

Exponential technologies – and hope?

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**The world is facing
perhaps the biggest
challenges in history.**

Is there hope?



Off the scale

A photograph of the International Space Station (ISS) in orbit above Earth. The station's complex structure, including solar panel arrays and various modules, is clearly visible against the blackness of space. Below the station, the Earth's surface is shown, featuring a large, swirling hurricane with a distinct eye. The horizon of the Earth is visible, showing the blue atmosphere and the white clouds of the hurricane.

Off the scale

Game is on

Redefining work

(Dis)trust is
everything

Security rules

A close-up photograph of a 3D printer's nozzle printing a red, lattice-like structure. The nozzle is positioned above the partially completed object, which has a complex, porous, and circular pattern. The background is blurred, showing a blue and white industrial setting.

Development of new technology is now moving from bits to also atoms.

Exponential technologies have the power to cause paradigm shifts, leading to systemic changes in our societies and the whole planet.

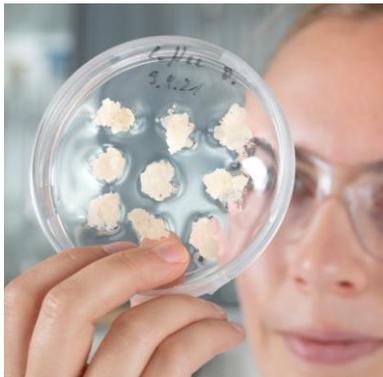
We are approaching several **tipping points** that may cause our living environment to change fundamentally and permanently.



A close-up photograph of a woman with blonde hair kissing a baby on the forehead. The woman is looking down at the baby with a gentle expression. The baby is wearing a white long-sleeved shirt and a light-colored headband. The background is softly blurred, suggesting an indoor setting with natural light.

**What kind of
a future do we
want?**

This is exponential and disruptive



**Synthetic
biology**



**Quantum
technology**



**New
materials**

Synthetic biology

We use living cells to produce the chemicals, materials, and food we need.

We can turn microbial cells into silkworm silk, egg white, or biodegradable bioplastic.

Synthetic biology enables sustainable food production

In the future, microbes are producing ingredients for food production: for example egg white without chicken or milk protein without cows.

This is called cellular agriculture.



Synthetic biology in a nutshell

Challenge: How to feed **growing global populations** and **minimise negative environmental impacts** of food production?

Solution: **Cellular agriculture** means using single cell organisms and bioreactors instead of animals and fields for food production. Microbes turn feedstocks into sustainable food ingredients: for instance, egg white without chickens or milk proteins without cows.

Impact: **Sustainable food production.** New food ingredients produced by microbes and other cells. Cellular agriculture scales vertically, freeing up land to be returned to its natural state.

We can produce food in completely novel ways

- 1. Egg without chicken, milk without cows,** and other everyday food ingredients made by microbes instead of animals.
- 2. New, sustainable foods from microbial mass** for consumers (e.g. Solein from Solar Foods – single cell protein).
- 3. Food without fields.** Cell factories scale vertically, which frees up land for return to natural state.
- 4. Food production in totally new places,** even deserts or space.

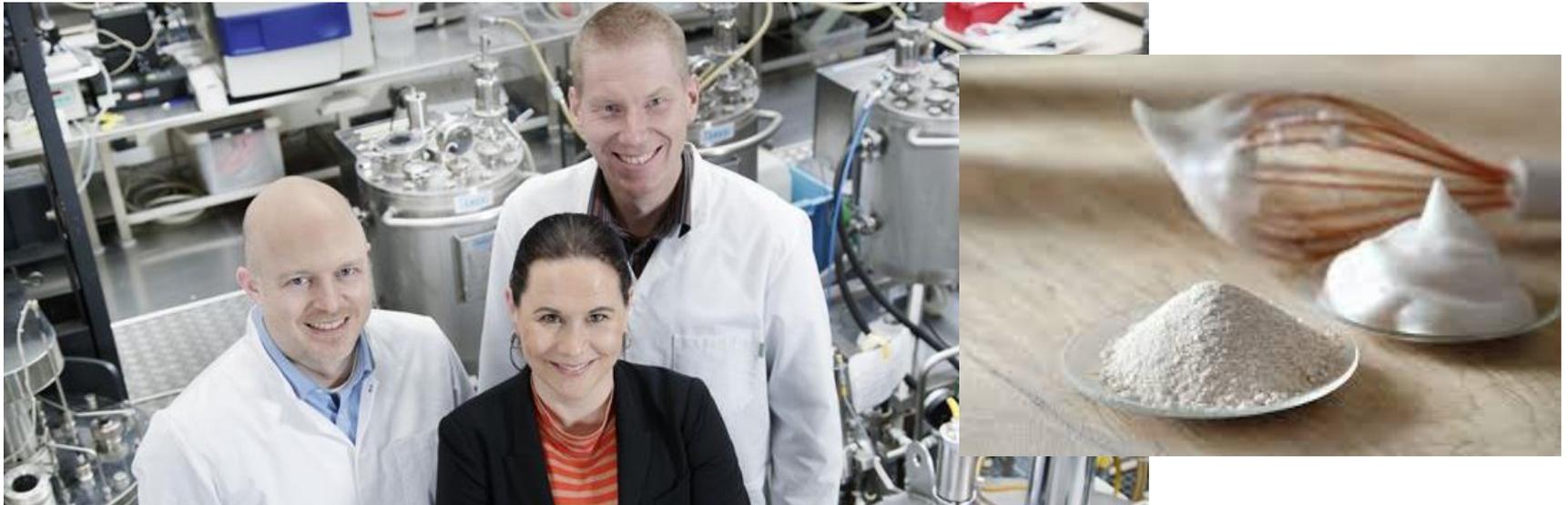
Why would this make sense in Finland?

- High-level food and biotech expertise and infra
- Open-minded consumer base for new food innovations
- Broad knowledge on production of both cell-based and microbe-based ingredients

Synthetic biology in food production

This is reality already!

OnegoBio raised 10M€ top commercialise the egg white without chickens



Quantum technology

We have new tools to solve the most important challenges humanity is facing.

We can develop more effective medicine or significantly reduce emissions from industrial logistics chains.

The quantum leap

Quantum technologies can achieve an astonishing computing power, far surpassing super-computers of today. It's on another scale.

Quantum computing will become a mainstream data handling platform by 2030.



Quantum technology in a nutshell

Challenge: Where to find the next **great leap in performance** after Moore's Law?

Solution: **Quantum technologies** can achieve an astonishing computing power, far surpassing super-computers of today. They can help us solve completely new kinds of computational tasks, like modelling complex molecules and systems.

Impact: They could enable extraordinarily **rapid development of medicines and vaccines**. Or be used to solve huge systemic problems like **hacking climate change and resource scarcity**.

The quantum advantage – transforming business

- 1. Simulation of molecules, proteins and materials** enabling faster development of new medicines and materials.
- 2. Quantum internet**, secured by quantum means with quantum computers as a cloud service.
- 3. Sensors and sensing applications** improved by quantum technology.
- 4. Optimization problems** tackled in logistics, finance and many other areas.

Why would this make sense in Finland?

- Expertise in electronics, superconducting circuits, sensors
- Quantum and low-temperature physics laboratories
- Functional 50-qubit quantum computer being built by 2024

This is reality already!

Finland's first quantum computer Helmi is functioning with 5 qubits and currently being extended to 20 qubits and then to 50. It is built by IQM and VTT, and located in Micronova, a joint research facility of Aalto University and VTT. Helmi is now connected to supercomputer LUMI – and quantum computing has begun!



New materials

We design new materials starting from atoms and molecules.

We can optimize use of materials and enable circularity.

New materials enable circular economy

Virtual materials design is will speed up development of new materials exponentially.

This will enable us to create carbon-neutral, circular and fit-for-purpose solutions to various sectors from building, electronics and food to health.



Optimising use of materials in a nutshell

Challenge: Materials are the key to developing a sustainable circular economy. But how can we **radically speed up** current “trial and error” **development of materials**?

Solution: Optimising the use of materials with **digital twins, virtual testing and optimising** materials to be sustainable, high-performing and competitive in cost.

Impact: **Minimising materials use and waste**, maximising product performance, properties and durability. This way we can ensure that the earth’s resources can sustain a growing population and mitigate climate change.



Concrete ways to apply:

1. **Sustainable materials** that enable circular economy.
2. **Digitally-designed "super materials"** that exceed present ones in performance by several hundreds of percents.
3. **Computational materials engineering** replacing expensive, time consuming testing and shortening time-to-market.

Why would this make sense in Finland:

- High-level of digitalisation
- Rock-solid expertise in materials science and engineering
- Physics-based modelling + AI-based solutions → Autonomous materials research
- Collaboration across businesses and research institutes for agile feedback



This is reality already!

Several Finnish startups are scaling up material innovations for sustainability and circularity:

Spinnova is transforming the way textiles are manufactured globally. With their technology, it's possible to make textile fibre out of wood or waste.

Infinited Fibre Company has technology to turn trashed textiles into premium, circular textile fiber.

Olefy Technologies has a novel technology to turn low value plastic waste to high-value virgin grade plastics – the first truly feasible technology for plastics recycling at industrial scale.

Finland has research-based spearhead technology expertise

Enabling technologies

- 1 Wireless networks**
More efficient processes, using less energy
- 2 Artificial intelligence**
Data and powerful computation everywhere
- 3 Microelectronics and photonics**
Platform for other technologies
- 4 Quantum technology**
New wave of computing
- 5 New materials**
Free from fossiles, enabling circular economy
- 6 Biotechnology**
Solutions to energy, food, medical and process industries

Solution technologies

- 7 Energy technology**
Smart energy system, clean energy
- 8 Manufacturing technology**
Sustainable, efficient production, resilience
- 9 Health technology**
Personal, predictive healthcare
- 10 Security technology**
Critical to societies' functions
- 11 Space technology**
Enabling transport, communication, New Space

VTT's vision paper:

<https://www.vttresearch.com/en/vtts-vision-paper-most-promising-technologies>

Deeptech means startups commercialising and scaling scientific breakthroughs to enable unique solutions to global-scale challenges



Helsinki is a globally interesting hub for startups and deeptech

Top 10 Institutions in Europe for deep tech funding for spinouts (2021)

• University of Oxford	1.8 bn €
• Mainz Universität	1.3 bn €
• Technische Universität München	1.3 bn €
• University of Dundee	610 M€
• University of Cambridge	449 M€
• Aalto University	283 M€
• Commissariat à l'énergie Atomique, CEA	237 M€
• ETH Zürich	228 M€
• Zürich Universität	160 M€
• VTT	151 M€

Source: NewCo Helsinki, helsinki.dealroom.co/lists

Startup-yhteisön liikevaihto kasvussa 4,8 mrd. euroon tänä vuonna – T&K-investoinnit kolminkertaistuvat vuoteen 2025 mennessä

10.10.2022 11:27:06 EEST | [Suomen startup-yhteisö](https://suomenstartup-yhteiso.fi)



Suomen startup-yhteisön tänään julkaistun startup-barometrin mukaan yhteisön jäsenyritysten liikevaihdon odotetaan nousevan jopa 4,76 miljardiin euroon tänä vuonna. Kotimaisten kasvuyritykset suhtautuvat myös positiivisesti tulevaan kasvuun; esimerkiksi T&K-investointien arvioidaan nousevan merkittävästi jopa ennätyselliseen 592M€ vuoteen 2025 mennessä.



Startup-rahoituksen määrä jälleen uusiin ennätyslukemiin

Suomalaiset startupit rikkovat jälleen ennätystä: vuonna 2021 rahoitusta on kerätty 1,2 miljardia, joka on kaikkien aikojen ennätyspotti. Sijoituksia on tullut runsaasti erityisesti kansainvälisiltä pääomasijoittajilta.

European quantum computing leader IQM raises €128m led by World Fund to help combat the climate crisis

22/07/2022

ICEYE

PRESS RELEASE

● FUNDING

● USA

ICEYE Raises USD 136M in Series D Funding Round

The tipping point

What kind of future do we want?

[Keikahduspiste: Millaisen tulevaisuuden haluamme? \(vttresearch.com\)](https://vttresearch.com)

A photograph of four people in a meeting. A woman with long blonde hair stands in the center, wearing a pink sweater. To her right, a man with a beard and dark hair sits at a table, wearing a dark blue shirt and gesturing with his hands. To her left, a woman with dark hair sits at the table, wearing a white blouse with black polka dots and smiling. In the foreground, a man with glasses and a dark jacket sits at the table, looking towards the others. The background is a modern office setting with grey panels.

**Diversity, dialogue,
working together**

A photograph of two children walking across a large, moss-covered fallen log in a forest. The child on the left is wearing a grey beanie and a dark blue jacket, while the child on the right is wearing a yellow beanie and a blue jacket. They are both smiling and appear to be enjoying the activity. The forest is filled with tall, thin trees and green moss on the ground.

**Trust, values,
psychological safety**

”No single futuristic invention is as important as today’s political decisions and investments that will continue to affect future generations in 80 years’ time.”

— Shadia Rask Research Manager, Finnish Institute for Health and Welfare (THL)

Finland is about to make historically important decisions on long-term R&D investments

The green transition, sustainability crisis and altered geopolitical situation demand **major investments in novel solutions and technology.**

Finland has set a **national goal to increase RDI investments to 4% of GDP.** Finland must make strategic choices on what we invest in to create unique excellence, renewal and sustainable solutions.

Public funding should be directed to **stimulate radical innovations**, share risk and leverage private investments, and connect Finnish players to **global value networks.**



The world is entering a new era in which geopolitics, industrial policy and security are connected

- **Finland should seek positioning with a strong technology profile** and aim to influence internationally based on our values.



I believe that hope arises from action – and indeed, it is time for action.

bey⁰nd

the obvious

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