

The Fourth Industrial Revolution

An (in)augural address
by an Industrial Engineer

Prof. Liezl van Dyk
6 June 2019





An (in)augural address

inaugural

- ceremonial induction into a position

address

- the act of delivering formal spoken communication

augural

- acting as a sign or warning of a good or bad event in the future



An inaugural address (NWU guidelines)

Opportunity to answer for herself, regarding her position in, and contributions to, the subject field and with regard to how she understands her mission at the NWU in the context of her subject

High-level publishable scientific address

Focus on interdisciplinary simplicity

Choose the theme of her inaugural speech as well as the format and presentation thereof, meticulously in deliberation with the Executive Dean

Approximately 40 minutes in length



The Fourth Industrial Evolution

An (in)augural address of
an Industrial Engineer

Prof. Liezl van Dyk
6 June 2019

... of an Industrial Engineer

What is an
Industrial Engineer?

Industrial
Engineers
themselves

prospective
students

current
students

family, friends,
colleagues,
acquaintances



What is an Industrial Engineer?

Industrial engineering is an engineering profession that is concerned with the optimization of complex processes, systems or organizations by developing, improving and implementing integrated systems of people, money, knowledge, information, equipment, energy and materials.

Salvendy, Gabriel. Handbook of Industrial Engineering. John Wiley & Sons
(First edition published in **1982**)

Industrial Engineering and the Industrial Revolutions

First Industrial Revolution (1760-1840)

people

money

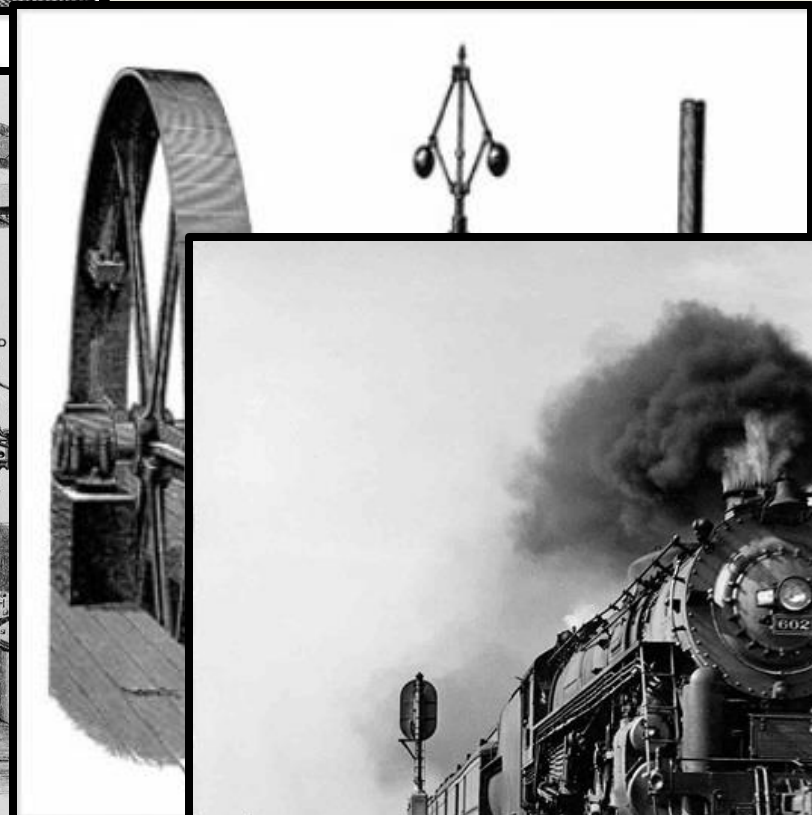
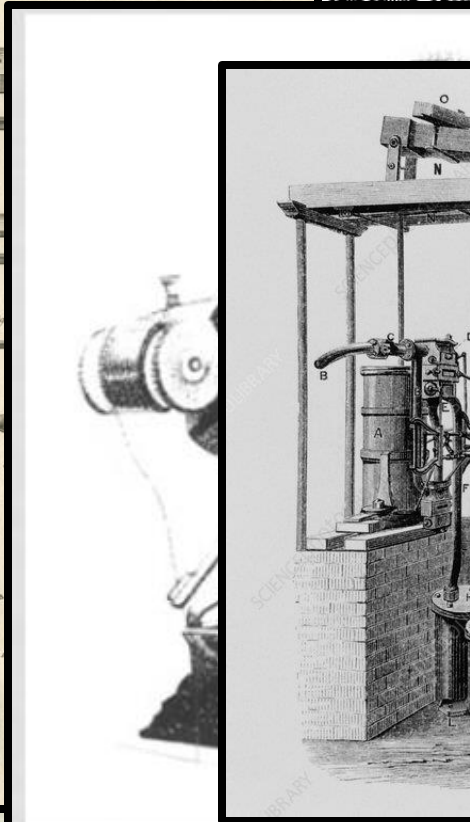
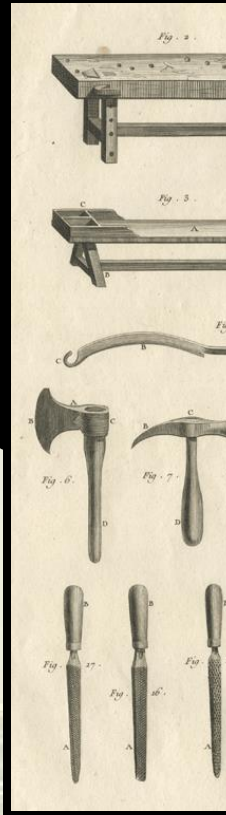
knowledge/
information

equipment

energy

material

processes,
systems,
organizations



Industrial Engineer

First (1760-18

people

money

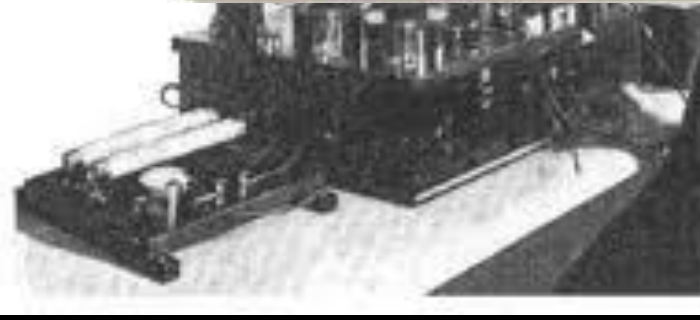
knowledge/
information

equipment

energy

material

processes,
systems,
organizations



Industrial Engineering and the Industrial Revolutions

First (1760-1840) ... Second (1860-1940) ... Third (1950-1970s) Industrial Revolutions

people

money

knowledge/
information

equipment

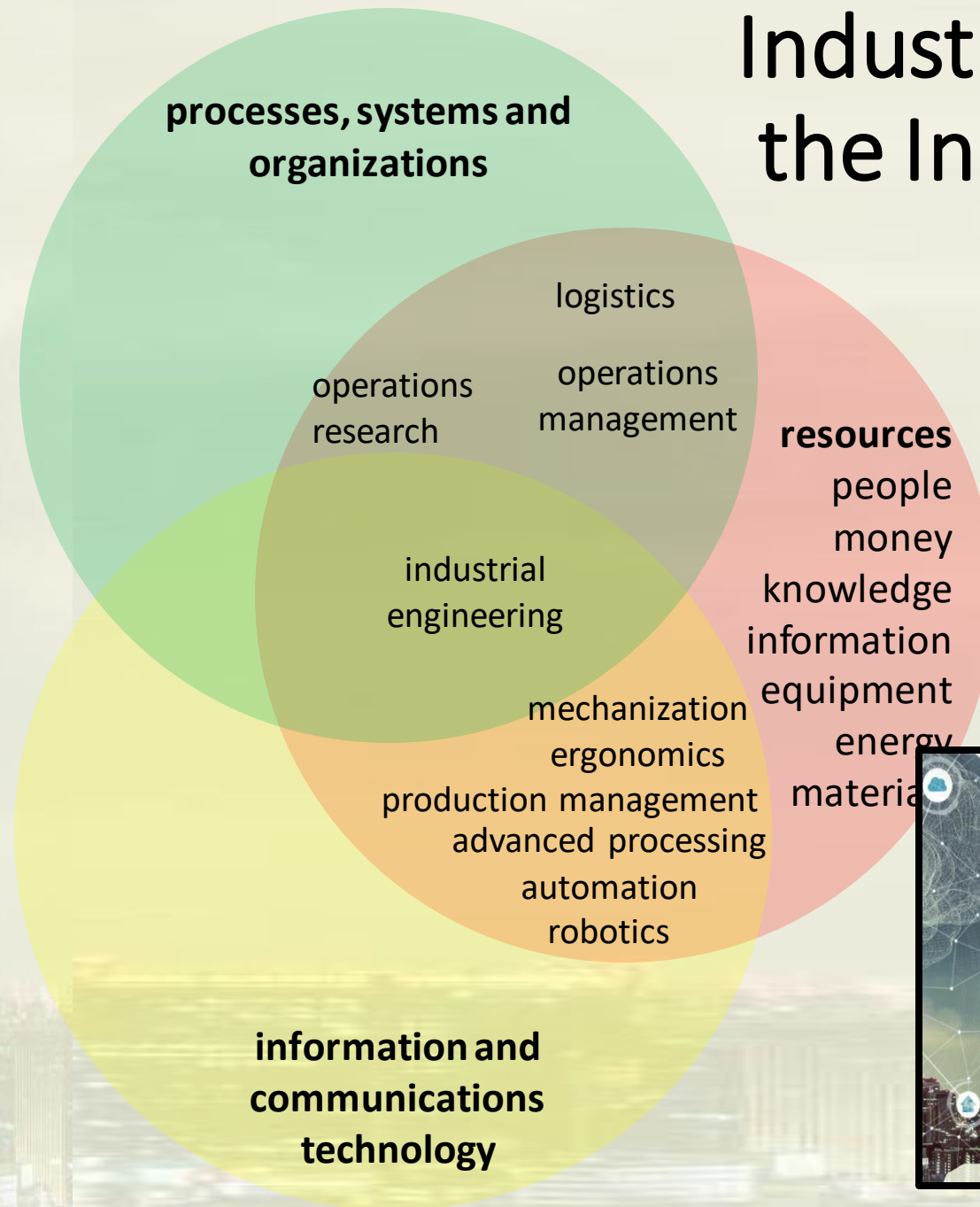
energy

material

processes,
systems,
organizations



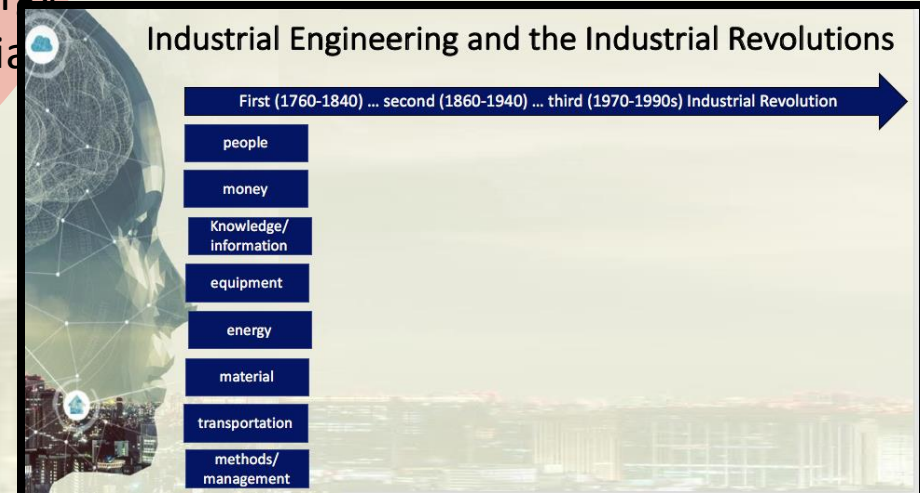
Industrial Engineering and the Industrial Revolutions



First Industrial Revolution

Second Industrial Revolution

Third Industrial Revolution



The Fourth Industrial Revolution

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Prof. Liezl van Dyk
6 June 2019

Augurs of the Industrial Revolutions

The Fourth Industrial Revolution

Klaus Schwab

2016

Alvin

Author

THE
TH
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THE THIRD INDUSTRIAL REVOLUTION



HOW LATERAL POWER IS TRANSFORMING ENERGY,
THE ECONOMY, AND THE WORLD

JEREMY RIFKIN

READ BY KEVIN FOLEY

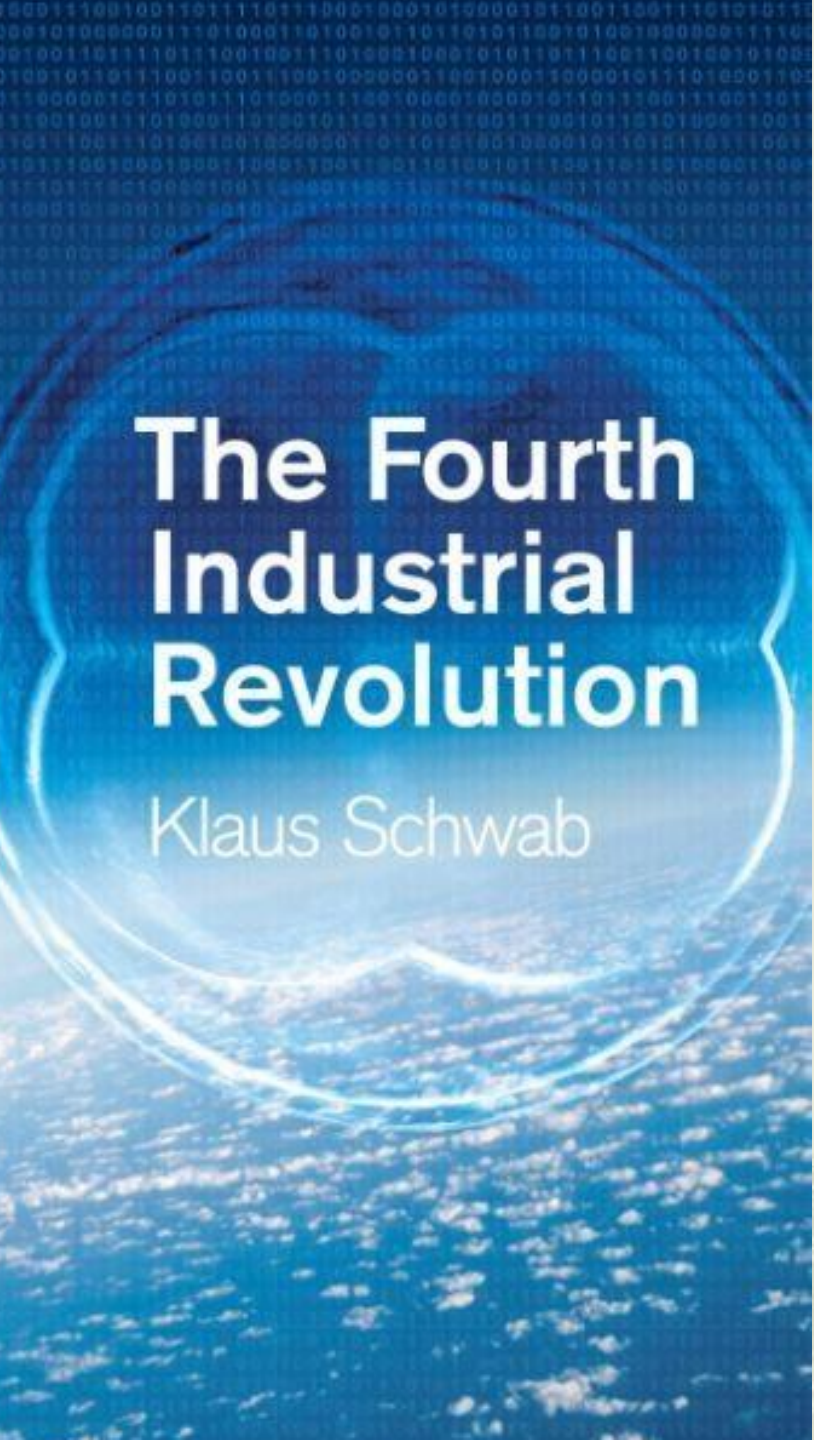
LECTURES ON THE INDUSTRIAL REVOLUTION IN ENGLAND

ARNOLD TOYNBEE



CAMBRIDGE

Toynbee



The Fourth Industrial Revolution

Klaus Schwab

Schwab's Fourth Industrial Revolution

velocity

breadth and depth

systems impact



~~Industry 4.0~~

Platform Industrie 4.0

2011

presented at
Hannover Messe

by the working
group of the
Federal German
Government

The overarching goal of the Industrie 4.0 platform is to secure and expand Germany's leading international position in the manufacturing industry.



The Fourth Industrial Revolution =/Industrie 4.0

manufacturing 4.0,
health 4.0, logistics 4.0,
globalization 4.0, careers
4.0, parenting 4.0

more than just
connected
machines and
systems

a clear future needs a
clear history

decolonizing
Industrie 4.0

The Fourth Industrial Revolution

people

money

knowledge/
information

equipment

energy

material

processes,
systems,
organizations



cyber resources

cyber-resources

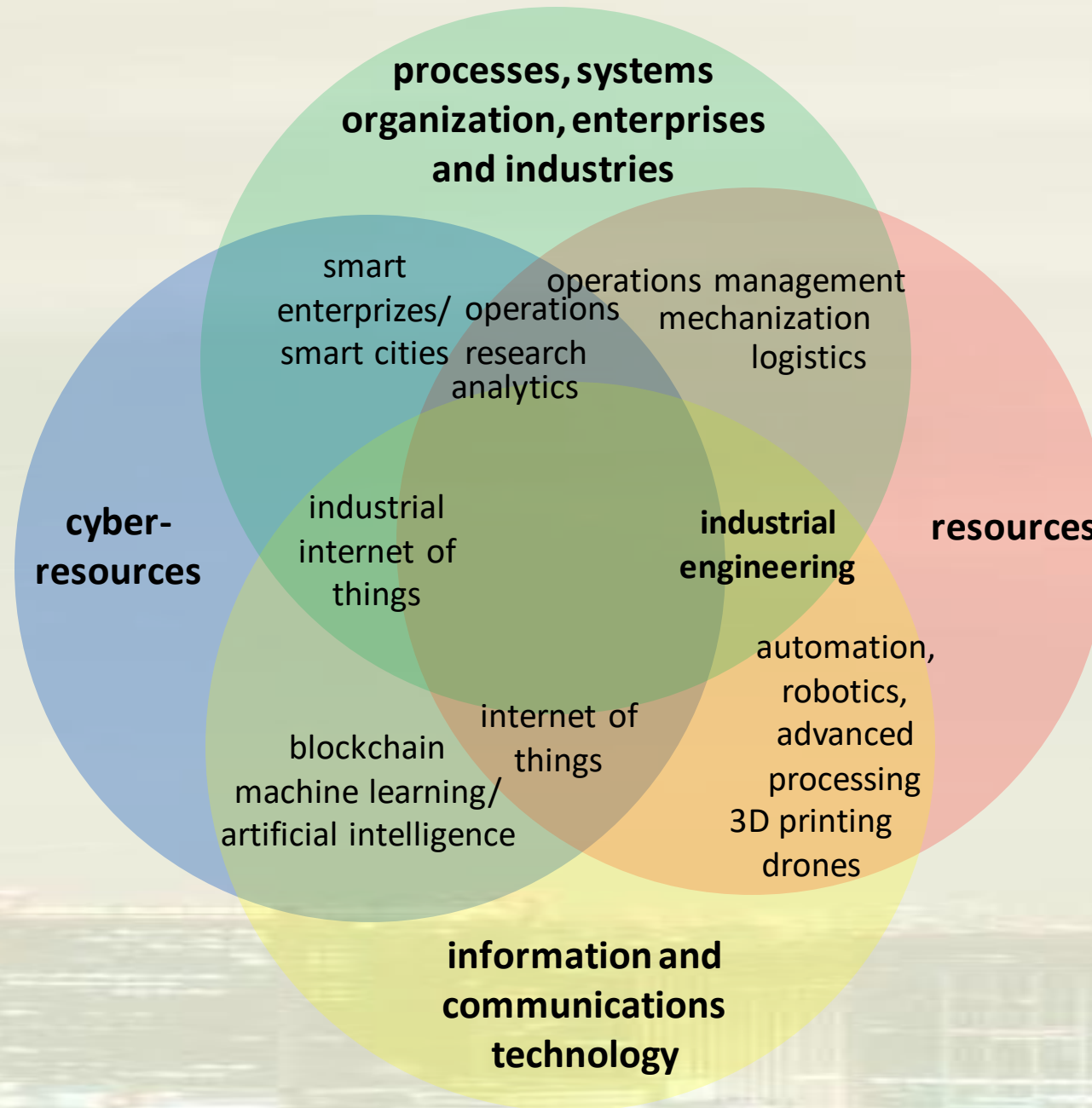
- biotechnology
- cryptocurrency/blockchain
- big data/ artificial intelligence
- digital twin / smart dust
- renewable energy/ storage/ networks
- lighter/stronger, smaller, self-healing, self-cleaning/ceramics that turn pressure in to energy

resources

- people
- money
- knowledge, information
- equipment
- energy
- materials

processes, systems
organization, enterprises
and industries

information and
communications
technology



What is an Industrial Engineer in the midst of the 4th Industrial Revolution?

prospective
students

65% of children starting
primary school will
eventually work in jobs
that do not exist yet

current
students

What is an
Industrial Engineer?

Industrial
Engineers
themselves

65% of Industrial
Engineering students will
eventually work in jobs
that do not exist yet

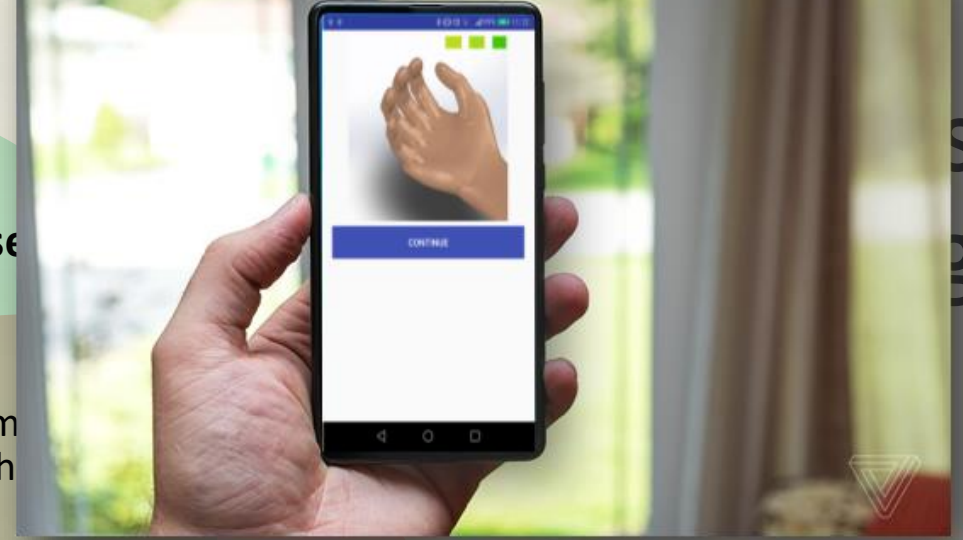
family, friends,
colleagues,
acquaintances

Microcontroller and Smartphone Application
connected via Bluetooth



processes, systems
organization, enterprise
and industries

Electrically Actuated Exoskeleton
Individually 3D printed finger
attachments
Reusable linear actuators



smart
enterprizes/
smart cities

operations m
mech

operations
research



resou

cyber-
res

Industrial
inter

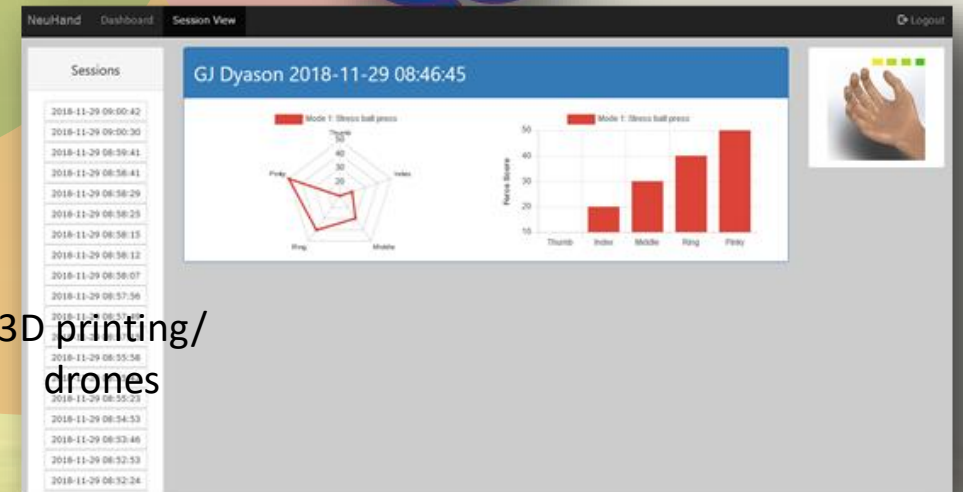
Health Systems
Engineering

internet of
things

ing/
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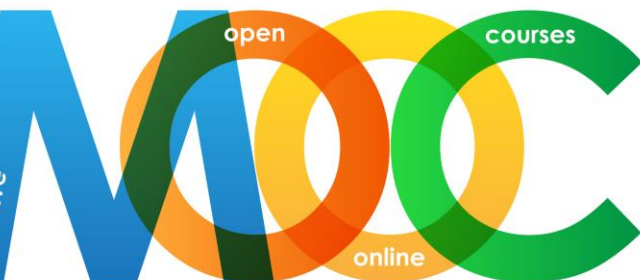
3D printing/
drones

telemedicine

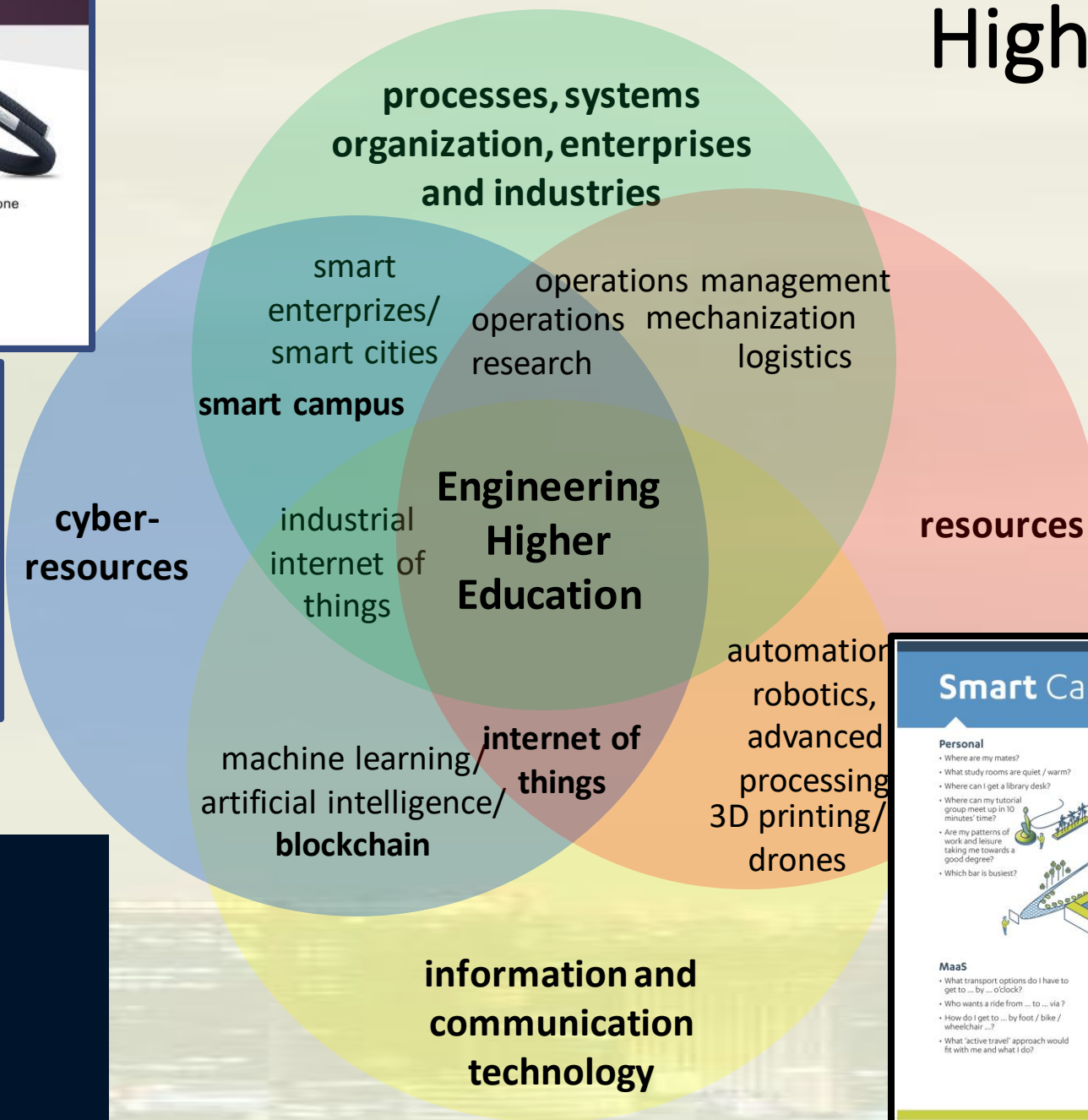


Therapist Application for remote surveillance

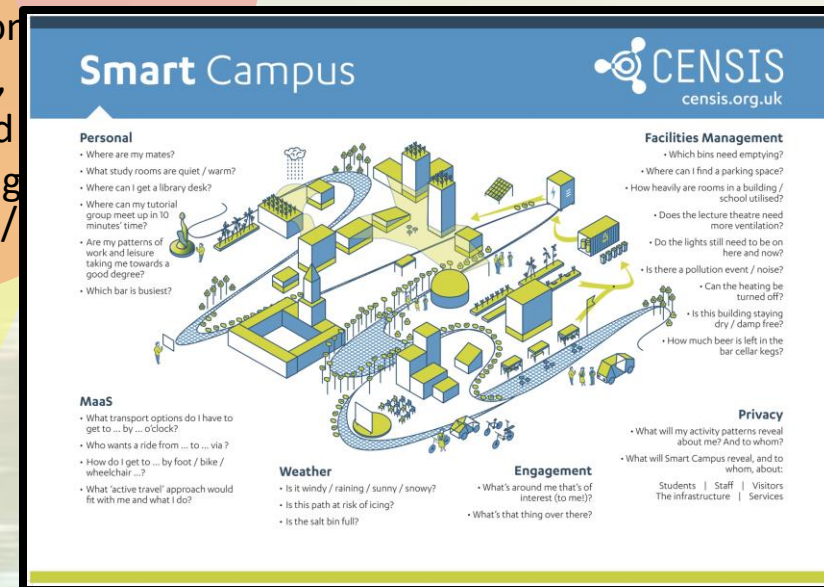
Wearable Devices in Education



BLOCKCHAIN



Higher Education Industry



The Fourth Industrial ~~R~~Evolution

Revolution



**radical change/
disruptive innovation**

kaikaku

PHYSIOLOGICAL
Food Water Shelter Warmth

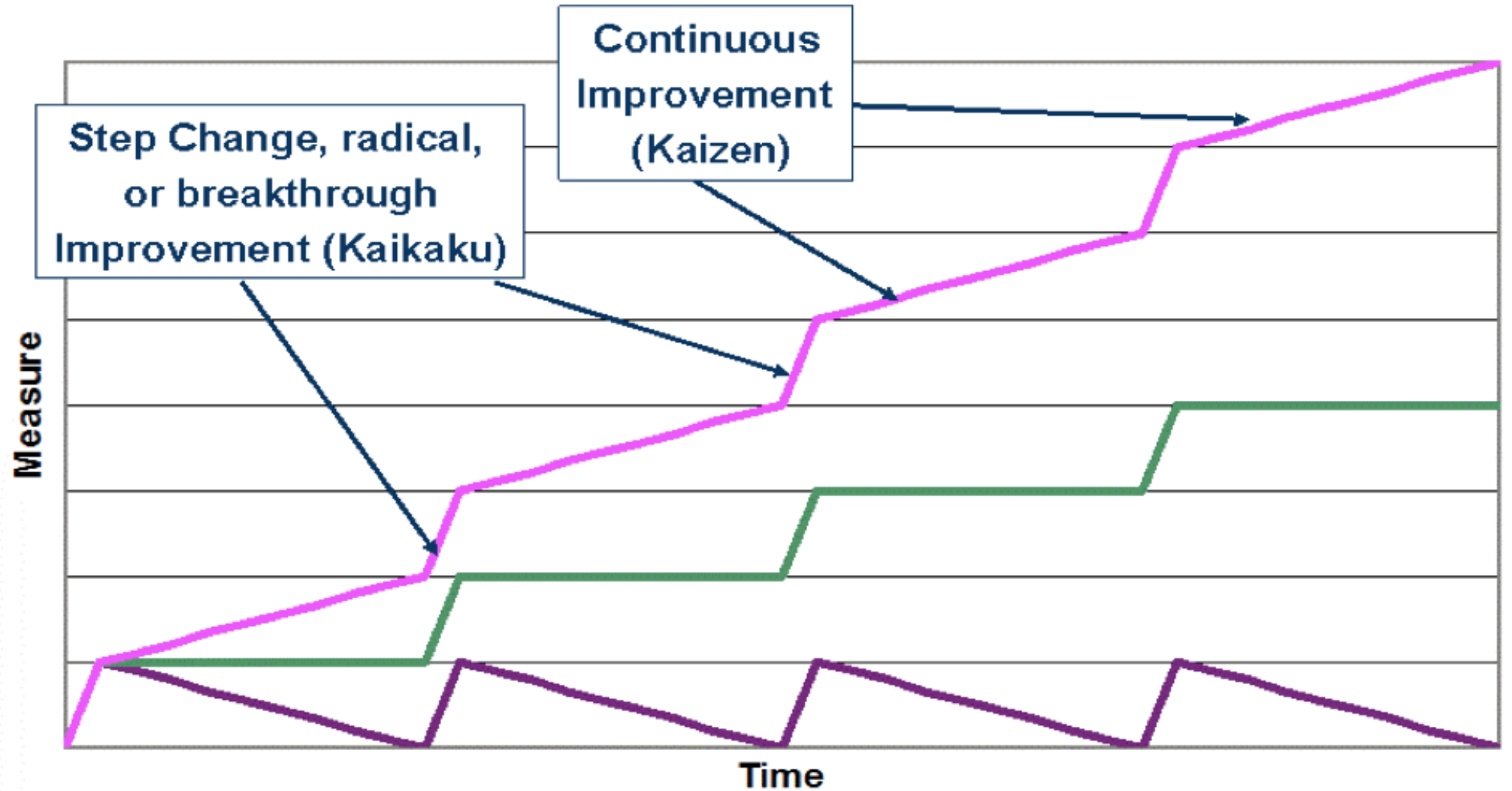
Evolution

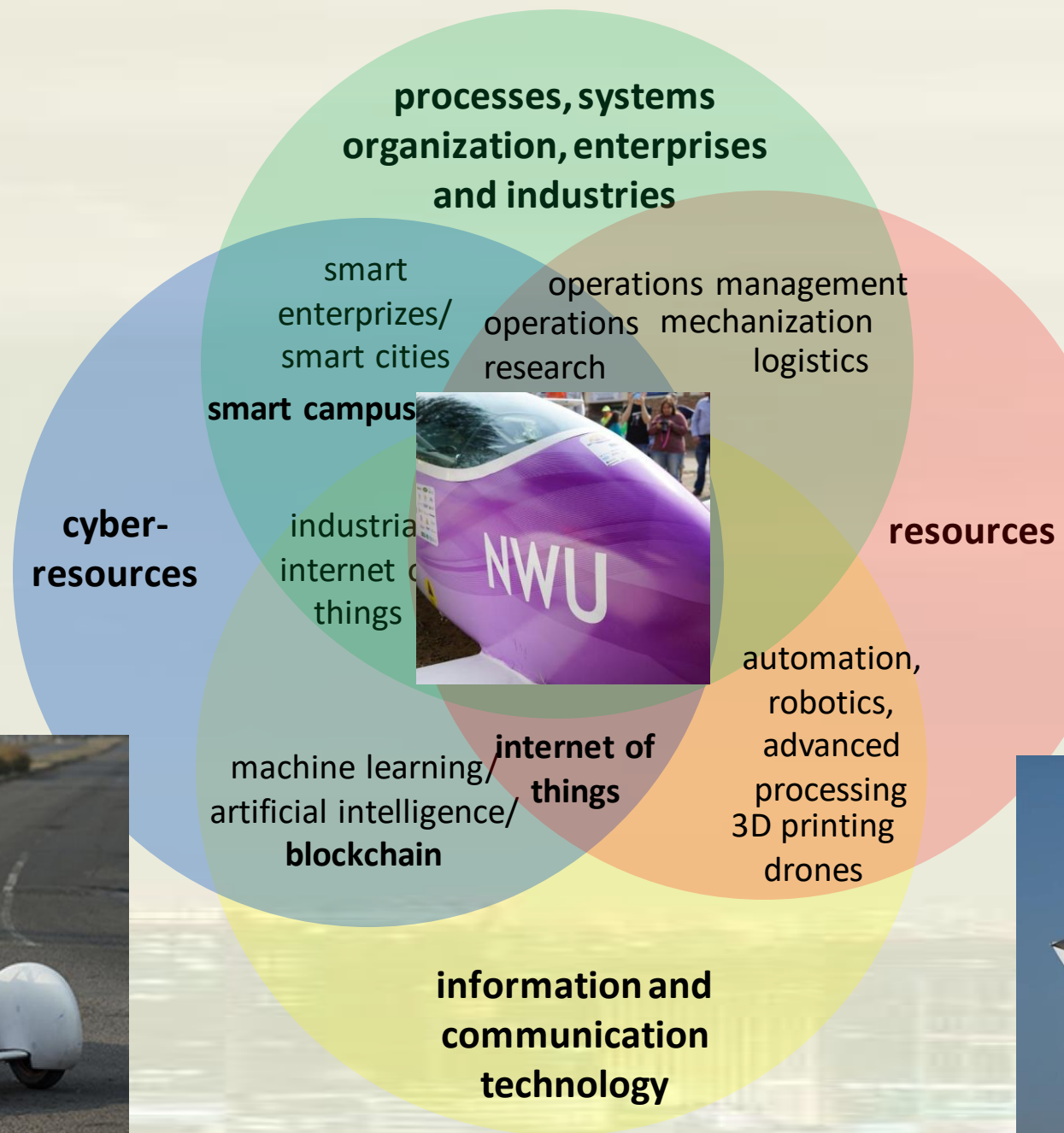
- a certain process of change in a certain direction
- a process of continuous change from a lower, simpler state to a higher, more complex or better state
- a process of gradual and relatively peaceful social, political advance
- change in the inherited traits of a population through successive generations

**incremental change/
continuous improvement**

kaizen

Kaizen (continuous) & Kaikaku (radical)





The Fourth Industrial Revolution

Klaus Schwab

Nicolas Guy Smith, 2019

“And at a time of such tremendous uncertainty and such rapid change, Schwab argues it’s our actions as individuals and leaders that will determine the trajectory our future will take. We all have a responsibility – as citizens, businesses, and institutions – to work with the current of progress, not against it, to build a future that is ethical, inclusive, sustainable and prosperous.”

KLAUS SCHWAB

FOUNDER AND EXECUTIVE CHAIRMAN, WORLD ECONOMIC FORUM
WITH NICHOLAS DAVIS

2018

SHAPING THE FUTURE OF THE FOURTH INDUSTRIAL

UNWU®

To be an internationally recognised university in Africa, distinguished for engaged scholarship, social responsiveness

and an ethical
We want to change the world for the better





The Fourth Industrial ~~R~~Evolution

*“Emerging technologies are not predetermined forces out of our control, nor are they simple tools with known impacts and consequences. The exciting capabilities provided by artificial intelligence, distributed ledger systems and cryptocurrencies, advanced materials and biotechnologies are already transforming society. The actions we take today - and those we don't - will quickly become embedded in ever-more powerful **technologies that surround us and will, very soon, become an integral part of us.**”*

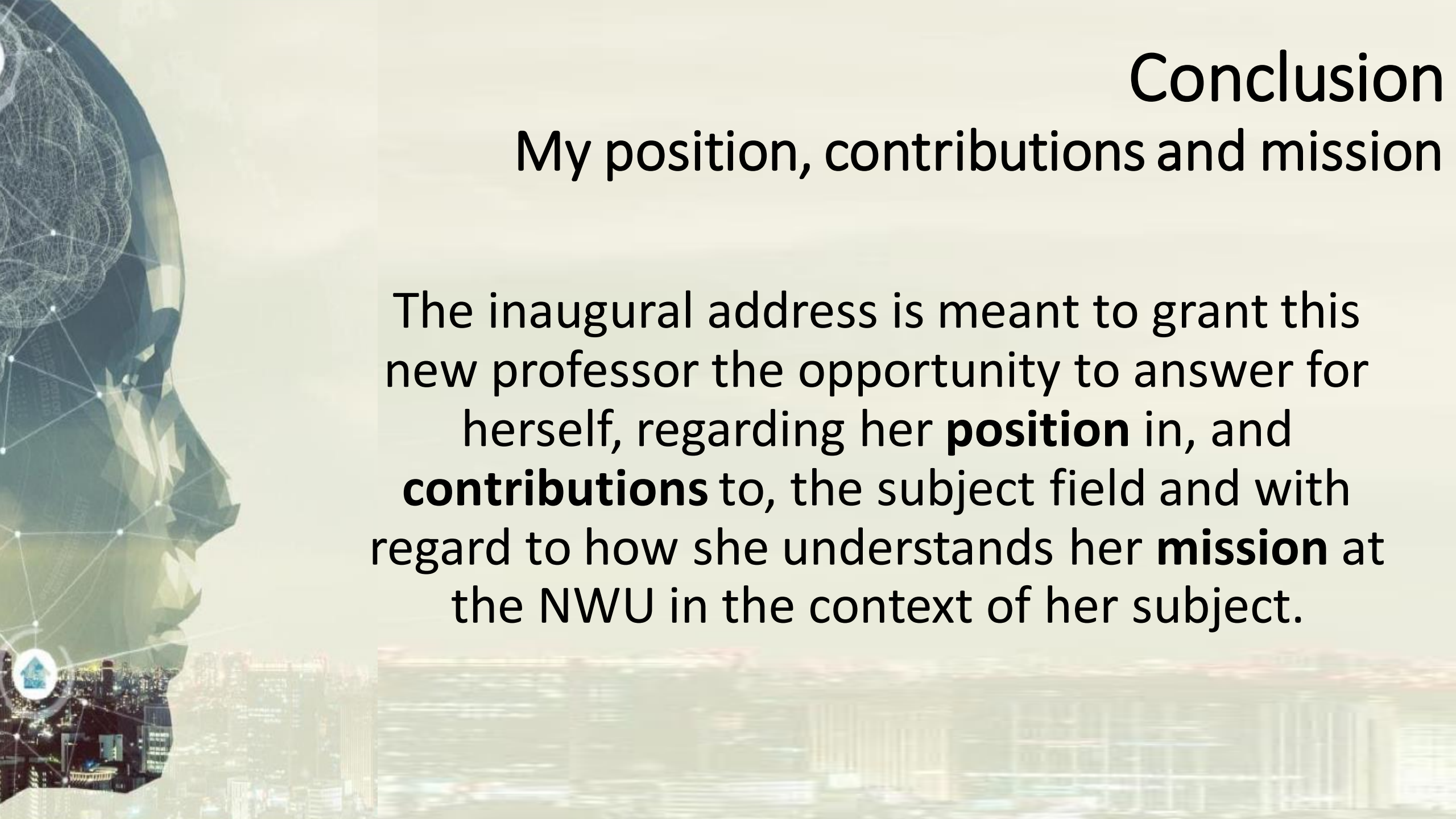
Klaus Schwab

(2018, Shaping the Future of the Fourth Industrial Revolution)

State of the Nation Address 2019

- Revolutionary advances in technology are reshaping the way people work and live.
- It is a choice between being overtaken by technological change or harnessing it to serve our developmental aspirations.
- To ensure that we effectively and with greater urgency harness technological change in pursuit of inclusive growth and social development, I have appointed a Presidential Commission on the 4th Industrial Revolution.





Conclusion

My position, contributions and mission

The inaugural address is meant to grant this new professor the opportunity to answer for herself, regarding her **position** in, and **contributions** to, the subject field and with regard to how she understands her **mission** at the NWU in the context of her subject.

A BRIEF HISTORY OF THE INDUSTRIAL REVOLUTION

The **Industrial Revolution** was the transition to new manufacturing processes. Here's a brief history of the industrial revolution.

- **1712**
Thomas Newcomen invents the first practical **Steam Engine**
- **1769**
James Watt patents his improved **Steam Engine**
- **1785**
Emdund Cartwright invents the **Power Loom**
- **1793**
Eli Whitney invents the **Cotton Gin**
- **1801**
Richard Trevithick invents the steam-powered **Locomotive**
- **1837**
John Deere invents the **Steel Plow**
- **1844**
Samuel Morse invents the **Telegraph**
- **1846**
Elias Howe invents the **Sewing Machine**
- **1876**
Alexander Graham Bell patents the **Telephone**
- **1879**
Thomas Edison perfects the **Incandescent Light Bulb**
- **1903**
Wilbur and Orville Wright make the first manned flight in an **Airplane**
- **1908**
Ford begins production of the **Model T Automobile**



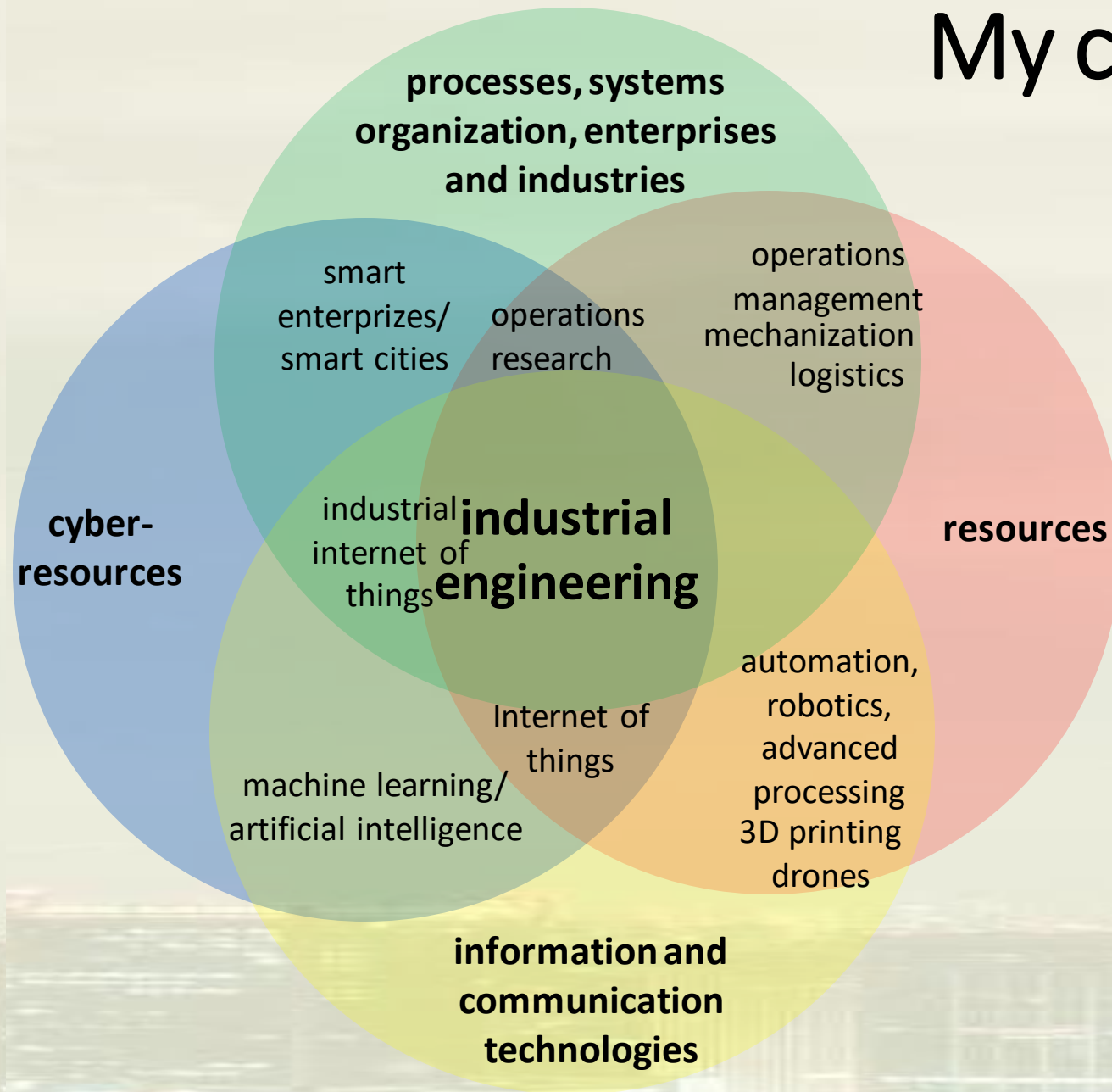
WWW.HISTORYOFMASSACHUSETTS.ORG



My position



My contribution





My mission at the NWU

My mission, aligned with the mission of my Faculty, and the mission of the NWU, is to

- change the world for the better, by educating industrial engineers that can and want to change the world,
- integrate and optimize systems and processes that will make the world a better place, through my research and professional practice.



**Be wise enough
to learn from the
past, shrewd
enough to
capitalize on the
present, and
clever enough to
prepare for the
future.**

Matshona Dhliwayo