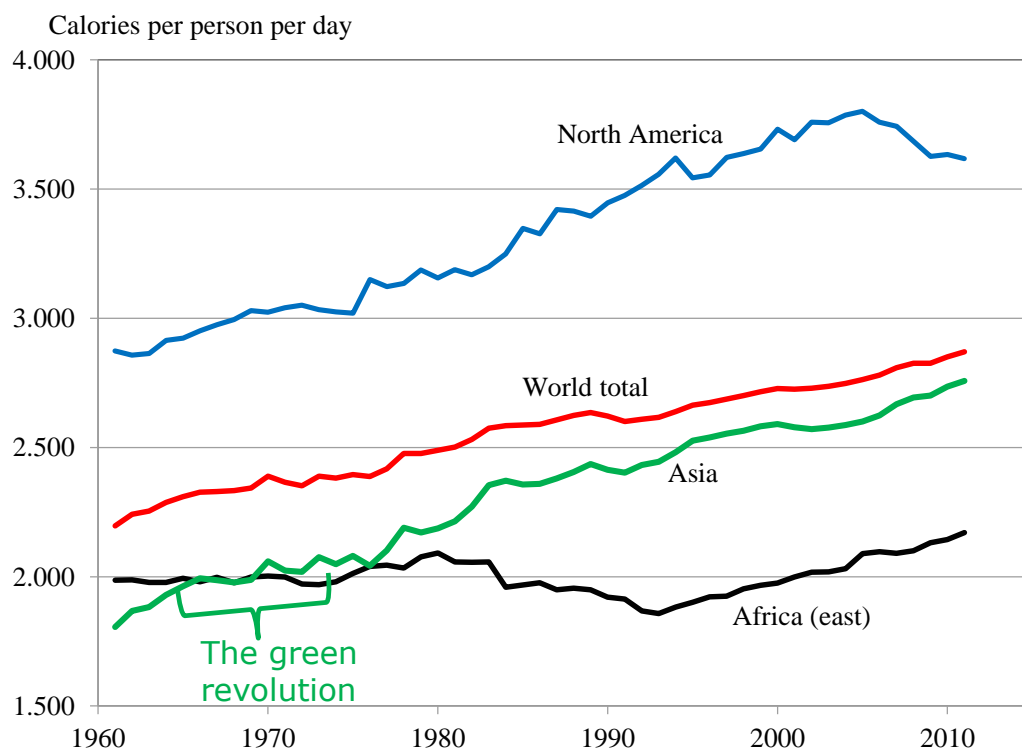


## **Can farmers produce sufficient amount of food?**

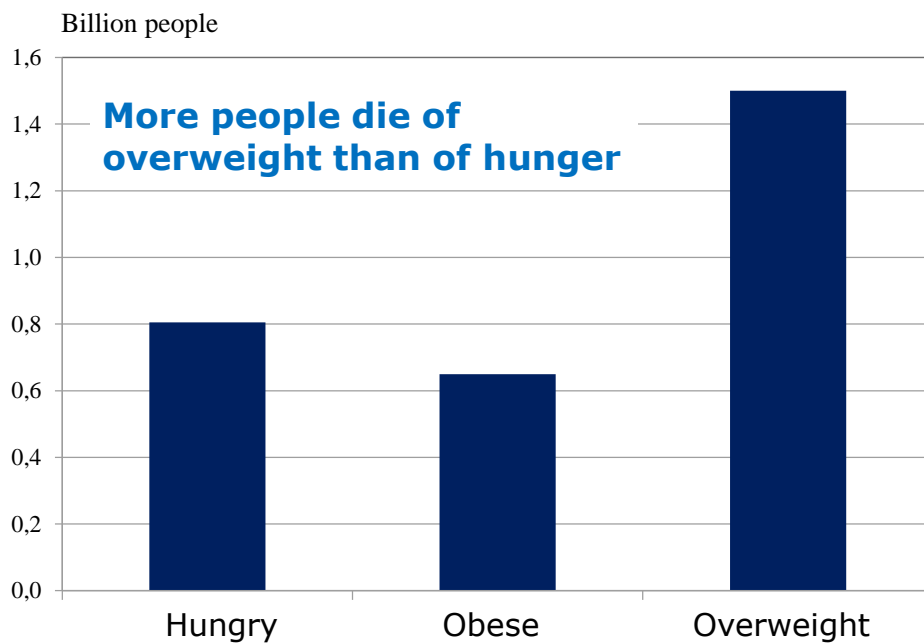
## Population and agricultural production



## Food per capita in average



## Both hunger and abundance



## Enough farmland?

**Farmland in 2050 will only increase by 5 per cent (70 mill. ha.)**

**More than 2 bn ha. farmland and forest have been completely or partially destroyed (last 50 years)**

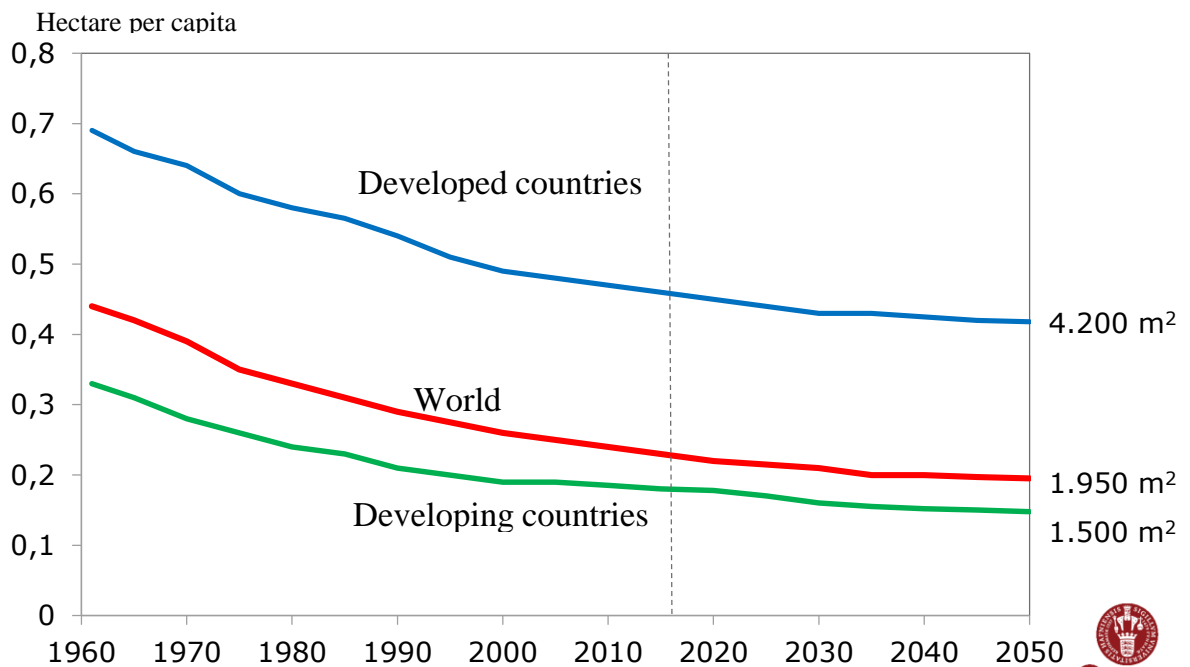
**Climate change will reduce agricultural production in Africa by 15-30 per cent.**

**Several major food crises will occur within the next 40 years**

**According to UN**



## Farmland per capita





## The use of farmland?



## Farmers must produce “5 F’s ” in the future:

**Food**



**Feed**



**Fuel**



**Forest**



**Fiber**



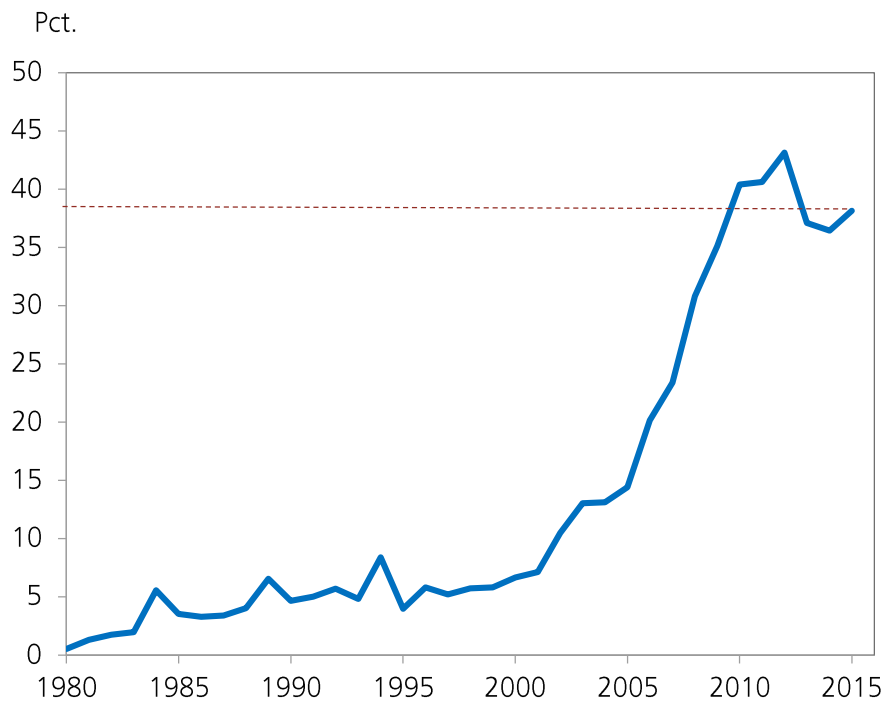
## Food and energy



## Food and energy



## Maize for bio energy in USA: % of total maize production

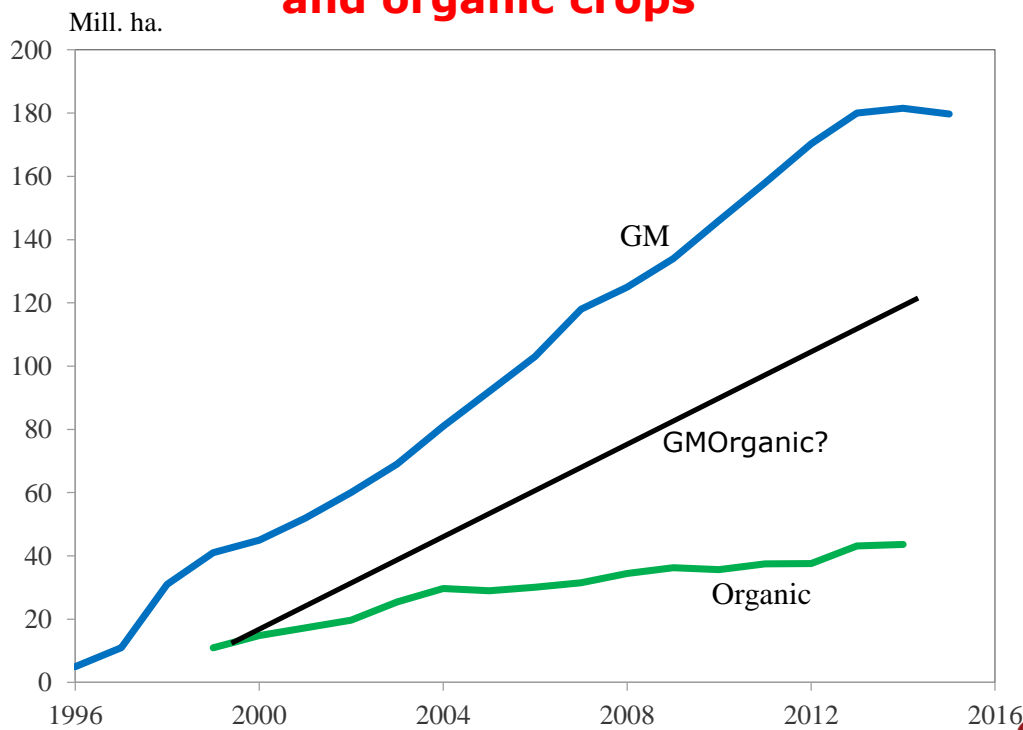


## **Solutions for how to feed the world . . .**

- \* Long term solutions**

- \*No simpel solution**

## World total farmland with GM crops and organic crops



## Solutions

**Berlingske** | 

Chronicle, May 03, 2022

### Technology is crucial in solving the food crisis

**To produce more food on a constant number of hectares . .**

**A new green revolution . . .**





## Development of farms

**Subsistence farming**



**Market based farms**



**Industrial farms**



**Biotech factories**

Lab meat  
Artificial meat  
Synthetic milk  
Vertical farming  
Etc.



*Dutch scientist Dr Mark Post with his lab-grown burger*



# TOMORROW'S FOOD



## SYNTHETIC MILK

COMPANIES SUCH AS MUUFRI ARE CLOSE TO PERFECTING COW-FREE MILK. MILK-PRODUCING GENES ARE INSERTED INTO YEAST, WHICH ARE THEN BRED IN VAST NUMBERS TO PRODUCE MILK PROTEINS.



## INSECT INGREDIENTS

INSECTS ARE A SUSTAINABLE PROTEIN. WHILE MANY MAY NOT BE PERSUADED TO EAT THEM, IT'S LIKELY THAT CONSUMERS WILL START FINDING INGREDIENTS SUCH AS FLOUR MADE FROM CRUSHED CRICKETS IN THEIR FOOD.



## APPETISING ALGAE

SEAWEED GROWS QUICKLY AND IS A CORE PART OF JAPANESE DIETS. AS IT CAN BE GROWN AT SEA, IT WOULD SOLVE THE ISSUE OF DWINDLING LAND FOR CROPS. THERE ARE THOUSANDS OF VARIETIES THAT COULD BE FARMED AND EATEN.

[DOWNLOAD DISHES](#)



Independent

**China signs \$300m deal to buy lab-grown meat from Israel in move welcomed by vegans**

**For many environmental and animal rights groups, lab meat is seen as a positive move away from the slaughter of billions of animals**

[Rachel Roberts](#)

Saturday 16 September 2017



## **Solutions: Industry level**

## **From shareholder to stakeholder focus**

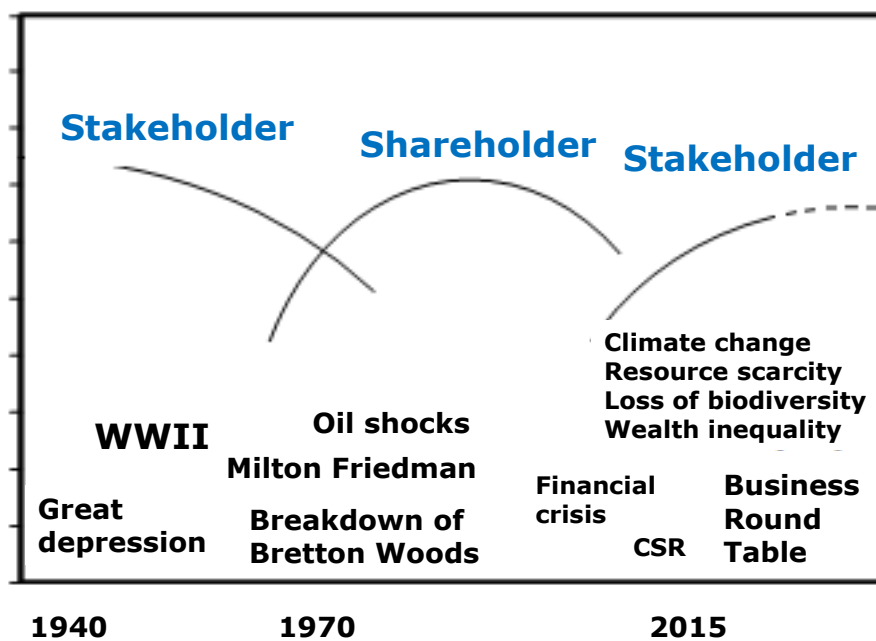
**Shareholder value: To benefit the owners**

**– increase profit for shareholders/owners**

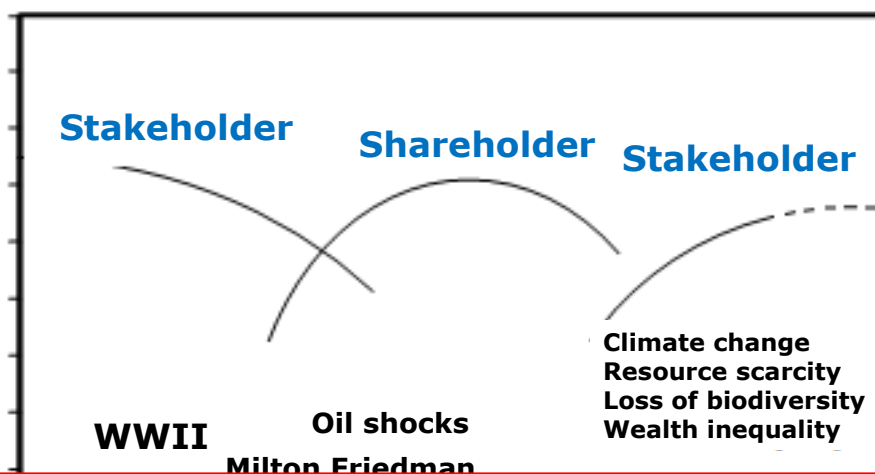
**Stakeholder value: To benefit all stakeholders  
(consumers, society, environment, owners etc.)**



## From shareholder to stakeholder focus



## From shareholder to stakeholder focus



### Why more stakeholder approach:

1. Completely new strategi, New goal (shareholder -> stakeholder)
2. Good business case
3. Pressure from stakeholders
4. License to operate



## Still challenges . . .

- **Enough food – but a welfare problem?**
- **Climate actions – just pushing emission to other countries? (leakage)**
- **“Free rider” countries (let other countries save CO<sub>2</sub>)**
- **Dilemmas to consider**
  - Food vs fuel
  - Food vs nature
- **Risk of new protectionism**
- **Disruptions**
  - Technology
  - Geopolitics
  - Lack of focus . . .

