New Agricultural Technologies: Reinforcing Corporate Concentration

Action Group on Erosion, Technology and Concentration (ETC Group)
The Fourth Industrial Revolution

1st
Mechanisation, water power, steam power

2nd
Mass production, assembly line, electricity

3rd
Computer and automation

4th
Cyber physical systems

1.0 1784: Steam and water power
2.0 1870: Mass production and the use of electricity
3.0 1969: Computer and automation
4.0 Tomorrow: Based on the use of cyber-physical systems
high tech
medium tech
low tech/no tech
Digital and Data-driven technologies

Molecular Engineering (nanotech+ biotechnology)

Earth Systems Engineering and ecosystem interventions

Impacting Food, Agriculture and Nutrition
Digital and Data-driven Technologies

• Artificial Intelligence/Machine Learning
• Computer Assisted Organic Synthesis (CAOS)
• Internet of Things
• Synthetic Biology/cell factories,
• Online markets and online delivery,
• Blockchain and financial technology tools
• Algorithmic trading
• Molecular communication

Impacting Food, Agriculture and Nutrition
Zymergen’s algorithms suggest making 1,000 or so changes to the microbe’s genetic material. Then the robots take over, injecting the suggested DNA snippets into the specimens, testing their properties, collecting data and feeding that information back into the data trove.”

- Bloomberg

“AI – driven Synthetic Biology ”
A growing band of chemists is now trying to free the field from its artisanal roots by creating a device with the ability to fabricate any organic molecule automatically ...

Such a device could thus offer an astonishing diversity of compounds for investigation by researchers developing drugs, agrochemicals or materials.

“A synthesis machine could make any of a billion defined small molecules on demand.”

“A growing band of chemists is now trying to free the field from its artisanal roots by creating a device with the ability to fabricate any organic molecule automatically ...

... Such a device could thus offer an astonishing diversity of compounds for investigation by researchers developing drugs, agrochemicals or materials.”
• Precision agriculture applications
• Drones, robotics (on the field, processing and in food service)
• Sensors and remote sensing technologies
• LIDAR
• 3d printing/additive manufacturing of food,
• Animal and crop health sensors
• Hydroponics and ‘vertical farming’
The Internet of nano-bio things:
information transmitted by artificial systems has largely been through media such as wave modulation (electromagnetic / acoustic) and particle/wave modulation (optical) while in Biology much communication is through molecules – e.g. pheromones, DNA etc. Molecular communication can be defined as a measurable information exchange process between networked artificial or biological entities through the use of molecules. (Inscribed matter)
DIGITAL FARMING: PRECISION AGRICULTURE
Farm Machineries: Market Size (2017)

Ag Equipment

$135 billion
Top 6 Farm Machinery Companies, 2017
Estimated Worldwide Sales of $135,300 million

- **Deere & Co. (USA)**, $20,167, 15%
- **Kubota (Japan)**, $11,246, 8.3%
- **CNH Industrial (UK/Netherlands)**, $11,130, 8.2%
- **AGCO (USA)**, $8,300, 6.1%
- **CLAAS (Germany)**, $4,075, 3%
- **Mahindra & Mahindra Ltd. (India)**, $2,050, 2%
- **Others**, $78,332.00, 58%
Molecular Engineering

( biotechnology)

Impacting Food, Agriculture and Nutrition

• Nanomaterials, nanofoods, nanocoatings, nanopesticides,
• Taste/sensory modification technologies,
• Synthetic biology /Gene-editing,
• In situ genome engineering
• Gene drives
• Molecular communication
• Metabolic engineering
• Cell culture engineering of food
• Epigenetic engineering
• RNAI sprays
• Microbiome engineering
• Photosynthesis engineering
• Nutrigenetics/nutrigenomics
• animal vaccines
14-20 increase in biomass from modified plans in Tobacco field trials
In-Situ Genome Engineering
Cellular Agriculture
Agricultural products by cell culture

Medical technology,
Agricultural application

Casein
Gelatin
Vanillin
Omega-3 fatty acids
Ovalbumin
Acellular products

Meat
Leather
Fur
Wood
Offal

Cellular products
IMPACTS OF TECHNOLOGY

- Society
- Culture
- Economy
- Environmental
- Politics
- Ethical Considerations
Systemic Issues around Technologies

1. **Alienation** (*Technology by whom?):* Top-down decisions on technology, absence of democratic governance of tech

2. **High-tech fixation** (*Which technologies?):* lack of recognition and support for indigenous knowledge systems and local innovations

3. **Technology for Control** (*Technology for whom?):* as a means to assert and reinforce control over resources and peoples

4. **Corporate Concentration** (*through which means?):* enabled by intellectual property rights (IPR), trade rules, standards

5. **Myth: Technology as “neutral”**
Neth Daño
neth@etcgroup.org
www.etcgroup.org