UNIVERSITY OF HOHENHEIM

200 YEARS 1818 2018

Robots in Agriculture – Prospects for Africa

Thomas Daum

Institute of Agricultural Science in the Tropics (Hans-Ruthenberg-Institute)

THE NEW YORKER

A REPORTER AT LARGE

THE AGE OF ROBOT FARMERS

Picking strawberries takes speed, stamina, and skill. Can a robot do it?

By John Seabrook April 8, 2019

Animals farmed
Environment

'We'll have space bots with lasers, killing plants': the rise of the robot farmer

John Harris
@johnharris1969

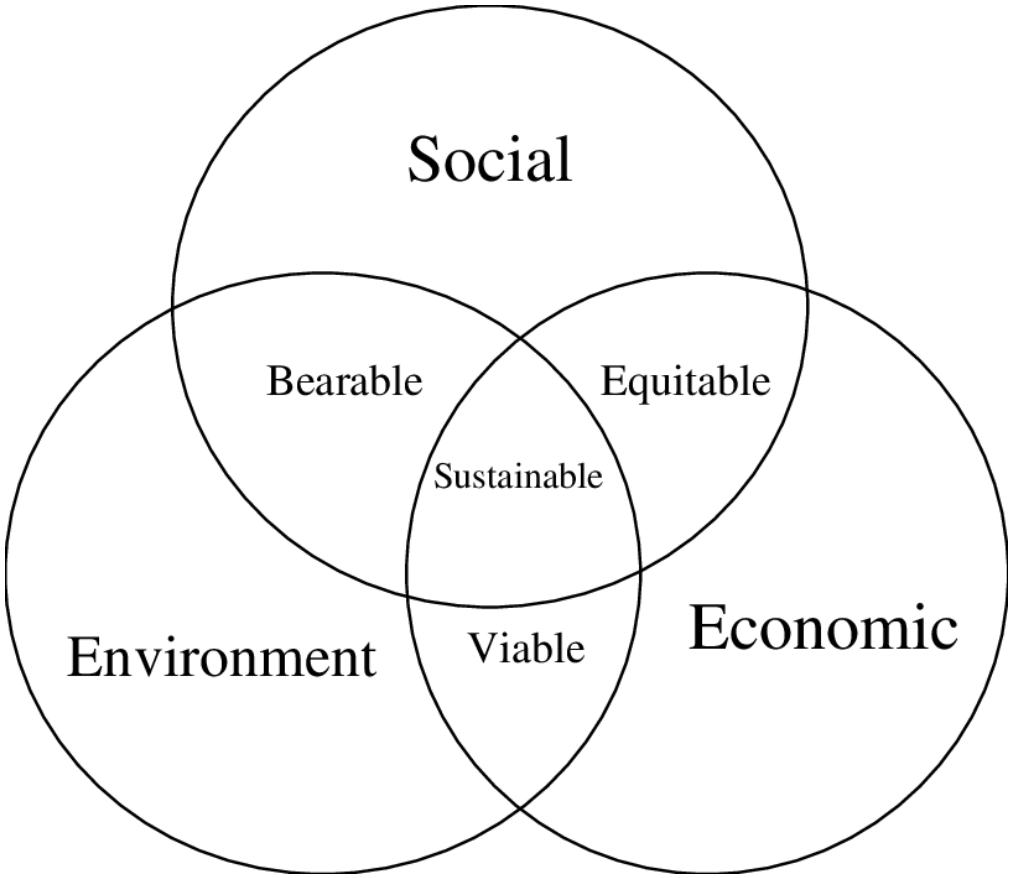
Sat 20 Oct 2018 08.00 BST

▲ 'Simple, robust, unlikely to break': a space-inspired Earth Rover robot. Photograph: Bas Niemans

Robots in Agriculture

- Much discussed for developed countries agriculture
  - more than replacing manual with robotic labor
  - IoT, sensors, big data, and variable rate technolgy allows smarter decisions and better targeting of inputs
- Potentials and challenges may be more pronounced in developing countries
  - more food needed but agricultural productivity low
  - majority of labour is unskilled and employed by agriculture
- What are environmental, economic and social prospects?

Sustainable Development



UNIVERSITY OF HOHENHEIM

200 YEARS 1818 2018

Environmental prospects

Thinking positive

- Less inputs (fuel, water, pesticides, fertilizers /// antibiotics, feed)
  - protection of surroundings (water bodies etc.)
  - less GHG emissions
    - nitrogen fertilizer accounts for approximately 1.2% of the global GHG emissions (Wood et al., 2004)
  - less indirect land use (i.e. from livestock production)
- Or even much less inputs
  - camera-guided robotic hoes and laser for weed control

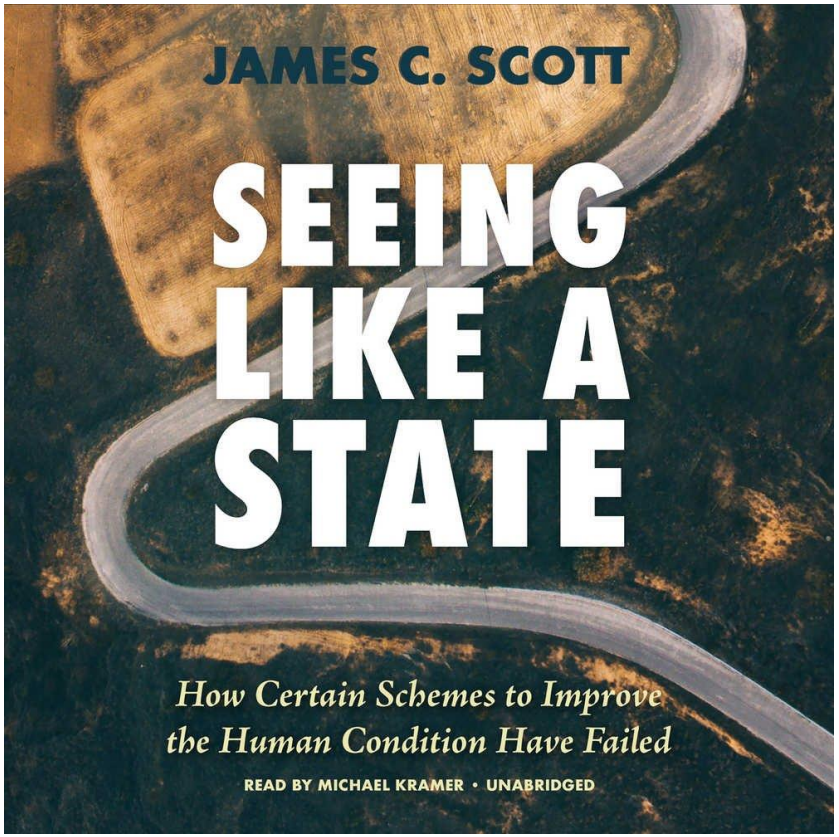
Thinking positive

- Fleets of small robots rather than larger tractors
  - Less soil compaction and erosion
  - Small, diverse plots, hedgerows, agro-silvo-pastoral systems

- IoT, sensors, big data, smarter decisions
  - may be of particular relevance for knowledge-intense organic farming practices

Thinking negative

- Automation works easier in more controlled systems with fewer variables
  - greenhouses and livestock production
  - but also large fields with monocultures and limited diversity
- Robots and digital agriculture as scientific farming or factory farming detached from nature



Thinking negative

- Will robots be actually be small?

UNIVERSITY OF HOHENHEIM

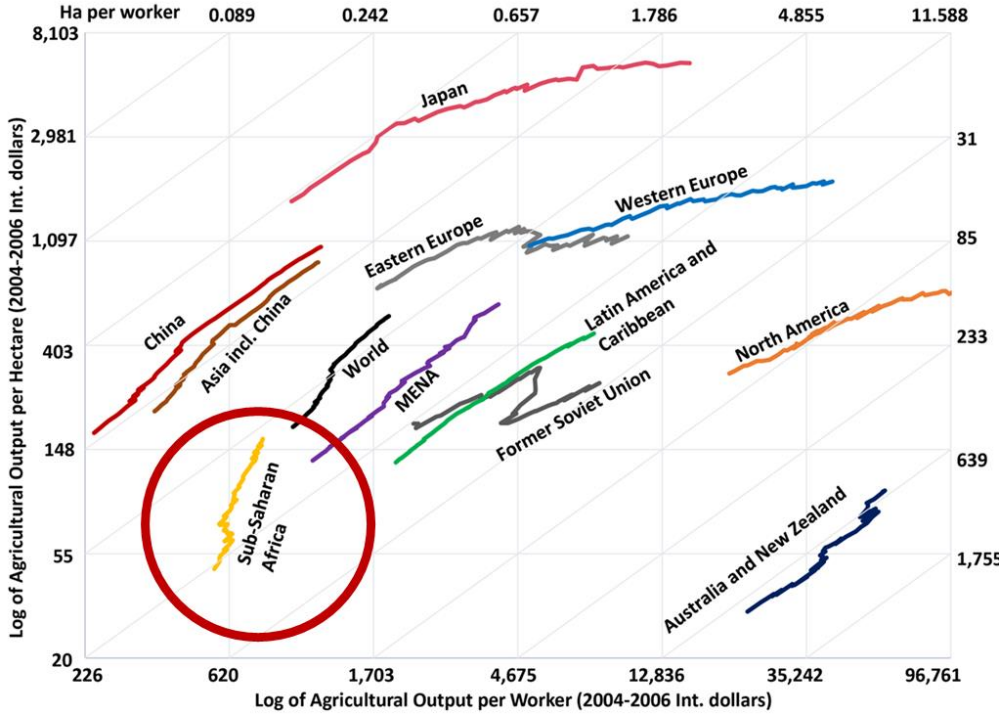
200 YEARS 1818 2018

Economic prospects

Yale Climate Connections

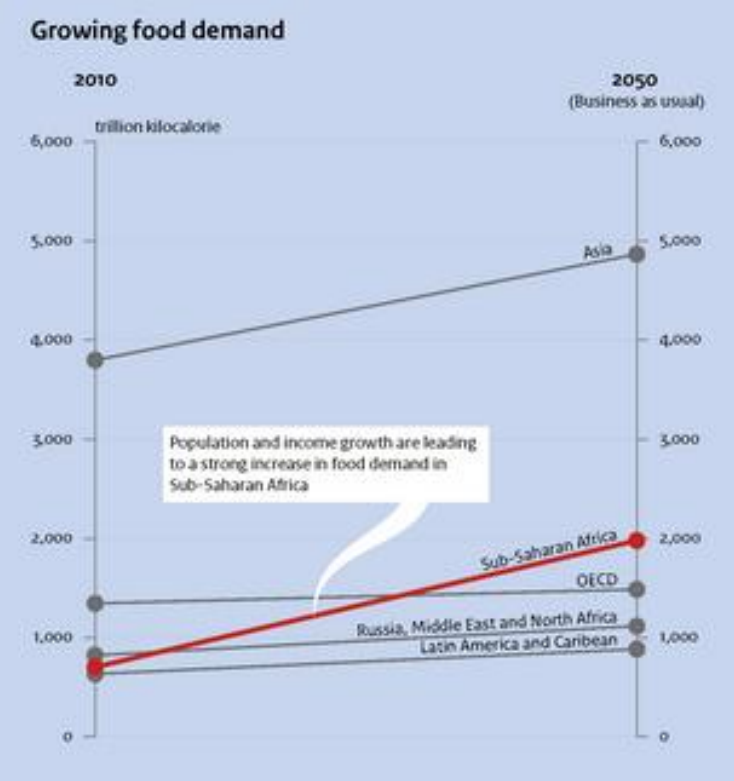
Thinking positive

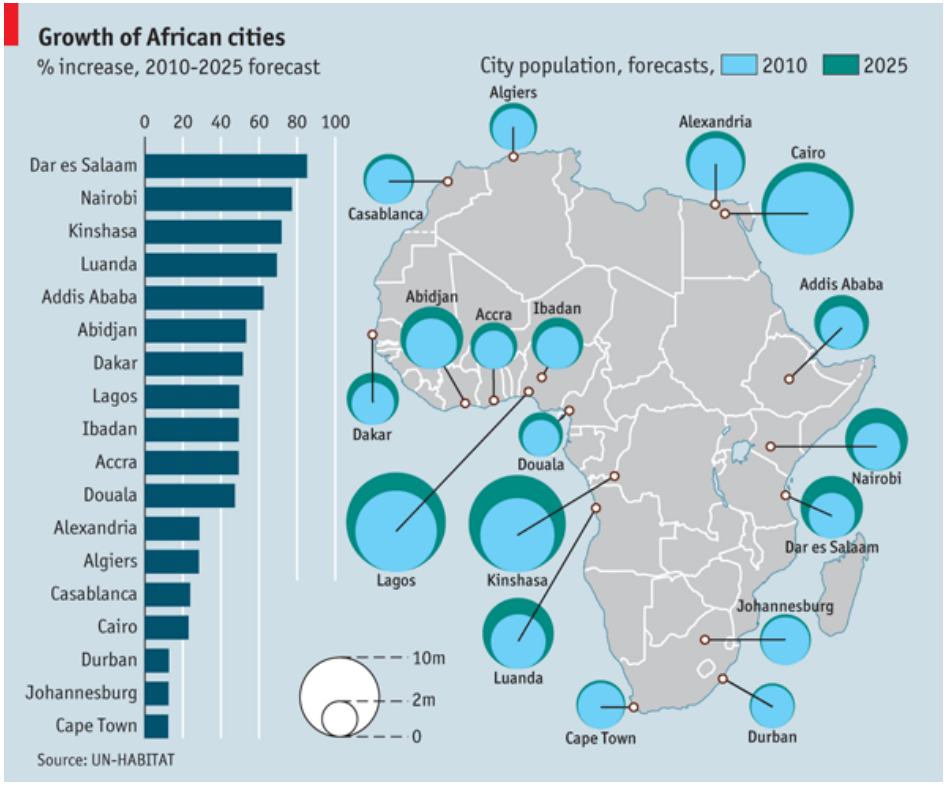
- Higher yields, less input costs
  - Increased land and labor productivity



Thinking positive

- Cheaper food for urban population





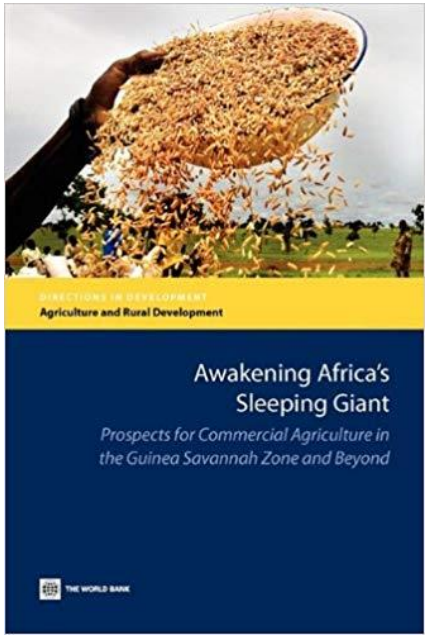
Netherlands Environmental Assessment Agency 2017 // economist.com/graphic-detail/2010/12/13/growth-areas

Thinking positive

- More data, better decisions, less risk
  - better and more continuous monitoring for pests as well as plant and livestock diseases
  - “digital farms” may have better access to finance and insurance
  - better pesticides, seeds and breeds
- new employment opportunities upstream and downstream
- No reshoring by developed nations possible

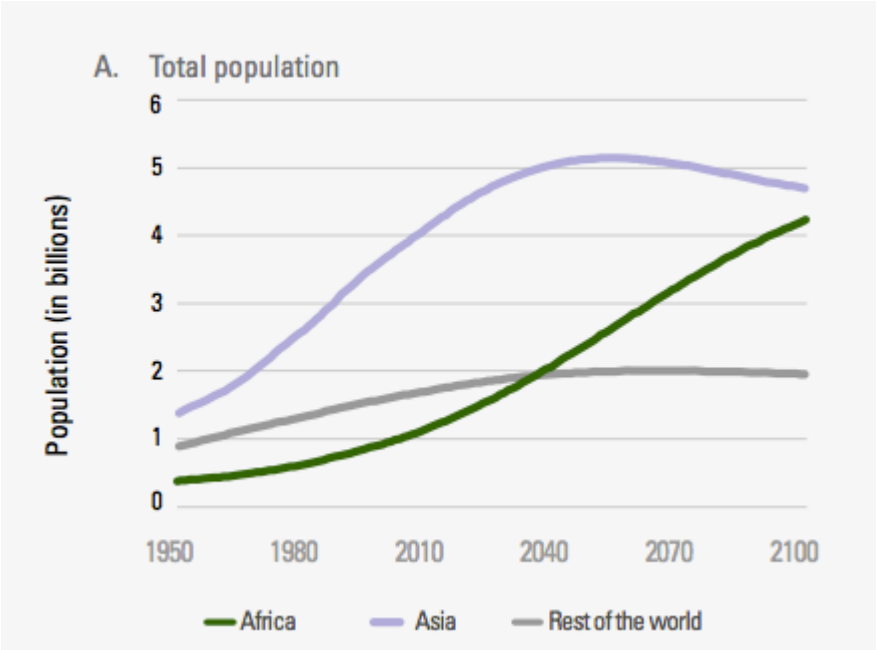
Thinking positive

- Use of unused land potentials in the hinterland with limited labor access (tough Savannah conversion associated with environmental concerns)



Thinking negative

- Unemployment with few alternatives or slower real wage growth (Schlogl and Sumner, 2018)
  - few jobs in urban areas and service sector
  - hinders poverty reduction
  - retraining and universal income more unlikely as compared to developed countries



https://www.cfr.org/blog/africas-youth-bulge-big-burden **with data from UNICEF (2014)**

Social prospects

Global Citizen

Thinking positive

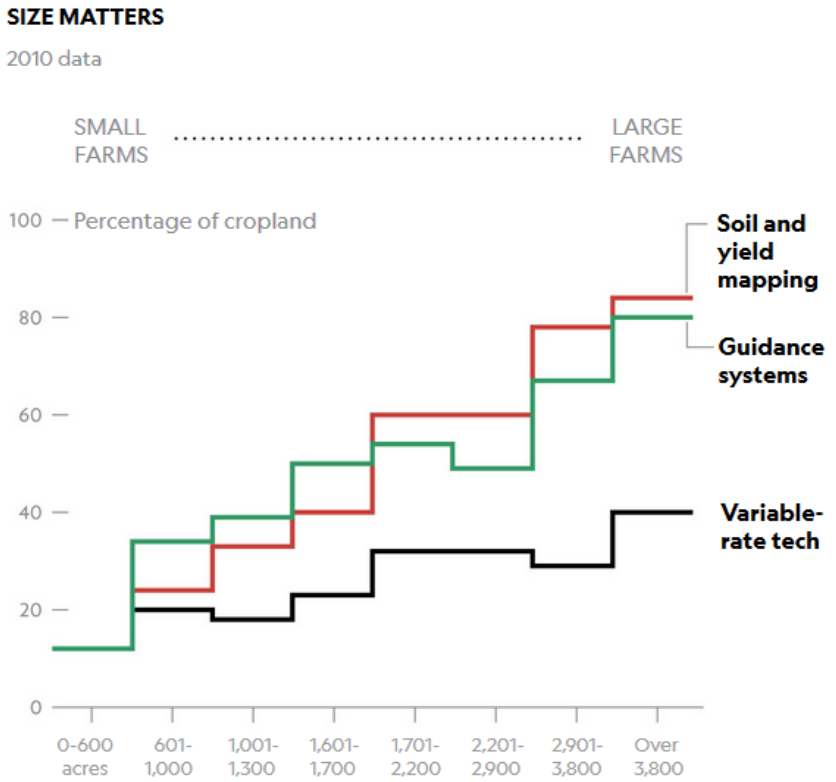
- Reduction of drudgery that plagued farmers ever since (hot, repetitive, hazardous)
  - increase farmers well-being; save time; increase flexibility (Thompson et al., 2019)
- Make farming attractive for youth (!?)

Thinking positive

- small robots and drones are scale neutral → both large and small farms can adopt them and service markets may evolve

Thinking negative

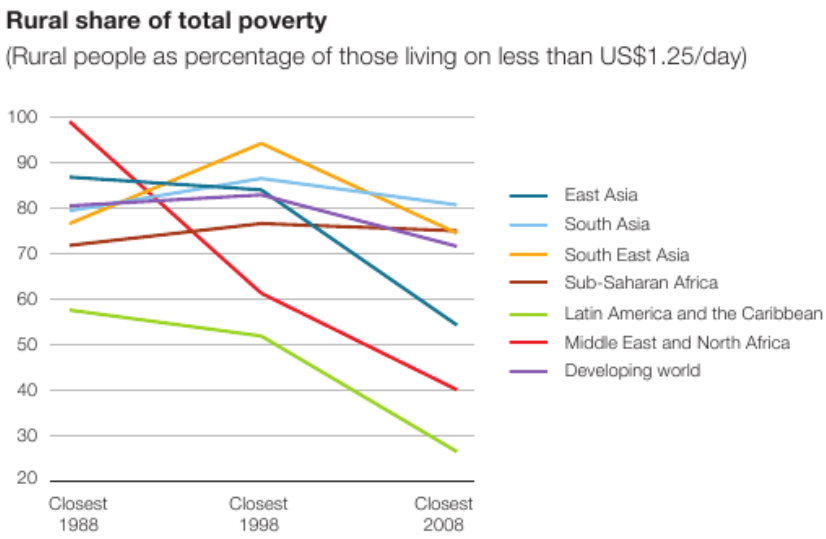
- Structural transformation
  - large farms adopt new technologies faster
    - rise of medium-scale farms (often urban and elite background) in Africa (Jayne et al., 2016; Sitko and Jayne, 2014)
    - Foreign investors
- Will robots be small?



www.nationalgeographic.com/environment/future-of-food/food-future-precision-agriculture based on Schimmelpfenning (2016), U.S. DEPARTMENT OF AGRICULTURE

Thinking negative

- small ones can not compete with lower food prices (tough many are net-buyers of food) and higher land prices
- but developing smallholder farmers is key for poverty reduction (75% of world poverty rural)



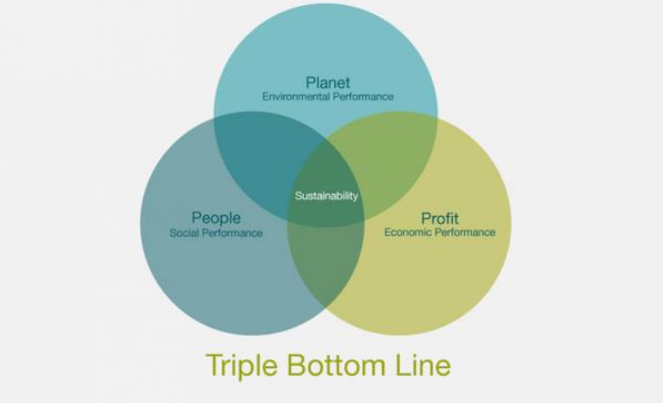
http://www.globalissues.org/article/4/poverty-around-the-world#InequalityinRuralAreas

Thinking negative

- fundamental questions of the future role of farmers
- Use of agro-bots and IoT is data-heavy
  - concerns with regard to data security, privacy and sovereignty (Bronson and Knezevic, 2016; Wolfert et al., 2017)
  - constraints regarding data compatibility and transferability may lead to path dependencies and a loss of bargaining power for farmers

Sum up

- Environmental, social and economic prospect are largely unkown
  - postive and negative prospects are imaginable
  - Trade-offs are likely



- Need to dicuss


Thanks!

References

- Bronson, K., & Knezevic, I. (2016). Big Data in food and agriculture. Big Data & Society, 3(1), 2053951716648174.
- Jayne, T. S., Chamberlin, J., Traub, L., Sitko, N., Muyanga, M., Yeboah, F. K., ... & Kachule, R. (2016). Africa's changing farm size distribution patterns: the rise of medium-scale farms. Agricultural Economics, 47(S1), 197-214.
- Sitko, N. J., & Jayne, T. S. (2014). Structural transformation or elite land capture? The growth of “emergent” farmers in Zambia. Food Policy, 48, 194-202.
- Schimmelpfennig, D. (2016). Farm profits and adoption of precision agriculture. Economic Research Report Number 217. United States Department of Agriculture.
- Schlogl, L., & Sumner, A. (2018). The Rise of the Robot Reserve Army: Automation and the Future of Economic Development, Work, and Wages in Developing Countries.
- Wood, S.; Cowie, A. A Review of Greenhouse Gas Emission Factors for Fertiliser Production; For IEA Bioenergy Task 38; Orange, Research and Development Division, State Forests of New South Wales: New South Wales, Australia, 2004.
- Wolfert, S., Ge, L., Verdouw, C., Bogaardt, M.J., 2017. Big data in smart farming–a review. Agric. Syst. 153, 69–80.