

# **Sustainable Agriculture through Innovative Vertical Farming**

**Professor Chungui Lu**

Nottingham Trent University

REAMIT Networking Symposium

09/01/2020

MUST READ: [Microsoft: You're being less toxic online but bullying, harassment still rife](#)

# Top 20 most popular future jobs of 2030: Vertical farmer, limb maker, waste data handler, narrowcaster

In 2030, some of the most popular jobs could be vertical farmer, limb maker, waste data handler or narrowcaster, according to a new U.K. report.



By [Andrew Nusca](#) | January 19, 2010 -- 10:48 GMT (10:48 GMT) | Topic: [Innovation](#)

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## The Telegraph

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## 10 well paid jobs of the future

- Digital architect
- Elderly well-being consultant
- Nano-medic

23 January 2020

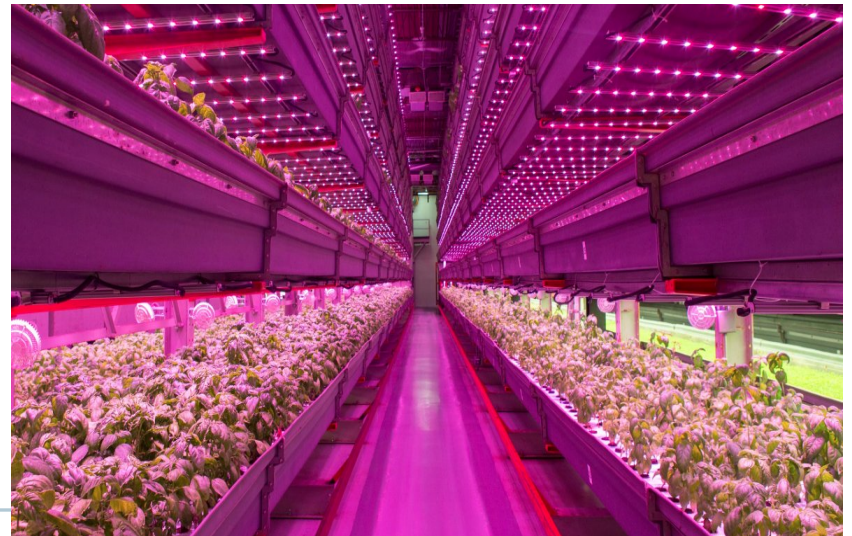
- **Vertical farmer**

2

NTU



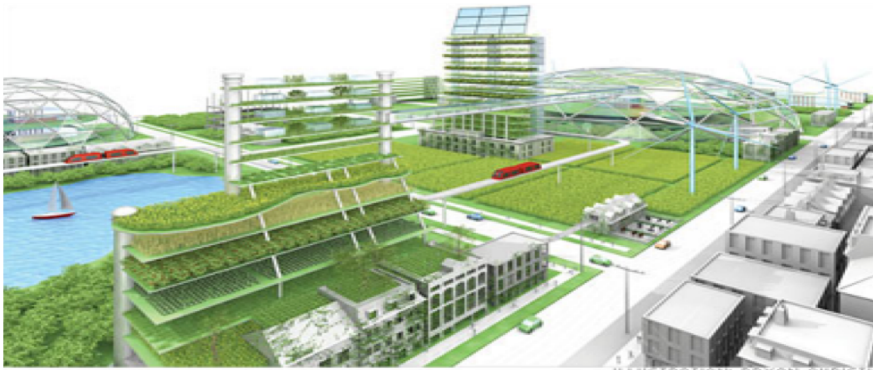
# What is Vertical Farming?



23 January 2020

# Vertical farming

*“.....indoor agricultural strategies to growing food in protected environment ( buildings, glasshouse.....)”*





# City farming & urban agriculture

- **Protected** environment (greenhouse, skyscraper..) year round
- **Advanced** technologies (hydroponics, LED light, automation with multi-tier).
- **Sustainable, precision, smart** for creating an eco-city.



# Protected cropping: past to future

- Protected farming (1930s, greenhouse)
- Prof Dickson Despommier introduced concept of vertical farming in 1999

**Greenhouse farm**



**Field farm**



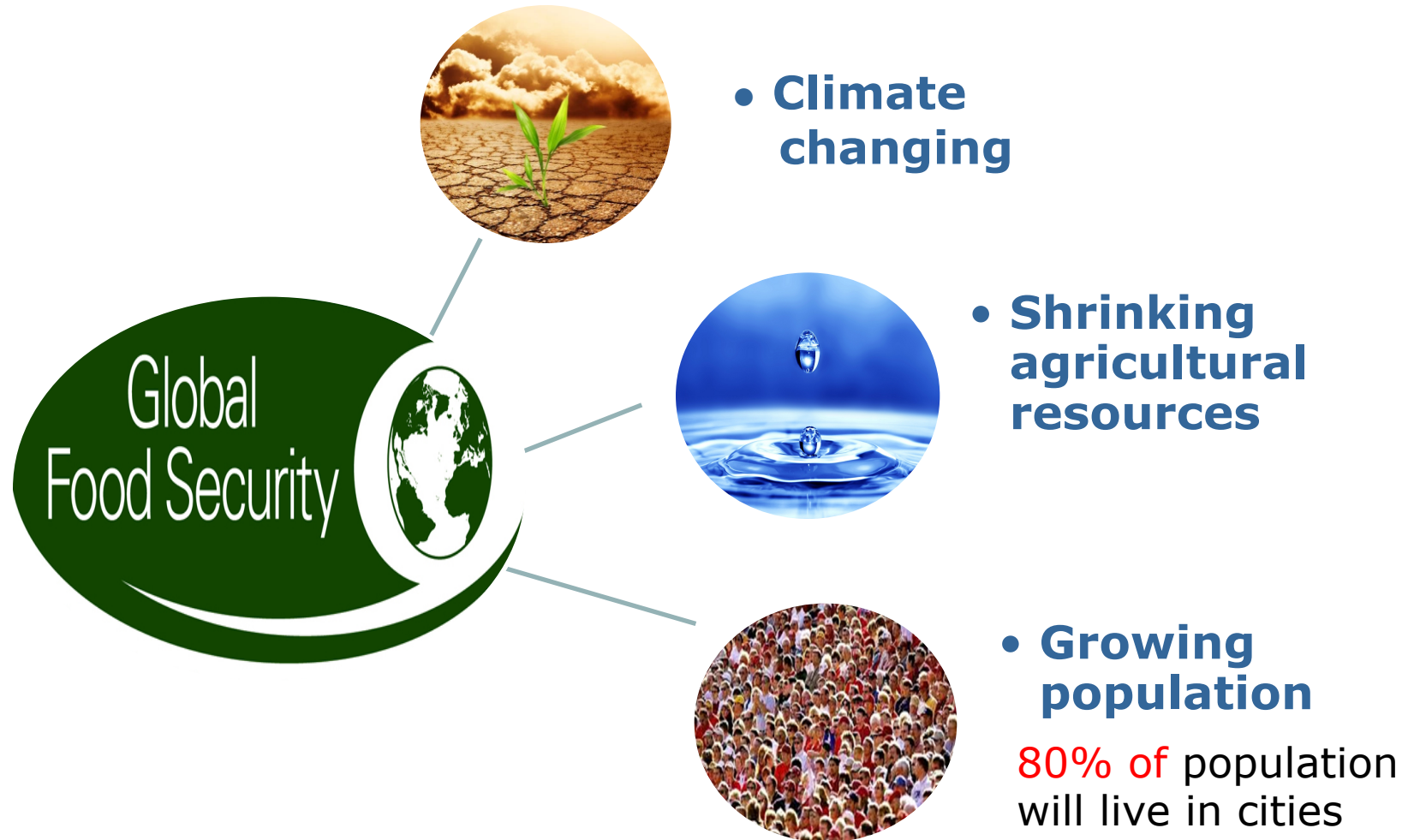
**Indoor farm**



**Future farm**



# Challenges on the global food security





# UK food supply "at risk"



The UK agri-food sector contributed £108 billion

~70% vegetables & fruits imported from EU & other countries



# Brexit will bring significant strategic risk and cost for UK food supply

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### Iceberg lettuces and broccoli rationed as vegetable crisis hits supermarkets

3 February 2017 | UK | 518

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# Current business cost models



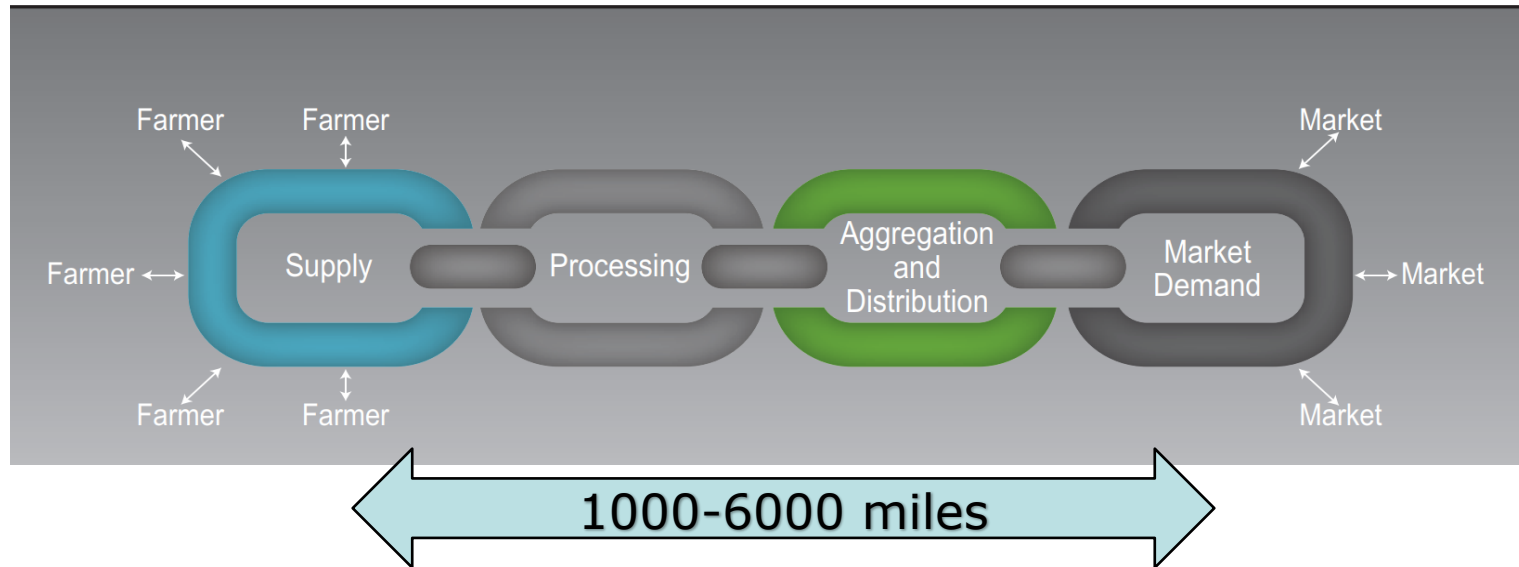
£100 food  
per week

Save £65  
per week

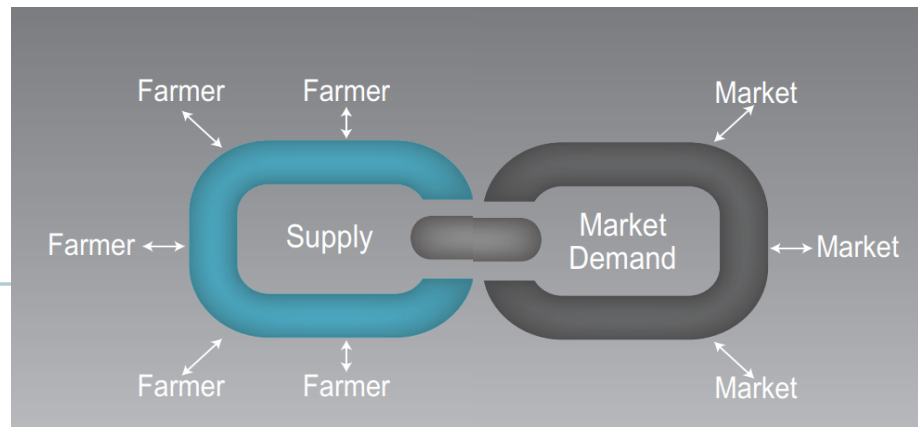
Save £3380  
per year  
for family  
holiday in  
Tenerife



# Current UK food supply chains



## City farming





A nice idea - but does not scale





# How to address these challenges?

## Sustainable Agriculture – City Farming

- Increased **efficiency** (energy, water, nutrient...)
- Enhanced innovative **technologies**



# Vertical farm category



**HYDROPONIC GREENHOUSES**



**VERTICAL FARMS**



**CONTAINER FARMS**



**IN HOME SYSTEMS**



25 January 2020



# Advantages of vertical farming

- Provide fresh, safe and nutritious food all year round
- Reduce food waste through consistent delivery
- Increase crop yields and profitability
- Shortened supply chains
- Limit environmental pollution pesticide
- Job creation in urban environments
- Reduce transportation costs
- Big packaging savings



# Smart green growth farm at NTU

- **Shipping container farm** with automated control system, LED lighting, high nutrient use efficiency
- **Greenhouse vertical farm** with energy saving and innovative and sustainable food production
- **Precision farm** with big data analytics in development of agricultural database





# Shipping container farm



# SMART shipping container farm

## Smart Hardware



## Cloud Service



## Mobile Control



A

- FUN
- EASY

WAY TO

- Manage plants and get safe food
- Keep indoor green and eco-friendly



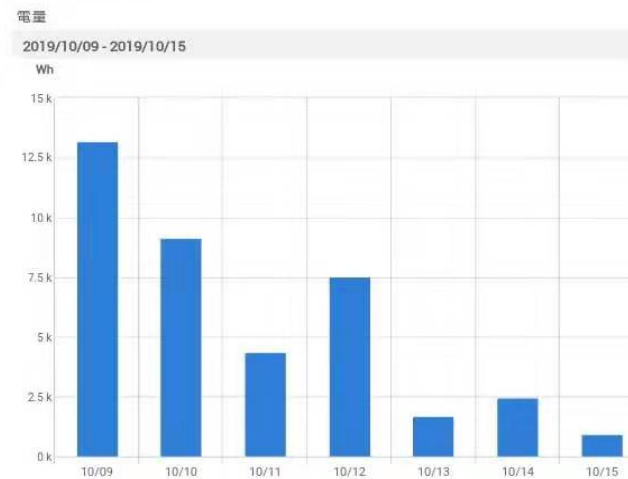
# Innovative energy saving container farm

## NTU Hydro Container

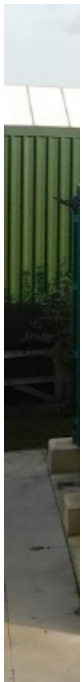
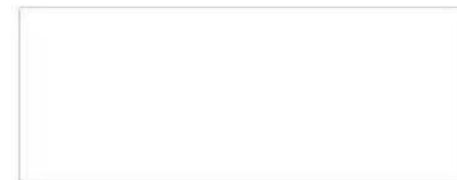
### 系統效益



### 功率和電量



最新的更新: 2019/10/15 10:15



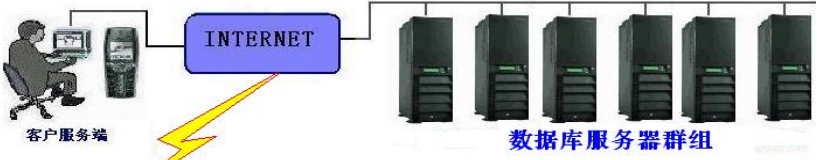
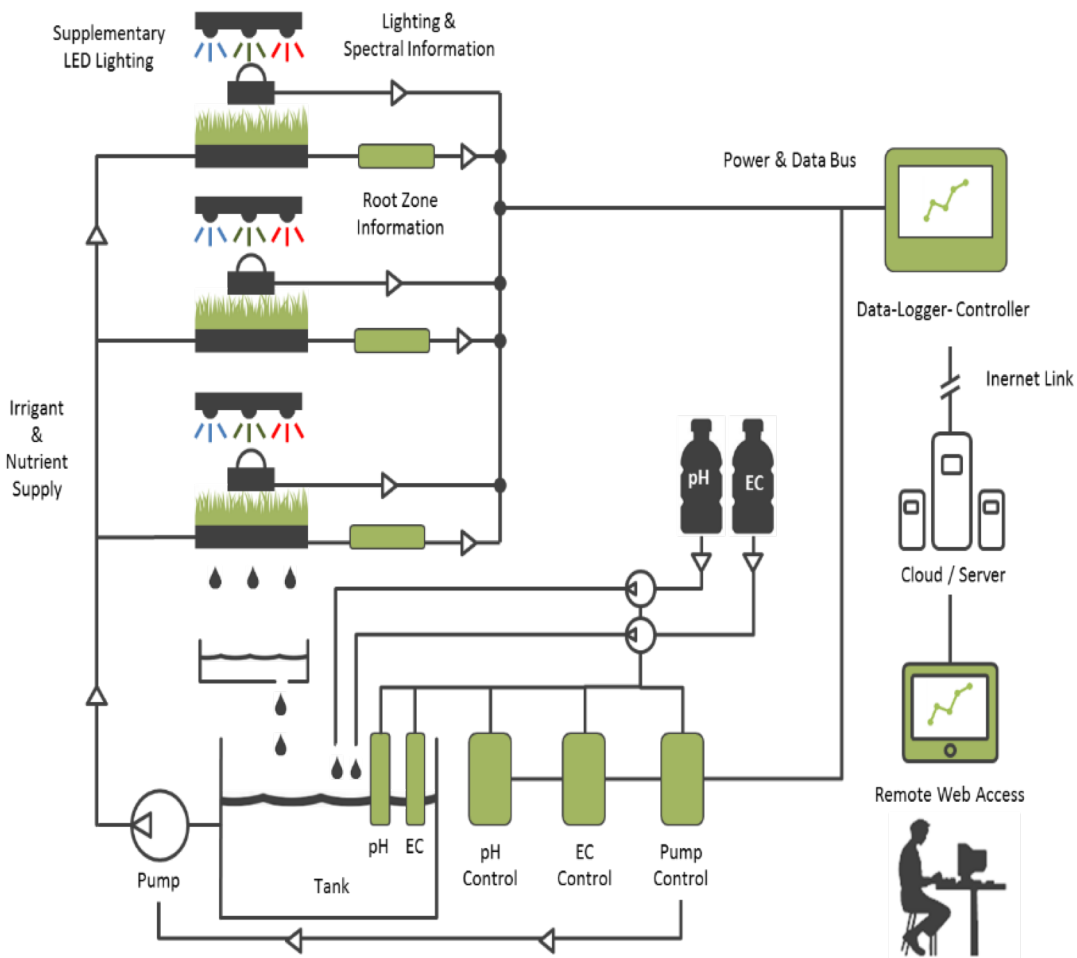


# Greenhouse vertical growing system





# Precision and automated control



Proposed Internet-of-Things enabled growth control system

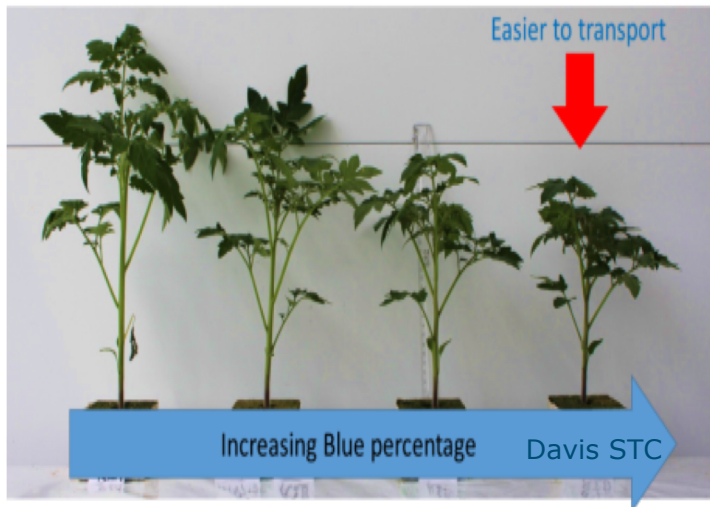
# The effects of LED light on plant growth



100% red

Increase Blue light percentage

100% blue



- FR

+FR



CK

-G

+G

Bian Z et., al 2016



# London growing underground farm



Phase 3

Products



# 3D farm (Saturn Bioponics)





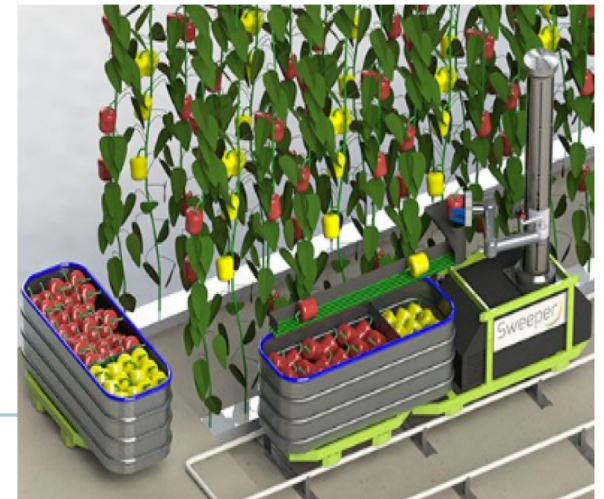
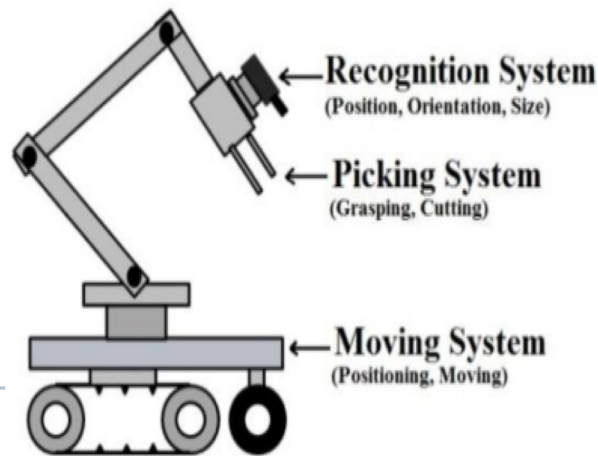
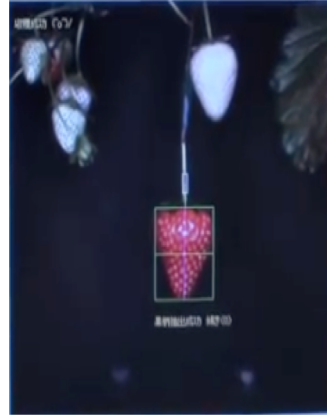
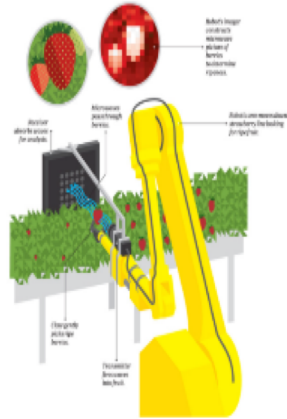
# Vertical farm in the supermarket



<https://www.thetimes.co.uk/imageserver/image/method%2Ftimes%2Fprod%2Fweb%2Fbin%2F4c66376-09c8-11e8-a5b3-3d239643ad40.jpg?crop=1500%2C844%2C0%2C78&resize=685>



# Big data and robotic garden





# Won gold medal at Chelsea Flower Show



Designed two attractive growing systems, "green wall" and "air tuber sweet potato" that impressed visitors

# SAVE THE DATE

International Conference on Vertical Farming  
7 & 8 April 2020 • Nottingham UK

Register your interest now at  
[www.ntu.ac.uk/vfconference2020](http://www.ntu.ac.uk/vfconference2020) • #ntuverticalfarming



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# Thanks and questions



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[Chungui.Lu@ntu.ac.uk](mailto:Chungui.Lu@ntu.ac.uk)

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