The Digital Society and Digital Competences for the Future

Bjørn Heineman, inFuture
June 19th 2019
Topics of today's presentation
4 main topics

The Second Wave of Digitization

The New Education

Competence Needs of The Future

Digital Skills

Today
Education  Work  Continuing education  Work

In the future
Education  Work  Skills upgrading and work in parallel
The Second Wave of Digitization
The world is changing at a higher pace, and the lifespan of companies are getting shorter.

Lifespan for large companies (7 year rolling average, S&P 500-companies)
When the world is changing at a higher pace, understanding the future gets more important

The world’s 10 largest corporations

2007 (December)
- 5 Oil & Gas: $2,085 billions, total value
- 1 Digital: $333 billions, total value

2017 (June)
- 1 Oil & Gas: $342 billions, total value
- 7 Digital: $3,431 billions, total value
The second wave of digitization

The first wave of digitization
- **Channel**
  - PC as main channel
    - Example: Online book sales
- **System**
  - Integration of internal data
    - Example: CRM system
- **Industry**
  - Influencing already digitized industries
    - Example: Banking, music, movies etc.

The second wave of digitization
- **Channel**
  - Mobile phone as main channel
    - Example: Omnichannel
- **System**
  - Integration of external data
    - Example: Integration of data from social media (for e.g. better credit ratings)
- **Industry**
  - Influencing all industries
    - Example – mobility:
      - Connected cars, self-driving cars, sharing economy
The second wave of digitization is enabled by the maturation of a number of key technologies:

- **Smart phones**
- **Artificial intelligence**
- **Wireless internet & cloud storage**
- **Sensors and the internet of things**
- **Big data**
- **Increased computing power and analysis capability**
- **Robotization & automation**
- **3D-printers**
Main trends in the second wave of digitization

**Increased resource utilization**

**Automation and artificial intelligence**

**Dissolving traditional work interdependencies**

**Simplified innovation**
Increased resource utilization

Through a series of key technologies the second wave of digitization may lead to increased resource utilization within non-digital sectors.

<table>
<thead>
<tr>
<th>3D-printing in aviation</th>
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<tbody>
<tr>
<td>GE Aviation utilizes 3D-printing to produce 45,000 fuel nozzles per year</td>
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<tr>
<th>The sharing economy provides better mobility services</th>
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<tbody>
<tr>
<td>Uber: Increased resource utilization of cars</td>
</tr>
<tr>
<td>Self driving cars: Can operate 24/7 and further increase resource utilization</td>
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</table>

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<thead>
<tr>
<th>Reduction in production cost (GE Aviation) (indexed)</th>
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<tr>
<td>Before</td>
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<td>After</td>
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<tr>
<th>Resource utilization, cars</th>
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</thead>
<tbody>
<tr>
<td>Privately owned car, Europe</td>
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<tr>
<td>Cab driver LA</td>
</tr>
<tr>
<td>Uber driver LA</td>
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</tbody>
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<tr>
<th>Smart phones</th>
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<th>Artificial intelligence</th>
</tr>
</thead>
</table>

Previously impossible tasks can now be solved using AI, making even high skilled professions vulnerable to automation.

**AI are not restricted by the limitations in computing power**

**The first wave of digitization**
Advanced algorithms and powerful processing

1997: GM Garry Kasparov defeated by IBM’s Deep Blue

**The second wave of digitization**
Machine learning with cognitive skills – limitations in computing power obsolete

Google is about to outsmart a 6-year-old

- **+74%** in 3 years
- 27
- 47
- 56

- Google-IQ (2014)
- Google-IQ (2017)
- IQ of a 6 year old

10^40 Chess outcomes < 10^80 Atoms in the observable universe < 10^{170} Outcomes in the game «Go»
Several industries, even high skill professions, are already impacted by automation and AI.

**Example of jobs that are under siege from automation and AI**

<table>
<thead>
<tr>
<th>Low skilled</th>
<th>Medium skilled</th>
<th>High skilled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cab driver</strong></td>
<td><strong>Chef</strong></td>
<td><strong>Law</strong></td>
</tr>
<tr>
<td>- Google, Tesla, Mercedes, Uber among others</td>
<td>- Chef Watson has invented 65 original dishes, published “his” own cookbook</td>
<td>- AI lawyer Ross replaces secretaries and junior lawyers for several tasks</td>
</tr>
<tr>
<td><strong>Airport employees</strong></td>
<td><strong>Construction</strong></td>
<td><strong>Architecture</strong></td>
</tr>
<tr>
<td>- New terminal at Oslo Airport drastically reduces the need for humans</td>
<td>- Japan 2020 Olympics is built by drones and self driving bulldozers</td>
<td>- AI-architect creates optimal floor plans based on regulations, area restrictions, sunlight needs, etc.</td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td><strong>Psychology</strong></td>
<td></td>
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<tr>
<td>- IBM Watson and Baylor College of Medicine: Identified 6 proteins related to cancer only in weeks (as opposed to 1 per year)</td>
<td>- AI-psychologist Ellie identifies depression in 9/10 cases</td>
<td></td>
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<tr>
<td></td>
<td>- More people open up to Ellie than to human psychologists</td>
<td></td>
</tr>
</tbody>
</table>
The sharing economy dissolves the traditional relation between the employer and the employee

Traditional organization: Unionized employer and employee

Example of stakeholders

- **Employee**
  - Organized

- **Employer**
  - Organized

- **Consumer**
  - Gets offers from drivers with a cab driver license

Organization in the sharing economy: The contractor is directly connected to the consumer

Example of stakeholders

- **Contractor:** Driver and car owner
  - No organization: The contractor has limited rights
  - A threat to employers and employees

- **Intermediary**
  - Gets a more extensive service offering

**The sharing economy threatens the rights and safety of the individual employee**
The sharing economy is dissolving traditional interdependencies across skill levels

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<th>Sharing economy for <strong>low skilled</strong> jobs</th>
<th>Sharing economy for <strong>high skilled</strong> jobs</th>
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<td><strong>Laundry services</strong></td>
<td><strong>Doctors</strong></td>
</tr>
<tr>
<td>- Cleaning services at home or at offices with contracted labour</td>
<td>- Chat, video consultation, home visits and doctor referrals</td>
</tr>
<tr>
<td></td>
<td><strong>Lawyers</strong></td>
</tr>
<tr>
<td></td>
<td>- Associated lawyers</td>
</tr>
<tr>
<td></td>
<td><strong>Management consulting</strong></td>
</tr>
<tr>
<td></td>
<td>- Associated management consultants hand picked on sharing economy platform</td>
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<tr>
<td><strong>Hair dressers</strong></td>
<td><strong>Courier services</strong></td>
</tr>
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<td>- Ordering a haircut through an app</td>
<td>- Catering service</td>
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<td>- Home visit from hairdresser</td>
<td>- Delivery by hired bicycle bids</td>
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**Simplified innovation**

Individuals and small companies can now do what only large corporations used to be able to.

### Hurdles to innovation reduced

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<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market access</td>
<td>140 billion downloads from AppStore, ads via Facebook</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Specialized high skill individuals are now freelancers</td>
</tr>
<tr>
<td>Capital</td>
<td>Crowdfunding for startups experiencing strong growth</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Factories are challenged by 3D-printers, IT systems by cloud computing</td>
</tr>
</tbody>
</table>

### Example of *democratized innovation*

**Virtual Reality**

**VR glasses Oculus Rift: Innovation without developing new technology**

- Developed by 18-year-old Palmer Luckey by combining existing technology from the market
- 2012: Financed by Kickstarter with 2.4 mUSD
- 2014: Bought by Facebook for 2 billion USD

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Digitization reduces hurdles to innovation from small companies and entrepreneurs.
What’s different this time?
During the industrial revolution, workers with medium skills levels were most vulnerable to new technology.

The luddites in the 18-19th century British textile industry were the ones who most strongly opposed to Spinning Jenny.
What’s different this time?
The middle skilled workers were also the most vulnerable during the first wave of digitization…

Changes in share of employment in low-, medium- and high-income groups, 1993-2010 (%)

- Finland: Low income = -2%, Medium income = 12%, High income = -11%
- Denmark: Low income = 2%, Medium income = 9%, High income = -10%
- Sweden: Low income = 1%, Medium income = 8%, High income = -10%
- Norway: Low income = 5%, Medium income = 4%, High income = -9%
...in the second wave of digitization all competency levels will be vulnerable. 1/3 jobs with a high probability of being taken over by technology during the next 20 years.

Need for upgrading competences across all skill levels.

Examples
- Electronics engineers, electrical engineers and IT engineers
- Attorneys, accountants, insurance and financial staff
- Freight forwarders, receptionists, waiters, guards
- Goldsmiths, carpenters, cabinetmakers
- Operators within plastic, chemistry, lumber, concrete, glass, food and process

inFuture research | Pajarinen, Rouvinen, & Ekeland (based on methodology from Frey & Osborne, Oxford University)
This trend is not limited only to Norway – other countries experience an even higher threat of job automation.

Digitization: The second wave

Digital innovations, such as machine learning, big data and artificial intelligence (AI), will change the nature of many jobs, reshaping how certain tasks are performed.

Cross-country variation in job automatability (2018)

Percentage of jobs at risk by degree of risk

Competence development is relevant across all skill levels & countries

Competence Needs of The Future

inFuture  urgency of the long-term
Future need of skills:
Enhance the human uniqueness and develop digital focus and depth

Power to create

Information proficiency

Dedication

Social competency
Creativity deteriorates with age and is hampered by fear of the unknown – and requires training both by the company and the individual.

**NASA: Creativity is not learned, but rather unlearned**

The share of 280,000 participants on NASA’s creativity test who scored “highly creative”

- 98% 5 year olds
- 30% 10 year olds
- 12% 15 year olds
- 2% 25 year olds

**We praise creativity, but in reality, we hate it**

- Our subconscious associations with creativity are the same as we have for poison, pain and vomiting
- A psychological study at Cornell University shows that people reject creative ideas in favor of ideas that are only practical

- Creativity **can** be trained – but is challenging because innovation is closely linked to risk

**To enhance creativity, tolerance for uncertainty should be implemented – for example through experimentation**
Information proficiency and digital formation becomes more important in the future workplace.

<table>
<thead>
<tr>
<th>Exponential growth in unstructured data</th>
<th>Digital laziness: Decline in critical thinking</th>
<th>Digitalization strengthen confirmation tendencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% of all data in the world was created the last 2 years</td>
<td>Share of people that receives news on politics from Facebook</td>
<td></td>
</tr>
<tr>
<td>Digital echo chambers: When we only receive the information that fits our existing opinions</td>
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<td></td>
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<tr>
<td>False news spread 6 times faster than true news</td>
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</tbody>
</table>

The ability to structure, and have a critical relationship to, data from several sources will become increasingly important.
Dedication and social competency will be important in the second wave of digitization.

Dedication needed as we face more digital distractions.

Characteristics (at 10-year-olds) and their impact on the likelihood of having a job at 42 years:

- Internal causal explanation: 0.5
- Self image: -0.2
- Educational self image: -0.1
- Good behavior: 1.7
- Sociability: 0.3
- Conscientiousness/self regulation: 2.1
- Cognitive abilities: 2.1

Social competency will be hard to replicate by machines and AI.

Diagnostics vs. Empathy:

Sharing economy: Social skills are crucial because of continuous evaluation/feedback.

Training in social skills should be further emphasized and included in more educations.

Self regulation and dedication will be more important in the second wave of digitization.
The New Education
The relationship between education and work is challenged by high pace of technological change

**Workforce composition changes over time**

**Professions and skills change at a higher pace**

1 out of 3 new jobs created in the US in the last 25 years are jobs **that did not exist before**

Some argue that **65% of elementary school kids today** will end up working with **professions and tasks that do not yet exist**

Skills needs to be more frequently updated than before

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People upgrade skills in parallel with work, rather than interrupting their careers to formally continue education.
Digitization changes how education and skills development take place

From knowledge society to learning society
- Growth in education technology (edtech)

Example: Nanodegrees and micro-courses
- Nano-degree from Udacity
  - Developed in cooperation with corporate partners
  - Guarantees job within 6 months of ended course
- Micro-courses from edX, Coursera and Mozilla Open Badges

Example: Practical experience + targeted online studies
- University of Wisconsin: Bachelors degree through a combination of work experience and targeted online courses → competency-based program
- Target: Minimum 50% of the degrees shall be offered as Flexible Option by December 2019

Estimated market for EdTech in 2020:
$252 billion

Through digitization, skills training can be provided to a broader set of people than before

Complication: Are digital tools applicable for people & countries with lower digital skills?
Digital Skills
Important nuances: Although some countries experience lower digital working skills this doesn’t imply that they are not receptive to digital tools.

<table>
<thead>
<tr>
<th>Digital work skills</th>
<th>Digital communication and information skills</th>
</tr>
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<tbody>
<tr>
<td>Nordic countries on top of the list</td>
<td>Nordic countries below the developing countries</td>
</tr>
</tbody>
</table>

### Proficiency in problem solving in technology-rich environments

<table>
<thead>
<tr>
<th>Country</th>
<th>Level 1 or below</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>(50)</td>
<td>(50)</td>
<td>(50)</td>
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<tr>
<td>Sweden</td>
<td>(50)</td>
<td>(50)</td>
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<tr>
<td>Finland</td>
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<tr>
<td>Netherlands</td>
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<td>Norway</td>
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<td>Denmark</td>
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<tr>
<td>Australia</td>
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<tr>
<td>Singapore</td>
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<tr>
<td>Slovak Republic</td>
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<td>Slovenia</td>
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<td>Ireland</td>
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<td>Poland</td>
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<td>Lithuania</td>
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<td>Chile</td>
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<td>Greece</td>
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<tr>
<td>Turkey</td>
<td>(73)</td>
<td>(73)</td>
<td>(73)</td>
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</tbody>
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### Usage of smartphone by purpose (2017)

- **Smartphone ownership**: Developed countries – 82%, Developing countries – 80% (±3%)
- **Smartphone addiction** (first access within 5 minutes): Developed countries – 50%, Developing countries – 33% (±52%)
- **Access 50+ times in a day**: Developed countries – 29%, Developing countries – 17% (±71%)
- **Payment for a product**: Developed countries – 51%, Developing countries – 30% (±70%)
- **TV on a smartphone**: Developed countries – 42%, Developing countries – 16% (±163%)
- **VR on smartphone**: Developed countries – 50%, Developing countries – 22% (±127%)

Digital tools for skills development should be applicable to a broad set of countries and people.
Digital tools can have significant impact: Several examples of countries ‘leapfrogging’ as effect of new digital tools

**Mobile banking:** Banking for the unbanked

- Launched in 2007
- Today: **30 million users** and available in 10 developing countries

**Mobile payments:** China leading the way

- Leapfrogging over both physical banking and internet banking directly towards mobile banking
- Leapfrogging over card payments directly towards mobile payments

**Final note:** Skills development through the use of digital tools can provide great potential for education and career guidance in the 2nd wave of digitization.
The Digital Society and Digital Competences for the Future

Bjørn Heineman, inFuture
19th of June 2019