

GLOBAL DIGITAL TRANSFORMATION

LECTURE 1 – BACKGROUND

TOMASZ JANOWSKI

GDAŃSK UNIVERSITY OF TECHNOLOGY, POLAND

DANUBE UNIVERSITY KREMS, AUSTRIA

COURSE

1.	BACKGROUND	What is digital transformation about?
2.	LANDSCAPE	What is the global adoption of digital transformation?
3.	INNOVATIONS	What are the cases of digital transformation?
4.	FEATURES	What features define digital transformation?
5.	BOUNTY	What benefits can digital transformation deliver?
6.	SPREAD	How unequal are the benefits of digital transformation?
7.	WINNERS	Who benefits most from digital transformation?
8.	IMPACT	What is the impact of the bounty and spread?

IMPACT OF DIGITALIZATION

Which areas of your life are affected by digitalization?

- Work
- Learning
- Health
- Relationships
- Sports
- Travel
- Entertainment
- Civic affairs
- More?

IMPACT OF DIGITALIZATION

How is your life affected by digitalization?

- Doing new things
- Doing things differently
- Doing things better/faster/cheaper
- New ways of thinking
- Making better decisions
- Interact socially
- Being always available
- More?

IMPACT OF DIGITALIZATION

What is the impact like?

- Broad/Narrow
- Deep/Shallow
- Uniform/Unequal
- Advancing/Contracting
- Positive/Negative
- More?

FORCES OF DIGITALIZATION

What drives digitalization:

- Digital technology and associated digital innovations
- Markets and how they respond to the needs and wants of customers

None of them necessarily leads society towards a better future:

- Technology is not always value-neutral, i.e. technology should not be blamed or praised for bad or good consequences of its use, only users should.
- Markets have inequality built into them, they respond preferentially to the wants of the rich and ignore the poor, they also fail to address externalities.

Source: Gregory Unruh and David Kiron, Digital Transformation on Purpose, MIT Sloan Management Review

Source: John Danaher, Is Technology Value-Neutral? New Technologies and Collective Action Problems, Philosophical Disquisitions

TOWARDS A BETTER DIGITAL FUTURE

What do society and business want from digitalization?

Can we pursue digitalization with a higher purpose in mind?

Can we steer digitalization to be a force for good, to transform societies and economies for greater equity, environmental integrity, and shared prosperity?

Source: Gregory Unruh and David Kiron, Digital Transformation on Purpose, MIT Sloan Management Review

Answering such questions requires:

- A bigger perspective and greater responsibility for decisions made by business and public leaders around digital technologies.
- Proactively scanning the emerging landscape for both social and environmental risks of digital technologies.
- Simultaneously looking for opportunities to use digital technologies to resolve global challenges.

However, most business and public leaders are struggling to address the implications of digitalization, let alone forming a strategy about how to deal with such questions.

Source: Gregory Unruh and David Kiron, Digital Transformation on Purpose, MIT Sloan Management Review

THIS COURSE

This course is about Digital Transformation as a potential force for good:

- How to understand it?
- What are its defining features?
- How to track its progress?
- What benefits can it deliver?
- What threats does it create?
- How to realize benefits?
- How to respond to threats?
- What can we expect in the future?

OUTLINE

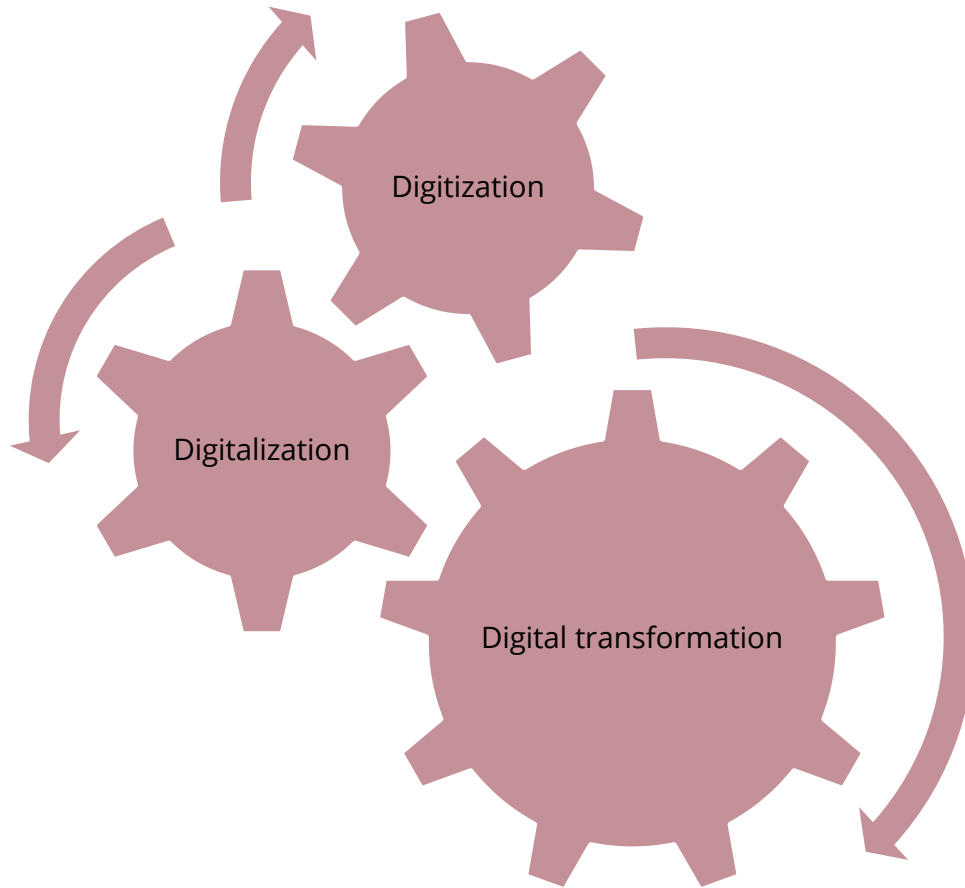
1. CONCEPTS
2. PRECEDENTS
3. EXPECTATIONS

WHICH CONCEPTS DEFINE DIGITAL TRANSFORMATION?

OUTLINE

1. CONCEPTS
 - 1.1. DIGITIZATION
 - 1.2. DIGITALIZATION
 - 1.3. DIGITAL TRANSFORMATION
2. PRECEDENTS
3. EXPECTATIONS

TERMINOLOGY



These terms are frequently confused.

They have different meanings though.

Those who confused them shortchange the power and importance of digital transformation.

This puts the survival of their organizations in peril.

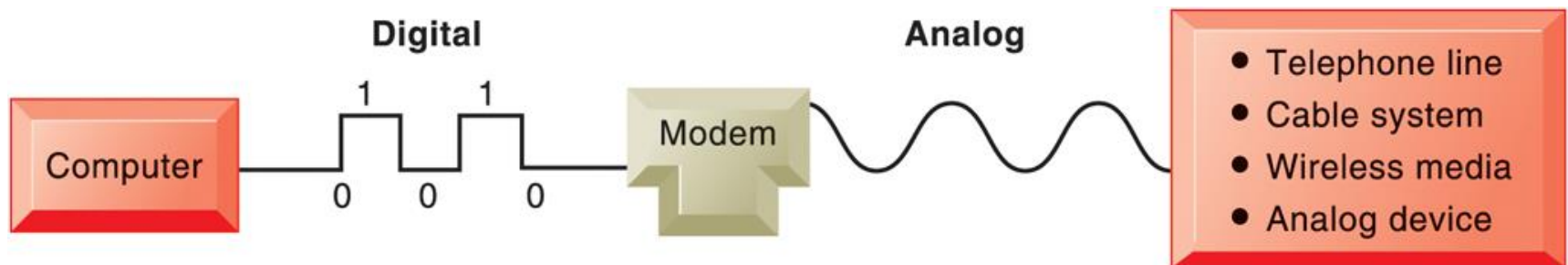
Jason Bloomberg, Digitization, Digitalization, And Digital Transformation: Confuse Them At Your Peril

DIGITIZATION – CONCEPT

Digitization is the process of converting an object, image, sound, document, signal or any other kind of information from analog to digital form.

Digital versus analog form:

- The digital form is usually a binary number, a series of 0 and 1, but any other numerical format, e.g. decimal, hexadecimal, etc. can be used as well.
- The analog form is continuous, both in the number of possible values at a time, and the number of points in a given period of time.



Copyright © 2016 Pearson Education, Inc.

Source: Laudon and Laudon. Management information systems: Managing the digital firm, 14th edition, Pearson, 2016

DIGITIZATION – STAGES

First stage of digitization:

- publishing, music and finance sectors
- products were information to begin with, just captured in analog form.

Second stage of digitization:

- manufacturing sector
- digitization of physical, tangible products
- imaging technology scanning 3-D objects into data files
- sensor and IoT technology capturing digital data about objects in real-time
- 3-D printing technology rendering digital files into desired objects

Source: Gregory Unruh and David Kiron, Digital Transformation on Purpose, MIT Sloan Management Review

DIGITIZATION – DIGITAL PRESERVATION

Digitization and digital preservation are not the same:

- Digitizing means converting from an analog into a digital format.
- Digitally preserving something means maintaining it over a period of time.

Digital preservation can apply to analog and born-digital materials, whereas digitization applies exclusively to analog materials.

Digital preservation is complicated because of:

- fast technology changes, a format that was used to save something years ago may become obsolete, forcing upgrades to new technology, and
- inherently unstable nature of digital storage and maintenance.

Source: Wikipedia, Digitalization

DIGITIZATION – VIDEO



Source: BFS-Auto: High Speed Book Scanner at over 250 pages/min

OUTLINE

1. CONCEPTS
 - 1.1. DIGITIZATION
 - 1.2. DIGITALIZATION
 - 1.3. DIGITAL TRANSFORMATION
2. PRECEDENTS
3. EXPECTATIONS

DIGITALIZATION – CONCEPT

In digitization, information is digitized, not the processes.

Digitalization refers to enabling, improving or transforming business processes by leveraging digital technologies and digitized data; it presumes digitization.

Digitalization:

- involves innovators and entrepreneurs developing business models and business processes that can take advantage of the newly digitized products
- is the process of moving to digital business, the creation of business design by blurring the digital and physical worlds
- is usually disruptive for incumbents because it renders their existing business models and processes obsolete

Source: Gregory Unruh and David Kiron, Digital Transformation on Purpose, MIT Sloan Management Review

Source: Amancio Bouza, What is Digital Transformation, Digitalization, and Digitization

Source: Gartner IT Glossary

DIGITALIZATION – BUSINESS

In business:

- The process of digitalization is accelerating, even in less extensively digital industries such as retail and health care.
- Industries are expanding their use of enterprise management software, digital payment systems, social media marketing, and data analytics.
- In the world of professional services and business administration, changes are on the horizon with advances in artificial intelligence and machine learning.

Source: M. Muro, S. Liu, J. Whiton, and S. Kulkarni, "Digitalization and the American Workforce, 2017.

DIGITALIZATION – GOVERNMENT

In government:

- Digital technologies do not, in general, recognize political or administrative boundaries but instead connect citizens of many countries into one network.
- The question of who is a constituent will change, e.g. many more people are affected by the US elections than those who vote in such elections.
- Digitalization will alter the role of governments, who are they constituencies, and how they will engage with them.
- Questions of inclusion, equity, prosperity, environment, etc. will shift away from traditional “government” to a broader understanding of “governance”.
- Governance includes the roles of communities, governments and businesses.

Source: M. Muro, S. Liu, J. Whiton, and S. Kulkarni, “Digitalization and the American Workforce, 2017.

DIGITALIZATION – VIDEO

DIGITAL ADVANCEMENT BY SECTOR



Source: Harvard Business Review, How digital is your industry?

OUTLINE

1. CONCEPTS
 - 1.1. DIGITIZATION
 - 1.2. DIGITALIZATION
 - 1.3. DIGITAL TRANSFORMATION
2. PRECEDENTS
3. EXPECTATIONS

DIGITAL TRANSFORMATION – SMALL SCALE

An organization might undertake a series of digitalization projects, ranging from automating processes to retraining workers to use computers.

However, undertaking digitalization projects by an organization is insufficient to realize its digital transformation.

For digital transformation to take place, the organization must:

- carry out digitalization projects,
- undergo cross-cutting organizational change to fulfill the potential and address the risks of newly digitalized processes, and
- make change-management its core competency, becoming more agile to facilitate ongoing digitalization initiatives.

Such agility is the essence of digital transformation.

Source: G. Unruh and D. Kiron, "Digital Transformation on Purpose," *MIT Sloan Manag. Rev.*, pp. 1–6, 2017.

Source: J. Bloomberg, "Digitization, Digitalization, And Digital Transformation: Confuse Them At Your Peril" pp. 2–7, 2018.

DIGITAL TRANSFORMATION – LARGE SCALE

Digital transformation is a system-level transition that, due to the adoption of digital technologies, alters social, economic, political, etc. behaviors on a large scale.

Digital transformation:

- restructures economies due to new digital business models and processes
- restructures societies due to people integrating new digital technologies into their lives and habits
- restructures politics due to new structures of political participation and activism, and new forms of political expression.

Source: G. Unruh and D. Kiron, "Digital Transformation on Purpose," *MIT Sloan Manag. Rev.*, pp. 1-6, 2017.

DIGITAL TRANSFORMATION – EXTERNALITIES

Digital transformation restructures society in both positive and negative ways.

This includes:

- Technological unemployment increasing inequality but also offering opportunities for leisure and artistic expression.
- Bioengineering brings the promise of combating diseases but also risks excluding genetic groups judged to be inferior and promoting superior.
- Ubiquitous digital infrastructure connects people around the world but also introduces systemic threats and vulnerabilities connected to it.

Source: G. Unruh and D. Kiron, "Digital Transformation on Purpose," *MIT Sloan Manag. Rev.*, pp. 1-6, 2017.

DIGITAL TRANSFORMATION – SOCIETAL ADAPTATION

Society usually adapts in a reactive — not proactive — ways to digital transformation.

This is often because digital technology can proliferate much faster than our ability to understand and anticipate its impact.

The automobile had been ubiquitous for decades before we understood the downsides of “car culture,” like smog, sprawl, and climate change.

Source: G. Unruh and D. Kiron, “Digital Transformation on Purpose,” *MIT Sloan Manag. Rev.*, pp. 1–6, 2017.

DIGITAL TRANSFORMATION – VIDEO



Source: <https://www.youtube.com/watch?v=ystdF6jN7hc>

DIGITIZATION, DIGITALIZATION, DIGITAL TRANSFORMATION

Ordering concepts:

- we digitize information,
- we digitalize processes and roles that make up the operations of a business,
- we digitally transform the business and its strategy.

Each one is necessary but not sufficient for the next.

Digitization and digitalization are about technology, but digital transformation is about the business (in the small scale) or society/economy (in the large scale).

Source: J. Bloomberg, "Digitization, Digitalization, And Digital Transformation: Confuse Them At Your Peril" pp. 2-7, 2018.

DIGITIZATION, DIGITALIZATION, DIGITAL TRANSFORMATION



Source: G. Unruh and D. Kiron, "Digital Transformation on Purpose," *MIT Sloan Manag. Rev.*, pp. 1-6, 2017.

QUESTIONS

1.	Does digitization have business value by itself?
2.	Is digitization the same as digital preservation?
3.	Did Apple invent the digitization of the music industry?
4.	Is society responding to technological change reactively or proactively?
5.	What is the main difference between digitization and digitalization?
6.	What is the main difference between digitalization and digital transformation?

WHICH CONCEPTS DEFINE DIGITAL TRANSFORMATION?

DIGITIZATION, DIGITALIZATION, DIGITAL TRANSFORMATION

OUTLINE

1. CONCEPTS
2. PRECEDENTS
3. EXPECTATIONS

WHICH HISTORICAL DEVELOPMENTS PRECEDE
DIGITAL TRANSFORMATION?

OUTLINE

1. CONCEPTS
2. PRECEDENTS
 - 2.1. HUMAN DEVELOPMENT
 - 2.2. FIRST MACHINE AGE
 - 2.3. SECOND MACHINE AGE
3. EXPECTATIONS

OUTLINE

1. CONCEPTS
2. PRECEDENTS
 - 2.1. HUMAN DEVELOPMENT
 - 2.2. FIRST MACHINE AGE
 - 2.3. SECOND MACHINE AGE
3. EXPECTATIONS

HUMAN DEVELOPMENT

Lets consider digital technology development in the context of human history.

What have been the most important developments in such history?

A hard question:

- When does the human history even begin?
- What constitutes human development?

Source: E. Brynjolfsson and A. McAfee, The Second Machine Age, 2016

HUMAN DEVELOPMENT – WHEN DID IT START?

- 60,000 BC: Homo Sapiens emerges, anatomically and behaviorally
- 25,000 BC: Homo Sapiens wipes out Neanderthals and thereafter faces no competition from other big-brained, upright-walking species
- 14,000 BC: The world starts getting warmer after the ice age

This a reasonable time to start tracking human progress.

Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

HUMAN DEVELOPMENT – WHAT IS IT?

What constitutes a truly important development?

An event or advance that significantly changes the course of human history.

Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

HUMAN DEVELOPMENT – SIGNIFICANT EVENTS

1. Domestication of animals – dog before 14,000 BC, horse and ox by 6000 BC, enabled transition from foraging to farming around 8000 BC.
2. Cities – agriculture ensures plentiful and reliable food sources, which in turn enable larger human settlements and, eventually, cities.
3. Wars – due to the concentration of wealth, cities in turn make tempting targets for plunder and conquest.
4. Writing and counting – writing was invented in Mesopotamia around 3,200 BC, symbols for counting also existed then, but not including zero.

Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

HUMAN DEVELOPMENT – SIGNIFICANT EVENTS

4. Thinking – Buddha (563–483 BCE), Confucius (551–479 BCE), and Socrates (469–399 BCE) all lived quite close to one another in time bringing transformative schools of thought to Indian, Chinese, and European civilizations.
5. Religion – Enabled by the spread of written word, major religions like Hinduism, Judaism, Christianity, and Islam influenced the lives of millions of people.
6. Democracy - the Athenians began to practice democracy around 500 BC.
7. Columbus sailed the ocean in 1492, beginning interactions between the New and the Old World that would transform both.
8. Etc.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

HUMAN DEVELOPMENT

How to get clarity about which of these developments is the most important?

All candidates above have advocates, argue forcefully for one event over others.

Confronted with the ocean of facts, is any attempt to rank or compare human development events even meaningful?

It is. If we want to know which developments bent the curve of human history, it makes sense to try to draw that curve.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

MEASURING HUMAN DEVELOPMENT

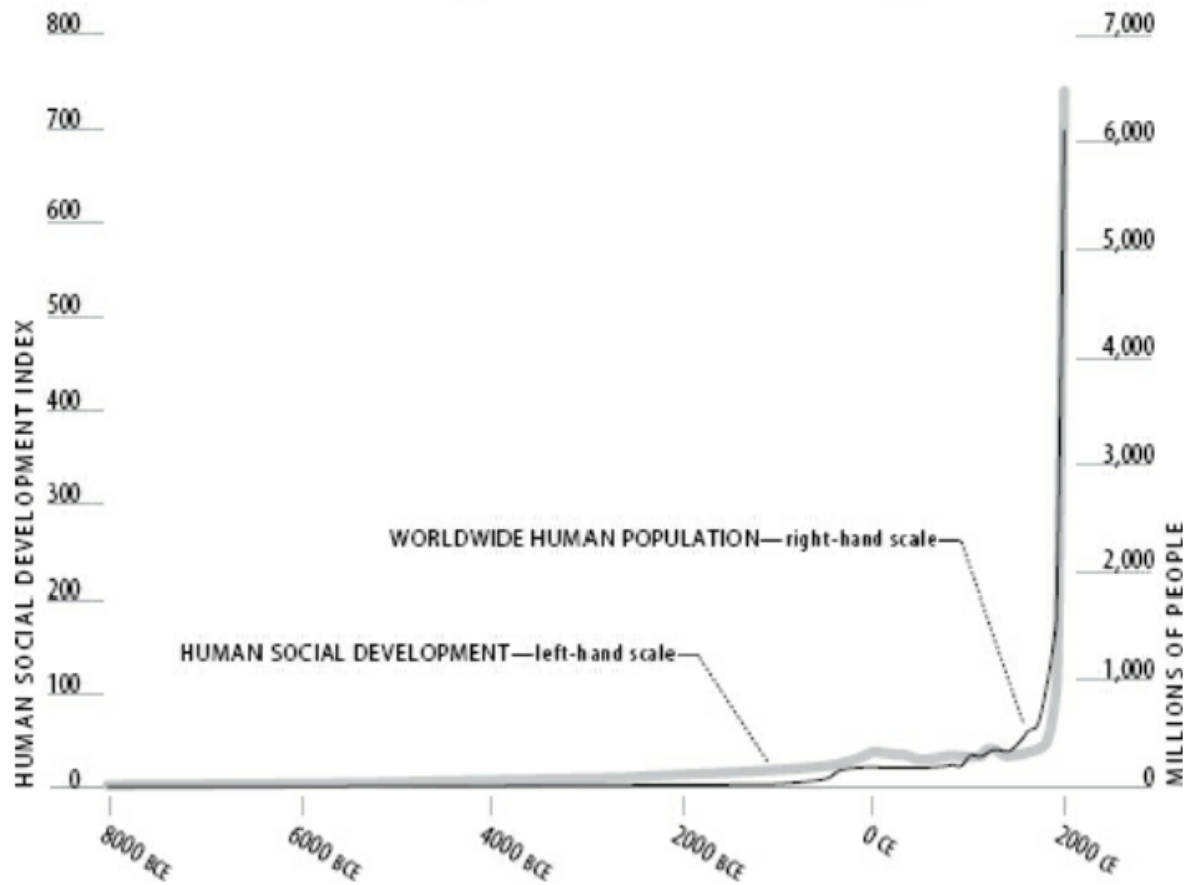
Four attributes:

1. energy capture (per-person calories obtained from the environment for food, home and commerce, industry and agriculture, and transportation),
2. organization (the size of the largest city),
3. war-making capacity (number of troops, power and speed of weapons, logistical capabilities, and other similar factors), and
4. information technology (the sophistication of available tools for sharing and processing information, and the extent of their use).

Each of these is converted into a number that varies over time from zero to 250. Overall social development the sum of these four numbers.

Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

THE CURVE OF HUMAN DEVELOPMENT



Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

FINDINGS

For thousands of years, humanity was on a gradual upward trajectory. Progress was achingly slow, almost invisible.

Animals and farms, wars and empires, philosophies and religions all failed to exert much influence.

However, two hundred years ago, something sudden and profound arrived and bent the curve of human population and social development almost ninety degrees.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

OUTLINE

1. CONCEPTS
2. PRECEDENTS
 - 2.1. HUMAN DEVELOPMENT
 - 2.2. FIRST MACHINE AGE
 - 2.3. SECOND MACHINE AGE
3. EXPECTATIONS

STEAM ENGINE

The technology that bent the curve was the steam engine.

- The steam engine, particularly one developed and improved by James Watt and his colleagues in the second half of the eighteenth century.
- Prior to Watt, steam engines were highly inefficient, harnessing only about one percent of the energy released by burning coal.
- Watt's tinkering between 1765 and 1776 increased this more than threefold.
- This was enough to trigger industrial revolution.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

THE FIRST MACHINE AGE

A sum of several nearly simultaneous developments in mechanical engineering, chemistry, metallurgy, and other disciplines.

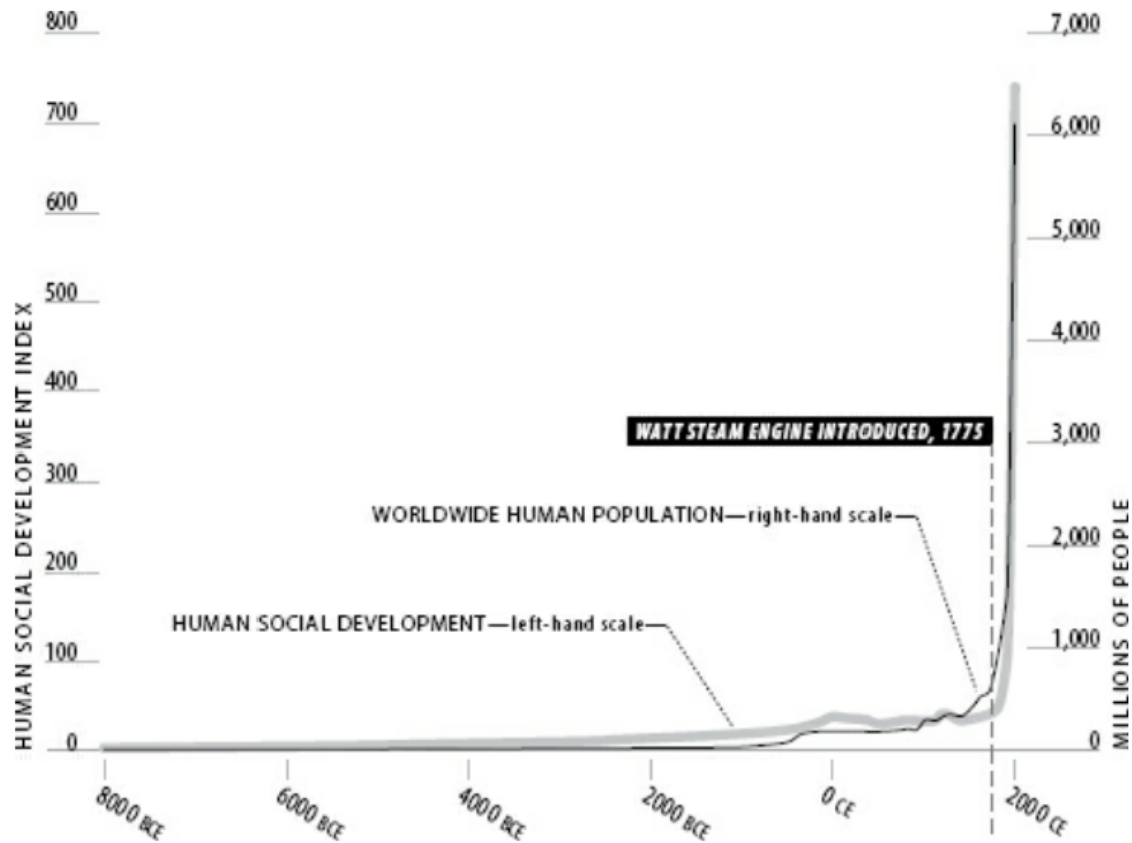
The steam engine allowed us to overcome the limitations of muscle power, human and animal, and generate massive amounts of useful energy at will.

This led to factories and mass production, to railways and mass transportation, to modern life.

The Industrial Revolution ushered the First Machine Age, the first time our progress was driven primarily by technological innovation.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

BENDING THE HUMAN DEVELOPMENT CURVE



Source: I. Morris, *Why the West is Rules, For Now*. Profile Books, 2010.

OUTLINE

1. CONCEPTS
2. PRECEDENTS
 - 2.1. HUMAN DEVELOPMENT
 - 2.2. FIRST MACHINE AGE
 - 2.3. SECOND MACHINE AGE
3. EXPECTATIONS

SECOND MACHINE AGE

Mental power is at least as important for development – for mastering our physical and intellectual environment to get things done – as physical power.

In the second machine age, computers and other digital advances are doing for mental power what the steam engine did for muscle power.

Whether or not the new machine age will bend the curve as dramatically as the Watt's steam engine, it is a very big deal indeed.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

SECOND MACHINE AGE ACCELERATING

For years we thought we developed a decent understanding of the capabilities, limitations and impact of digital technologies, e.g. computers, software, networks.

But over the past few years, digital technologies started surprising us:

- diagnosing diseases,
- listening and speaking to us,
- writing high-quality prose,
- driving cars with minimal or no guidance.

Digital technologies had been very bad at such applications for a long time, then suddenly got very good. How did this happen?

What are the implications of this progress?

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

VIDEO



Source: <https://www.youtube.com/watch?v=IMD0VCeamjA>

QUESTIONS

1.	Why is it hard to determine the most important developments in human history?
2.	Why is it controversial to measure human social development?
3.	Which elements could be applied to measure human social development?
4.	What parallels the curve of human social development?
5.	Which event bent the history of human social development?
6.	What are the parallels between the first and the second machine age?

WHICH HISTORICAL DEVELOPMENTS PRECEDE DIGITAL TRANSFORMATION?

HUMAN DEVELOPMENT LEADING UP TO THE STEAM ENGINE,
THEN THE FIRST AND SECOND MACHINE AGE

OUTLINE

1. CONCEPTS
2. PRECEDENTS
3. EXPECTATIONS

WHAT CAN WE EXPECT FROM THE SECOND MACHINE AGE?

EXPECTATIONS

1. Rapid progress with digital technologies.
2. The transformations brought by this progress will be profoundly beneficial.
3. The transformation will also bring out negative consequences.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

EXPECTATIONS 1 – PROGRESS WITH DIGITAL TECHNOLOGIES

Astonishing progress with digital technologies.

These technologies are not brand-new; businesses have been buying computers since 1970s, and Time declared personal computer its “Machine of the Year” in 1982.

But just as it took generations to improve the steam engine to the point that it could power the industrial revolution, it’s also taken time to refine our digital engines.

Why and how the full force of these technologies has recently been achieved?

Full force means that the key building blocks are in place for digital technologies to be as important to society and the economy as the steam engine.

But full doesn’t mean mature. Computers are going to continue to improve.

We are at a point where the curve starts to bend a lot because of computers.

Source: E. Brynjolfsson and A. McAfee, The Second Machine Age, 2016

EXPECTATIONS 2 – BENEFITS OF DIGITAL TRANSFORMATION

The transformation brought about by digital technology will be profoundly beneficial.

We are heading into an era that won't just be different. It will be better because it will increase the variety and the volume of our consumption.

Not just calories and gasoline but books, friends, entertainment, expertise, etc. Technology can bring us more choice and freedom.

When digitized, i.e. converted into bits, stored on computers and sent over networks, they are subject to different economics, where abundance not scarcity is the norm.

Physical goods are still essential, but whether we want to eat more, we'd like to eat better, whether we want to burn more fossil fuels, we'd like to visit more places.

Computers are helping accomplish these goals, and improving the physical world.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

EXPECTATIONS 3 – CHALLENGES OF DIGITAL TRANSFORMATION

Digitalization is going to bring with it some challenges.

This is not surprising, e.g. the Industrial Revolution was accompanied by smog and exploitation of child labor. What will be their modern equivalents?

Accelerating digitalization is likely to bring economic disruption, as computers get more powerful, companies have less need for some kinds of workers.

A great time for workers with special skills and right education, able to use technology to create and capture value.

A bad time for worker with 'ordinary' skills and abilities, because digital technologies are rapidly acquiring these skills and abilities.

Like the challenges of industrial revolution, the challenges of the digital revolution can also be met, but we have to understand what they are and how to mitigate them.

Source: E. Brynjolfsson and A. McAfee, *The Second Machine Age*, 2016

VIDEO



Source: <https://www.youtube.com/watch?v=IRhl40rXOgs>

QUESTIONS

1.	Is digital technology brand new?
2.	Is digital technology already mature?
3.	What benefits digital technology bring to us?
4.	Can digital technology improve the physical world? How?
5.	What are the negative consequences of digital transformation?
6.	Which skills/abilities will be of value in the second machine age, which won't?

WHAT CAN WE EXPECT FROM THE SECOND MACHINE AGE?

CONTINUED PROGRESS WITH DIGITAL TECHNOLOGIES
LEADING TO BENEFITS AND CHALLENGES
WITH DIGITAL TRANSFORMATION

THANK YOU FOR YOUR ATTENTION

Tomasz Janowski

tomasz.janowski@pg.edu.pl