



IUFoST

Session 2: Integrating Capacity Building and Future of Food Science

Future of Food Science Technology & Engineering (FST&E)

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Outline

- **Introduction**
- **Enabling Technologies & Challenges**
- **Paradigm Shift for the Future**
- **Take Home Messages**
- **Personal Note**

Introduction - Creative Destruction*

(*Capitalism, Socialism & Democracy*, Joseph Schumpeter)

- Joseph A. Schumpeter (1883 – 1950)
 - Austrian political economist
 - Emigrated to the USA (1932)
 - Prof. at Harvard University (1932-50)
 - “*Gale of creative destruction*”:



“process of industrial mutation that continuously revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one”

- Expect dramatic shifts in business, working force & education

[*https://en.wikipedia.org/wiki/Creative_destruction](https://en.wikipedia.org/wiki/Creative_destruction)

Example: Creative Destruction

Median Age of S&P Top 10 Companies

Exhibit 2

Organic growth has eluded many long-standing companies, and younger companies are outperforming these more established players.

The speed of disruption is accelerating ...

Median age of S&P top 10, 2000

85

years



Median age of S&P top 10, 2018

33

years



Average S&P 500 tenure by 2027

12

years



Average age of a unicorn start-up

6

years

5-year valuation growth in post-IPO unicorns¹

8.7

x

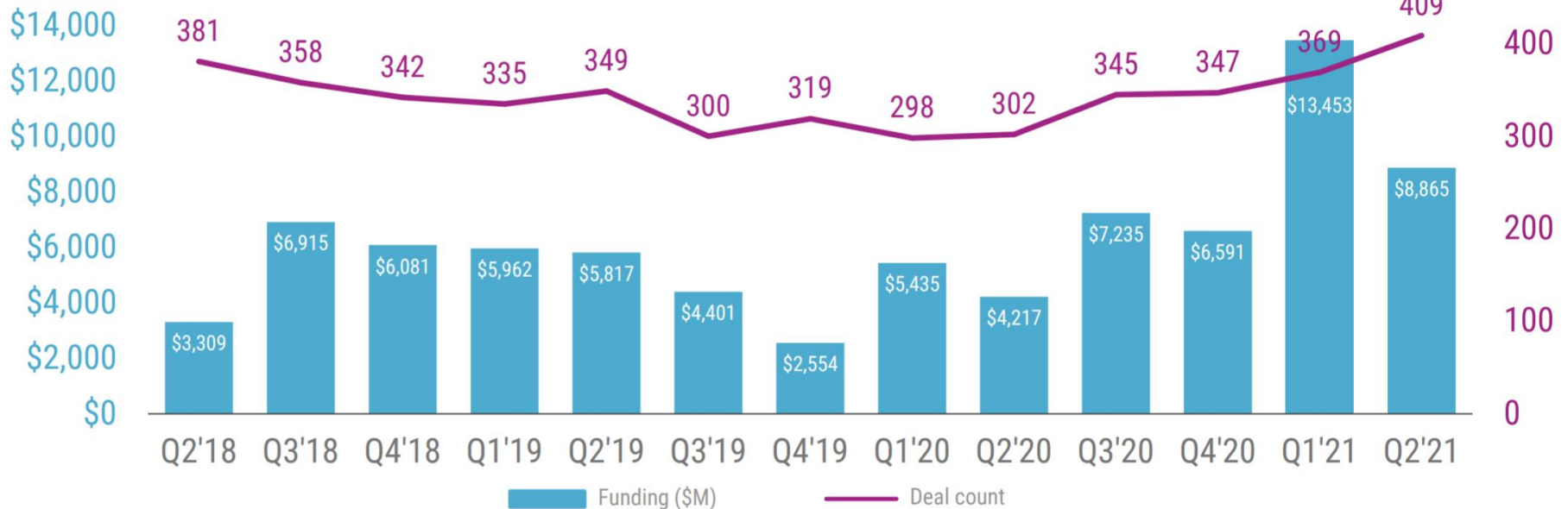
... causing a steady decrease in the tenure of S&P 500-listed companies

<https://www.mckinsey.com/~media/McKinsey/Industries/Electric%20Power%20and%20Natural%20Gas/Our%20Insights/Traditional%20company%20new%20businesses%20The%20pairing%20that%20can%20ensure%20an%20incumbents%20survival/Traditional-company-new-businesses-VF.ashx>

Quarterly FoodTech Deals & Funding (\$M) Q2'18 to Q2'21

Total Funding
(\$M)

Of Deals



CBINSIGHTS

Source: CB Insights

2020

\$23.58Bn

2021

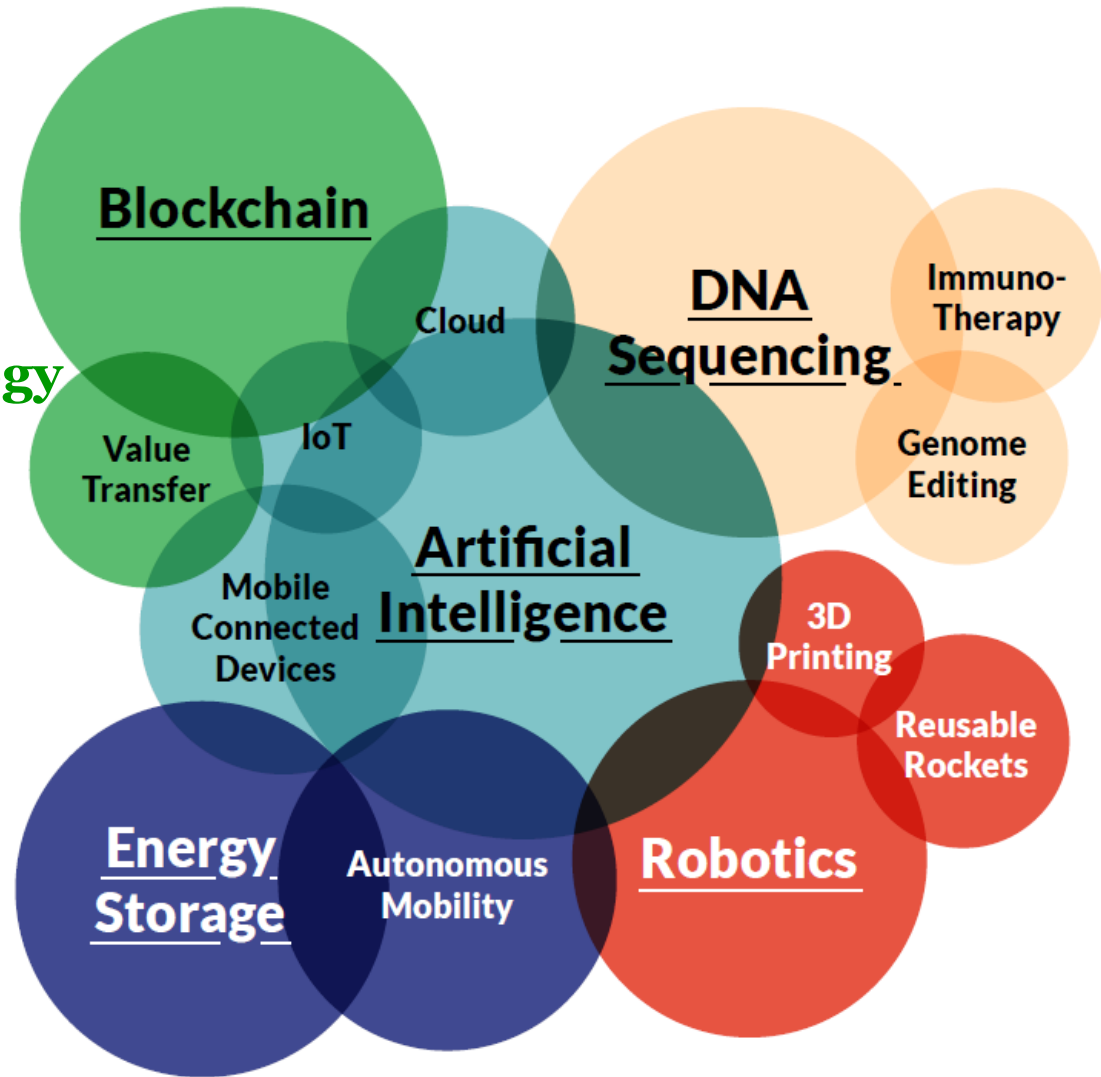
\$22.32Bn

https://www.cbinsights.com/reports/CB-Insights_Food-Tech-Report-Q2-2021.pdf

ARK's Cluster of Major Innovation Platforms*

Major platforms:

1. **Blockchain Technology**
2. **AI**
3. **DNA Sequencing**
4. **Robotics**
5. **Energy Storage**



*ARK Investment Management LLC:

https://research.ark-invest.com/hubfs/1_Download_Files_ARK-Invest/White_Papers/ARK%20Invest_052919_whitepaper_DI-Why-Now.pdf

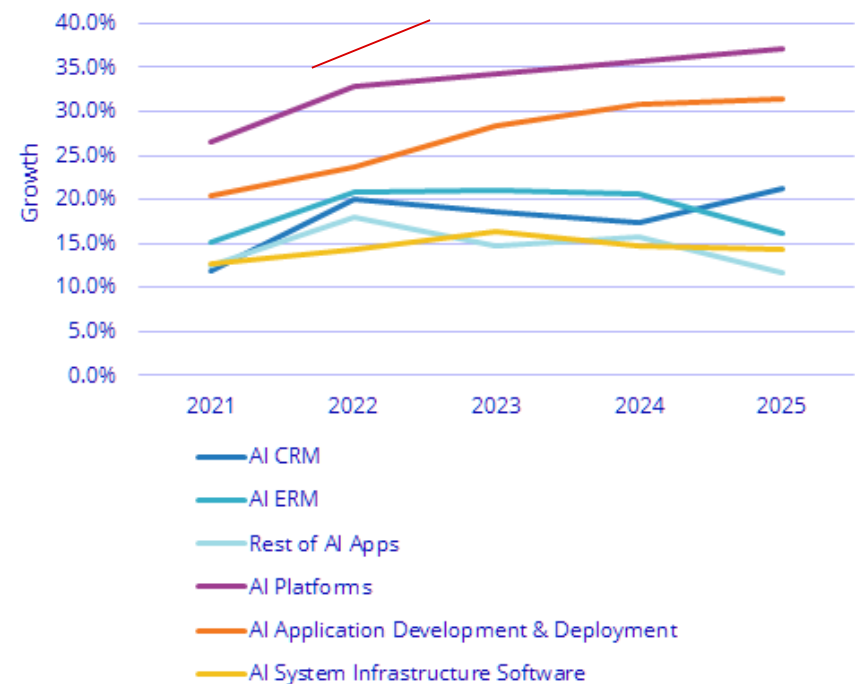
Example: Artificial Intelligence AI*



- Global revenues AI (software, hardware, and services): **\$341.8 Bn** (2021e) → **\$500 Bn** (2024 p)
- Virtual Reality (VR)
- Augmented Reality (AR)
- Mixed (extended) Reality (MR)
- **Metaverse** (Neal Stephenson's 1992 novel “*Snow Crash*”: humans, & avatars, interact with each other in a virtual space)



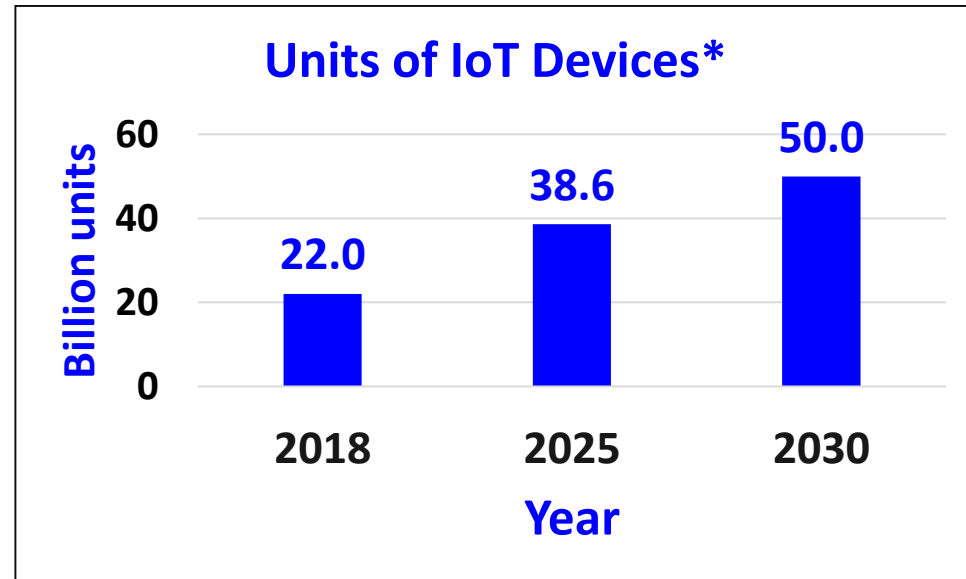
Worldwide AI Software Forecast, 2021-2025



Source: IDC 2021

<https://www.idc.com/getdoc.jsp?containerId=prUS48127321>

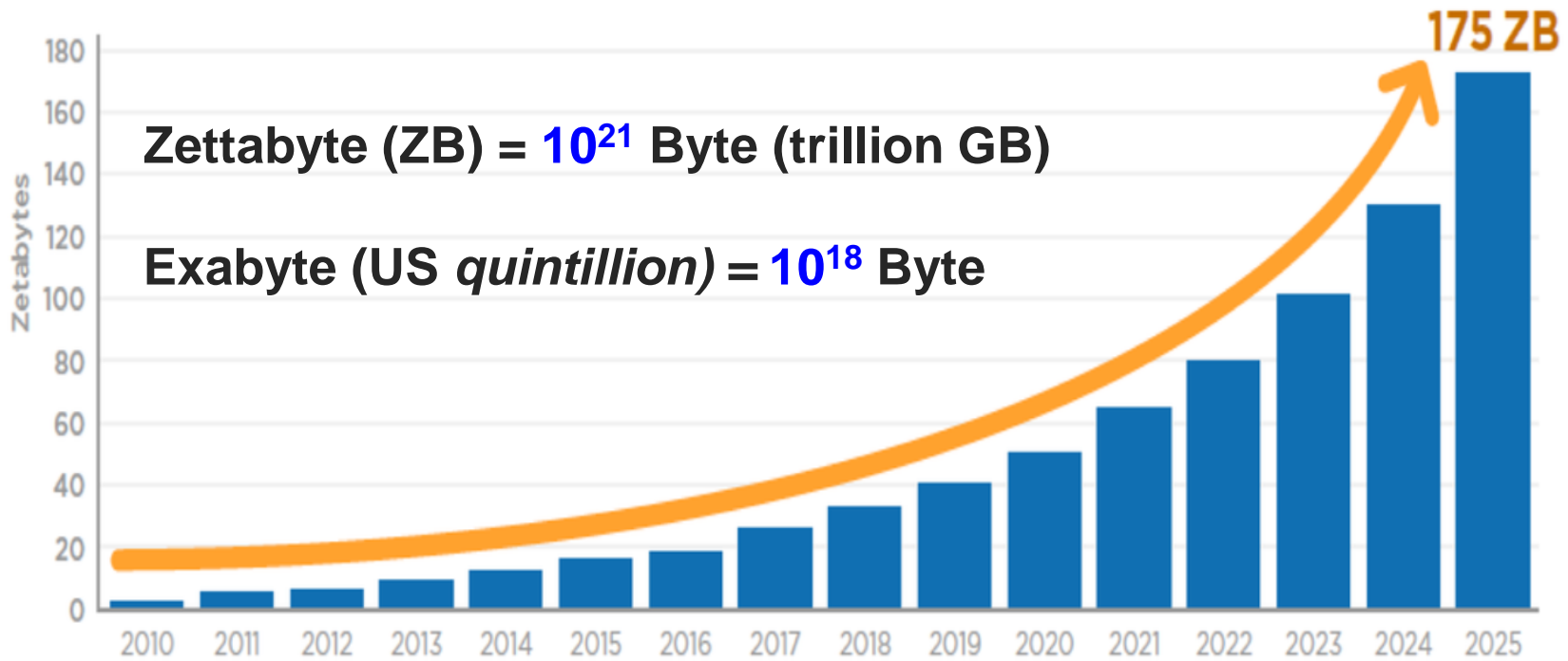
Internet of Things (IoT)



- **IoT Devices:**
 - Creating a massive web of interconnected devices (from Industry, cars, smartphones, to kitchen appliances...)
- **IoT global market revenue (estimated/predicted):**
 - **2021 (e): \$212 Bn**
 - **2025 (p): \$4 T** (~20x in 4 years; ~15% of US GDP (2021)=\$26.7 T)
- **IoT devices will generate 79.4 ZB (~50% of all data) by 2025**

<https://findstack.com/internet-of-things-statistics/>

Data Growth Prediction: Bio Data



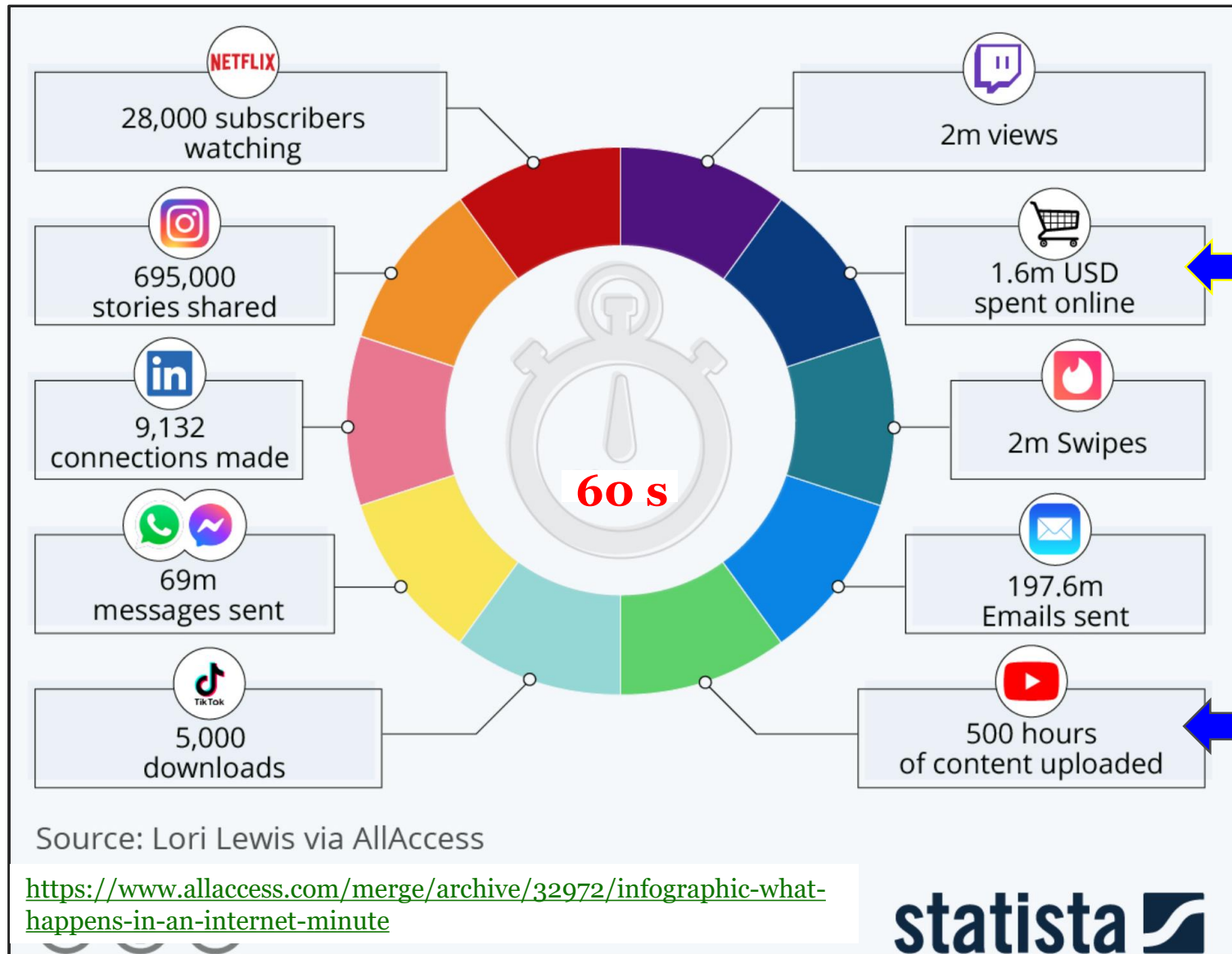
Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

Data growth prediction

<https://medium.com/analytics-vidhya/the-5-vs-of-big-data-2758bfcc51d>

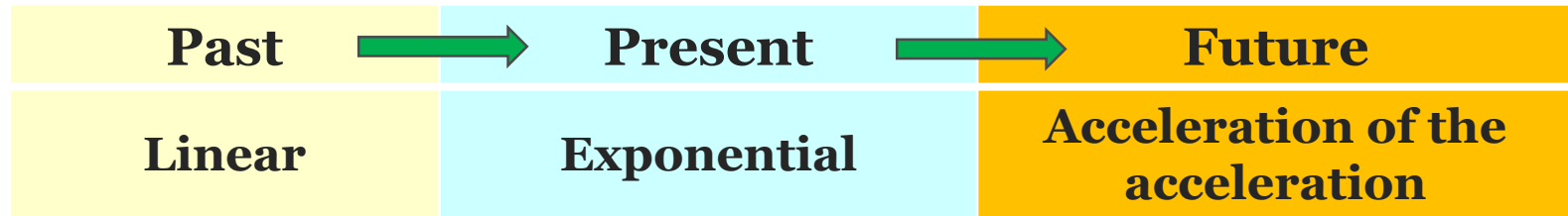
A Minute on the Internet in 2001

(estimated amount of data created in 60 s)



The Changing World – The Information Age

- Rate of change

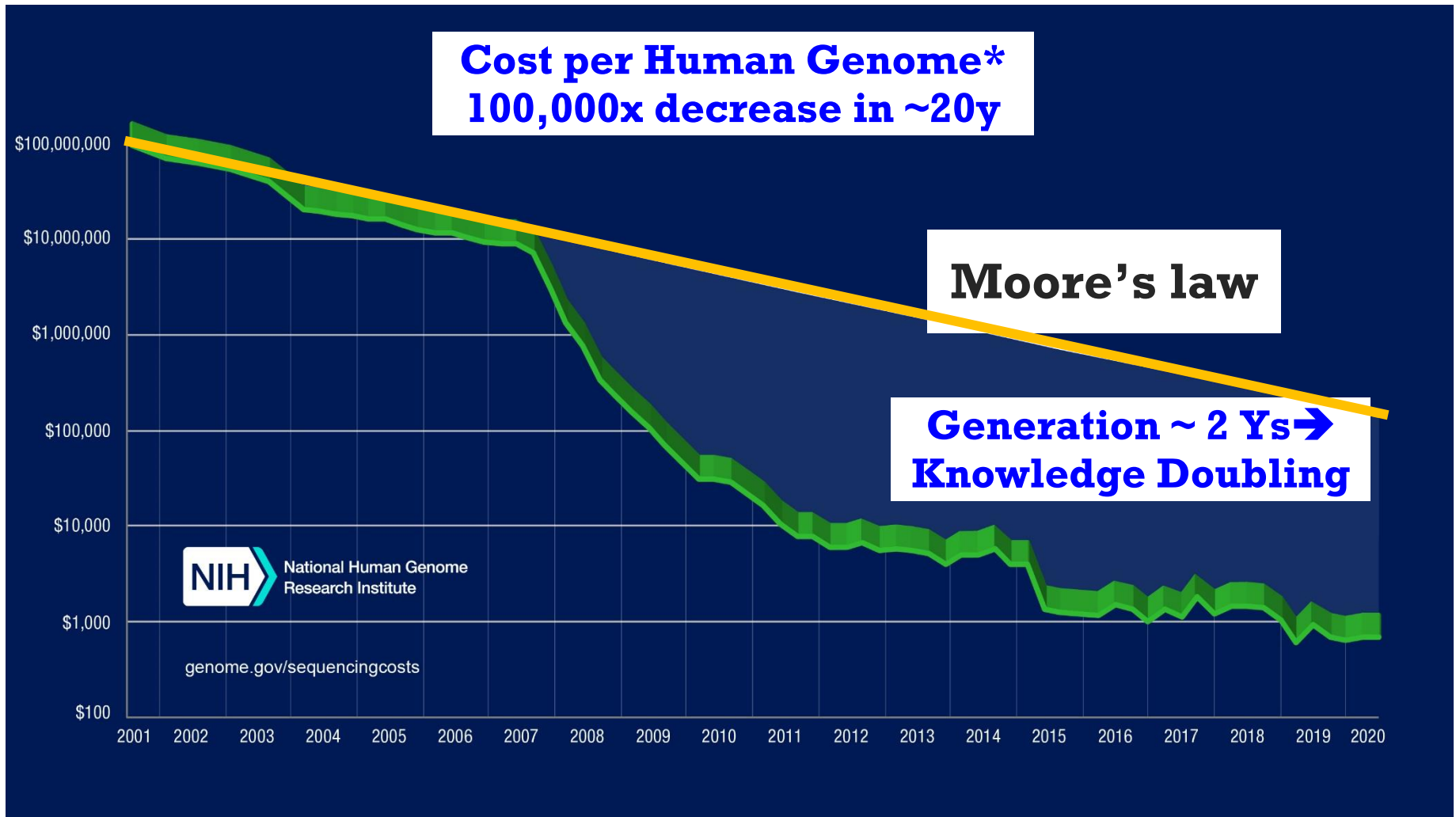


- Information age

- **VUCA** (*V*olatility, *U*ncertainty, *C*omplexity & *A*mbiguity) environment
- 1920 → 2020 (100 years) \approx 2020 → 2030 (10 years)
- Time '*Templosion*'

- Exponential change → Exponential opportunities & **threats**

Exponential Change



*<https://www.genome.gov/about-genomics/fact-sheets/Sequencing-Human-Genome-cost>

“Change is the law of life. And those who look only to the past or present are certain to miss the future”

John F. Kennedy

“If you want to predict the future create it”

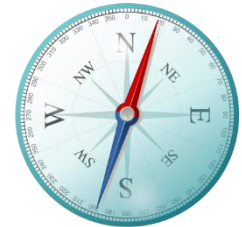
Peter Drucker

Future of Food Science Technology & Engineering (FST&E): Gap Analysis

- Assessment of current performance → identifying GAPS between current state and where we would like/**SHOULD** be
- Boils down to these 3-questions:
 - Where are **we** now?
 - Where do **we** wish we were?
 - How are **we** going to close the gaps?
- Why/Who/When? → **CHANGE/WE/YESTERDAY!**

→ **3-Steps action**

Step 1: Leadership



- **Leadership (visionary: seeing the invisible and believing the unbelievable)**
- Creating the space for people to share their talent & **passion**

Massive Transformational Purpose (MTP)

- **MTP** (Ismail et al., 2014*):
 - WHY does **our** organization exist?
 - HOW will **our** organization solve the problem?
 - WHAT will be **our** global impact?
- Netflix: *“To change the way people watch movies and television”*
- **IUFoST** (example): ***Becoming the global knowledge & education ecosystem for producing safe, personalized, nutritional, healthy and sustainable foods***

***Ismail S., Malone, MS & van Geest, Y (2014). *Exponential Organizations*.
Diversio Books. New York, NY.**

Step 2:

Paradigm Shift & Change

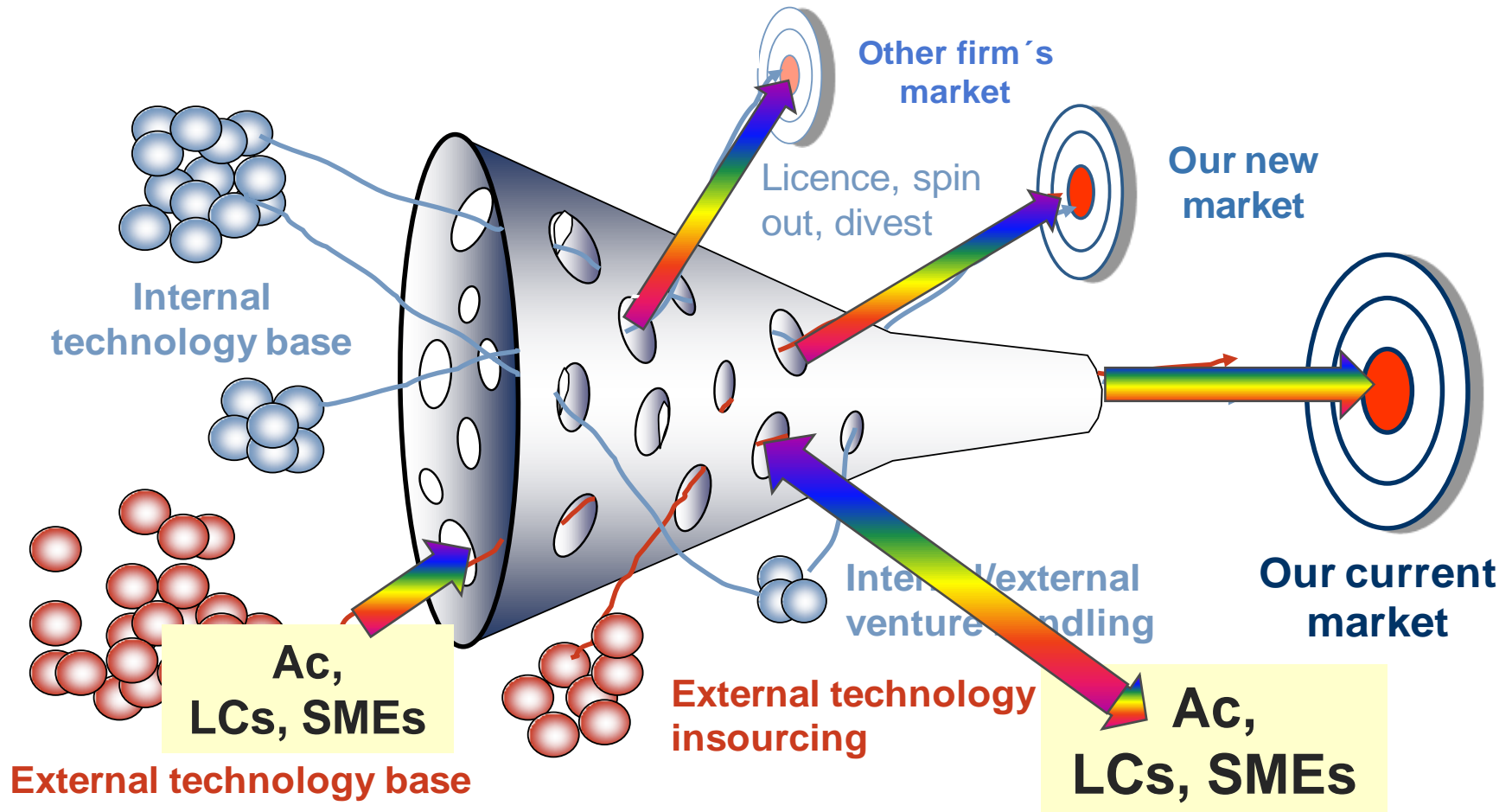




1. Open & Disruptive Innovation, New Mindset



Open Innovation (Henry Chesbrough, 2003, 6)



Stolen with pride from Prof Henry Chesbrough UC Berkeley, *Open Innovation: Renewing Growth from Industrial R&D*, 10th Annual Innovation Convergence, Minneapolis Sept 27, 2004

New Mindset, Open & Disruptive Innovation

- Embracing Open Innovation, new mindset
- Entrepreneurship, employability
- **From Kaizen → Disruptive innovation**

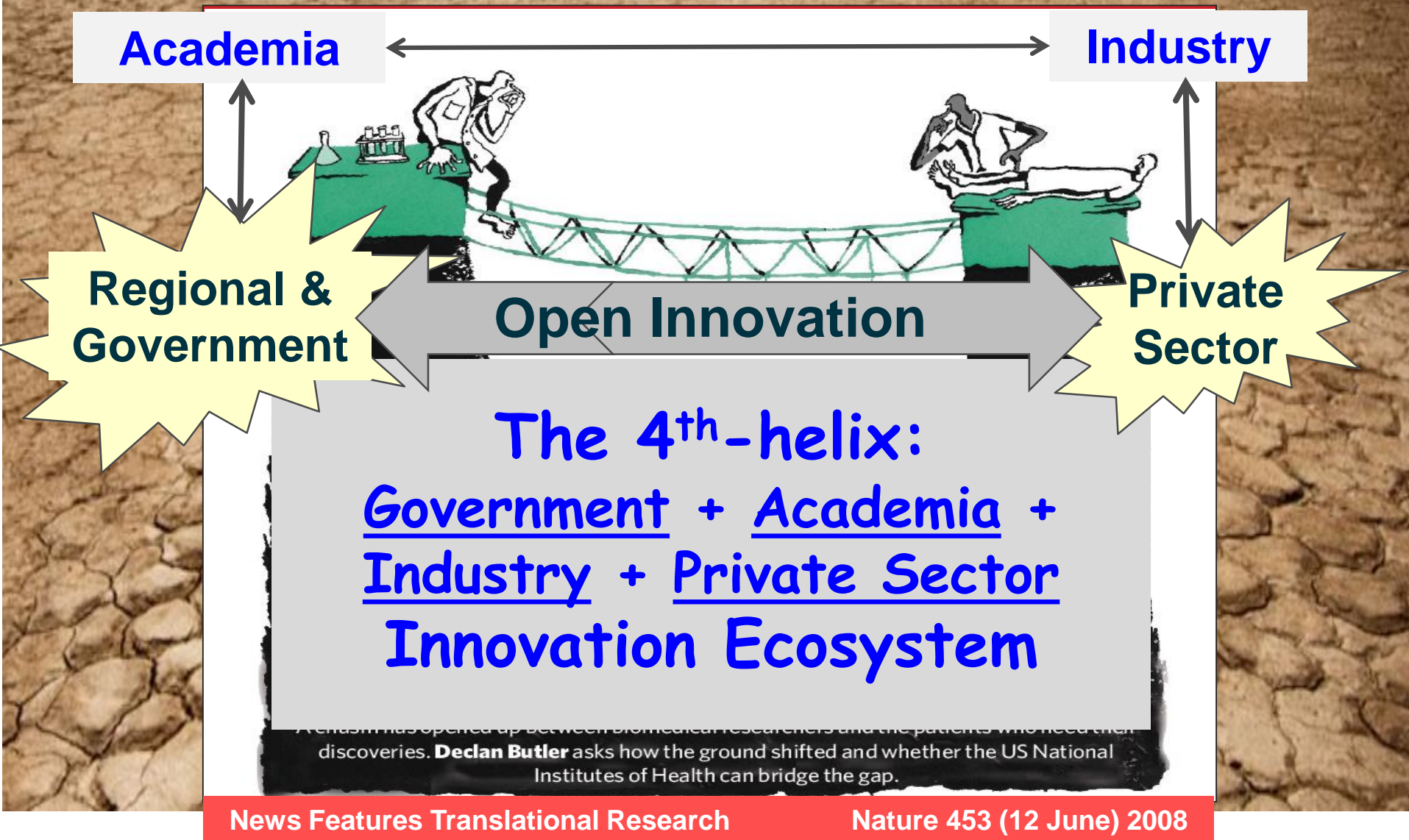


2. Four-Helix Partnerships & Ecosystem



Crossing the “Valley of Death”

(Merrifield, BD, 1995 *Tech. Management* 2(2): 73-83)



Bridging Nutrition and FST&E

FST&E

Nutrition

Enginomics*
(host/microbiome)

Health and Wellness

Consumers

The 4th-helix:
Nutrition + FST&E
+ Enginomics* + Consumers
Innovation Ecosystem

**Saguy & Taoukis (2017). Trends in Food Science & Technology 60:64-70*



3. Big Data, Information Integration & Personalization



The Future is Personal

Food Life Cycle Assessment

Sustainability

Device
experts

Software
experts

Genomic
experts

Microbiome

FST&E

Personalised
nutrition

Consumers
& products



Innovation

Big data
experts

App
experts

Nutrition
experts

*Prof. Mike Gibney

IUFoST Keynote Speech August 2016 Dublin Ireland
UCD Institute of Food & Health, University College Dublin

Sushi Video: Personalization

https://www.open-meals.com/sushisingularity/index_e.html

H&W and Sustainability – Most Recent Approaches

- **Food Life Cycle Assessment** (Prof. Olivier Jolliet*):
 - **The Healthy Nutrient Index (HENI)** provides an epidemiological-based and health based assessment of each individual food:
$$T_{\text{time_gain}} (+ \text{ min}) \text{ or } T_{\text{time_lost}} (- \text{ min})$$
 - **New Life Loss Function** (‘Taguchi’s quality’) = $\sum (T_{\text{time_gain}} + T_{\text{time_lost}})$
 - Combining Sustainability & Nutritional assessment
 - **Small targeted realistic changes generate substantial gains for human health & the environment**
- Google Mapping Foods (Dr. Heribert Watzke, 2021)
- Big Data, digital capabilities, cloud computing **and** make it possible

***Stylianou et al. (2021). Small targeted dietary changes can yield substantial gains for human health and the environment. *Nature Food*, 2(8), 616-627.**



4. Education, Hybrid Teaching, Lifelong Learning/Unlearning



The Future of Jobs

Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution (2016)



- By one popular estimate, “***65% of children entering primary school today will ultimately end up working in completely new job types that don’t yet exist***”
- To date, the most in-demand occupations or specialties did not exist **10 or even 5 years ago**
- “***... the ability to anticipate and prepare for future skills requirements, job content and the aggregate effect on employment is increasingly critical***”

http://www3.weforum.org/docs/WEF_FOJ_Executive_Summary_Jobs.pdf

The Digital New World of Education

- **Students (Y & Z generation)**

- Born to be digital, technology savvies, virtual, AI
- Looking for: personalization, experience, **WIFM** (What's in it for me?)
- Values (time, environment, sustainability, leisure, family, ...)
- 24/7/365 whenever & wherever access to learning

- **Educators (Hybrid Teaching)**

- Facilitators/enablers of entrepreneurial actions*
- Personalization
- Interdisciplinary project based learning
- **New curricula**

<http://Inovation-project.org>

The Digital New World of Education (cont..)

- **Educators of the Future:** Internal & External (partnerships, disciplines, industry, ecosystem), paramount changes, hybrid teaching, new curricula, ...
- International Players (**coursera; edX, FutureLearn, ...**)
- Short training (**Udacity, Hack Reactor, Experis, FullStack Academy, ...**)
- Global employers (**Google, Microsoft, ...**)
- Importance of an **Academic Degree?** (**GIG economy:** freelance, temporary, or independent contract work)
- **Possible Ramifications**
 - **Opportunities vs. Threats → CHANGE**
 - **Learning/Unlearning**
 - **Revised Curricula: Integration of Nutrition + FST&E**
 - **Start at Earlier Age**
 - **Effective and impact presence on all digital media**



5. Adaptability Quotient, Life (“soft”) Skills



Life (“soft”) Skills (“Human” Competences)

- Adaptability, **AQ** (Measures the ability *to cope & thrive with change*, flexibility (self & others), openness & curiosity, **unlearning & relearning**, resilience to persist, delaying personal gratification for greater gain, problem-solving skills, **tolerance to failure**)
- Interpersonal skills (listening, difficult conversation, empathy, ...)
- *Critical thinking*, creativity & entrepreneurship
- Time and people management, languages,
- **Are we doing our best?**

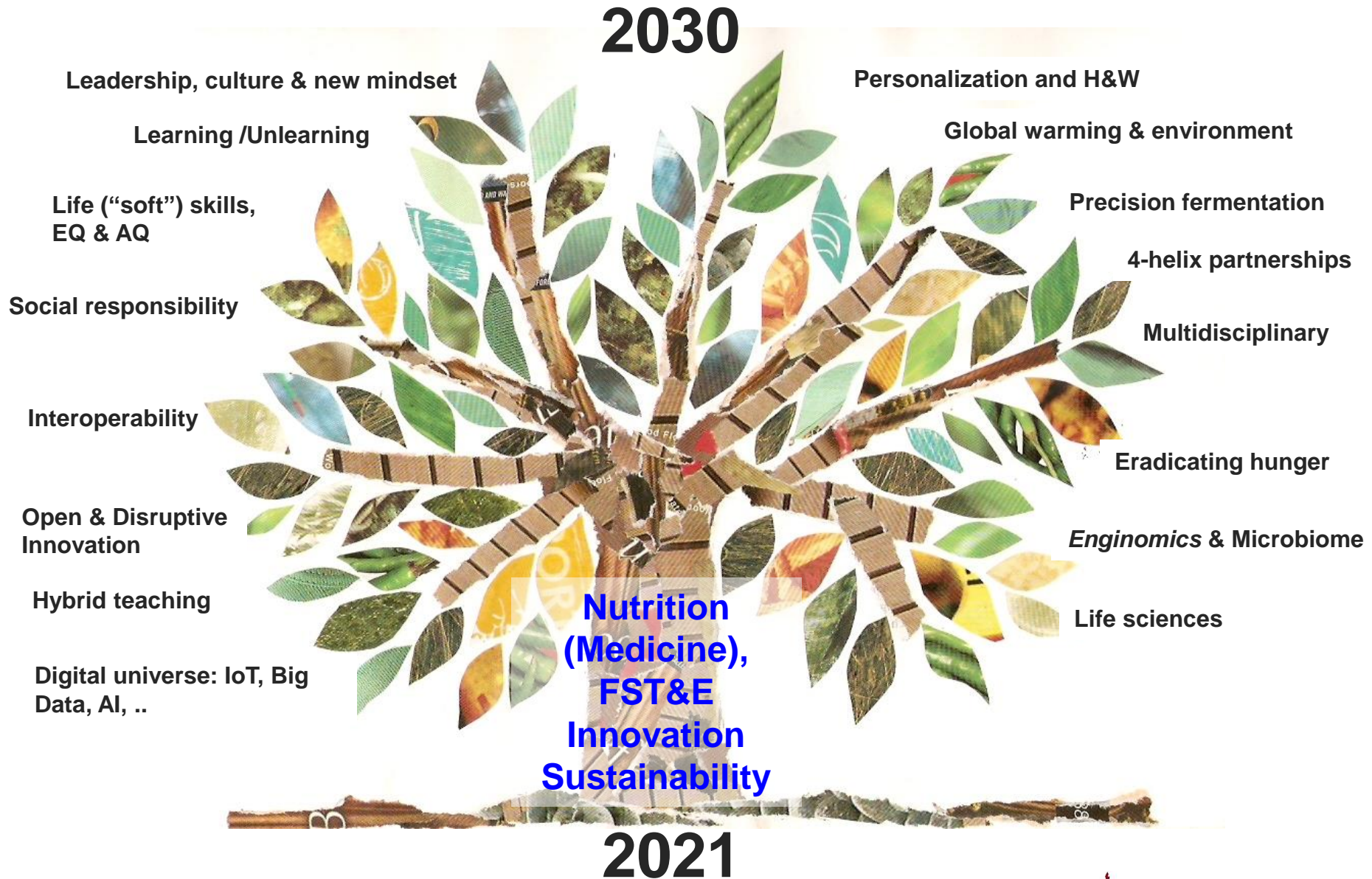
Take Home Messages



FST&E Ramifications

- Complex time (e.g., post COVID-19), **New Normal, sustainability, H&W**
- Significant exponential changes, challenges & opportunities
- Innovation & the digital transformation mandate ecosystem of multidisciplinary collaborations, partnerships & risk taking
- **Leadership, culture, new mindset, open & disruptive innovation & visibility**
- **Integration of Nutrition and FST&E**
- Paradigm shifts, **Education** (younger generation, Lifelong Learning/Unlearning, life skills, AQ...), hybrid teaching, AI & AR, ...
- IUFoST leadership role (**MTP**): **Becoming the global knowledge & education ecosystem for producing safe personalized, nutritional, healthy and sustainable foods**

Take Home Messages: Knowledge Tree



Personal Note

*“To accomplish great things,
we must not only act, but also **dream**;
not only plan, but also **believe**”*

Anatole France 1844-1924

1921 Nobel Prize for Literature

What is **YOUR** Professional Dream?
How will **YOU** contribute to shape
the future?

Step 3: ACTIONS

תודה

Большое спасибо



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