Risks and Challenges in Digitisation

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Digitisation is the transformation from analog to digital or digital representation of a physical item with the goal to digitise and automate processes or workflows.

Digitalisation means the use of digital technologies and of data in order to create revenue, improve business, replace/transform business processes and create an environment for digital business, whereby digital information is at the core.

Digital Transformation is the novel use of digital technology to solve traditional problems. These digital solutions enable inherently new types of innovation and creativity, rather than simply enhance and support traditional methods.

Source:
https://www.i-scoop.eu/digitization-digitalization-digital-transformation-disruption
The Digital Strategy of the German Government

5 Fields of Action

1. Digital Skills
2. Infrastructure and Equipment
3. Innovation & Digital Transformation
4. Society in Digital Change
5. Modern State

The German government wants everybody to be able to make use of the opportunities afforded by digitalisation. They are to play an active and self-reliant part in shaping digital change and are to be enabled to deal responsibly with the risks involved. To this end more services are to be made available across the boards and the education system is to be geared even more to digital technology in everyday life, to the digital working and economic world and to the digital knowledge society.

Teacher creates handwriting exercises, storytelling or exercises to support a more fluent writing style

Scientific Goals:

- Statistical analysis of writing speed, angle pressure
- Longterm goal: Digital support system for diagnosis and treatment of reading/writing disabilities

Contact: Prof. Dr. Gerald Pirkl, OTH Amberg-Weiden, Email: g.pirkl@oth-aw.de
Medical Training – Basic CPR
(Cardiovascular resuscitation) training for nurses using smartwatch or mixed reality systems (Hololens)

Gather deeper insights in physical experiments: how does a resistor influence voltage and current (Ohm’s law)?

Contact: Prof. Dr. Gerald Pirkl, OTH Amberg-Weiden, Email: g.pirkl@oth-aw.de
Effective infrastructure is the lifeblood of our society, particularly digital networks. Without them the people, private companies and public authorities will not be able to use the advantages of digital change – and they are needed in urban and in rural areas. The aim is for everyone to have a connection – everywhere at all times. The special importance and the vulnerability of digital infrastructure calls for security and special protection.

Average Mobile Internet Connection Speeds

Average Speeds in Mbps

Netherlands: 54.0
Singapore: 50.2
Australia: 48.9
Canada: 44.6
Belgium: 44.2
South Korea: 43.0
New Zealand: 35.6
Sweden: 36.8
Taiwan: 34.9
Hong Kong: 34.7
China: 32.5
Spain: 31.3
Turkey: 32.2
Italy: 30.7
France: 30.5
UK: 27.6
USA: 27.2
Germany: 26.4
Portugal: 24.1
Japan: 23.0
Poland: 22.9
Mexico: 21.7
Vietnam: 20.3
Ireland: 16.7
Russia: 16.4
Morocco: 16.2
Saudi Arabia: 16.0
Malaysia: 15.4
Egypt: 15.1
Kenya: 14.3
Argentina: 13.6
Thailand: 13.5
Nigeria: 10.5
Indonesia: 9.8
Ghana: 9.2
India: 9.1

Sources:
Ookla Speedtest, December 2017. Notes: Figures represent average download speeds.
We are Social and Hootsuite, "Digital in 2018", published on Jan 29, 2018.

© Andreas Aßmuth
Historical Internet Context

2002:
100 GB per second

2007:
2,000 GB per second

2017:
46,600 GB per second

2022:
150,700 GB per second

1992:
100 GB per day

1997:
100 GB per hour

Source: Cisco VNI, 2018.
Global Consumer Internet Traffic

Source: Cisco VNI, 2018.

© Andreas Aßmuth
The force to shape change and create something new is a precondition for underpinning **sustainable prosperity and social cohesion** in Germany, Europe and the world in the long-term. The German government aims to ensure that **technology and innovations are in line with the legal framework** and the values of Germany and Europe. We want to become better at taking excellent technical research and using it to make and market excellent technological products in Germany and in Europe, and to **set international standards** with these.

Industry 4.0

1st
Mechanization, water power, steam power

2nd
Mass production, assembly line, electricity

3rd
Computer and automation

4th
Cyber Physical Systems

Created by Christoph Roser at AllAboutLean.com, Wikimedia Commons, CC BY-SA 4.0
INDUSTRIE 4.0

Networks

Source: https://industrie.de/top/6637/, Image created by IFF Meisterschule.
The Internet of Things: making the most of the Second Digital Revolution

A report by the UK Government Chief Scientific Adviser

Kochbot


Further information: EBRU TV – Folge 46: Youtube Video (German)
mobilegeeks.de, “Kochbot - Cooking App & Automated Kitchen”: Youtube Video (English)

Contact: Prof. Dr. Ulrich Schäfer, OTH Amberg-Weiden, Email: u.schaefer@oth-aw.de
Contact: Prof. Dr. Alfred Höß, OTH Amberg-Weiden, Email: a.hoess@oth-aw.de
Digitalisation needs values. People must be at the heart of all of the government’s considerations and projects – even in the digital era. Whether people are open to digitalisation, or have concerns and fears, or whether they have to date been entirely indifferent to the digital world: digital transformation is to improve the lives of the people. The government aims to bring the country together and move it forward, safely and securely.

## Digital Around the World in 2018

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>7.593 Billion</td>
<td>(+7 %)</td>
</tr>
<tr>
<td>Internet users</td>
<td>4.021 Billion</td>
<td>(+13 %)</td>
</tr>
<tr>
<td>Active social media users</td>
<td>3.196 Billion</td>
<td>(+4 %)</td>
</tr>
<tr>
<td>Unique mobile users</td>
<td>5.135 Billion</td>
<td>(+14 %)</td>
</tr>
<tr>
<td>Active mobile social users</td>
<td>2.958 Billion</td>
<td>(+14 %)</td>
</tr>
</tbody>
</table>

**Sources:** Population: United Nations; US Census Bureau; Internet: Internet Worldstats; ITU; Eurostat; InternetLiveStats; CIA World Factbook; Mideastmedia.org; Facebook; Government officials; Regulatory Authorities; Reputable Media. Social Media and Mobile Social Media: Facebook, Tencent, Vkontakte, Kakao, Naver, Ding, Techrasa, Similarweb, Kepios Analysis. Mobile: GSMA Intelligence; Google; Ericsson; Kepios Analysis. Note: Penetration figures are for total population (all ages).

We are Social and Hootsuite, "Digital in 2018", published on Jan 29, 2018.

**Icons (LTR):** people by Untashable from the Noun Project, Globe by il Capitano from the Noun Project, chat by cathy moser from the Noun Project, Smartphone by Guilhem from the Noun Project, chat by Benny Forsberg from the Noun Project, CC BY 3.0
Social Media Penetration by Country

Monthly Active Accounts on the Top Social Network, Compared To Population

Sources:
Facebook, Tencent, Vkontakte, Kakao, Naver, Ding, Techrasa, Similarweb, Kepios Analysis.

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Authorities should make people and company’s lives easier not more complicated. That is why the German government wants to make dialogue with the authorities, and requests for services simple and secure for everyone. To this end, by the end of 2022, all of the services offered by authorities will be offered online.

1. **Connectivity** – building world-class digital infrastructure for the UK

2. **Digital skills and inclusion** – giving everyone access to the digital skills they need

3. **The digital sectors** – making the UK the best place to start and grow a digital business

4. **The wider economy** – helping every British business become a digital business

5. **A safe and secure cyberspace** – making the UK the safest place in the world to live and work online

6. **Digital government** – maintaining the UK government as a world leader in serving its citizens online

7. **Data** – unlocking the power of data in the UK economy and improving public confidence in its use

*Source: Department for Digital, Culture, Media & Sport and The Rt Hon Karen Bradley MP, "UK Digital Strategy"*
Belief in a Bright Future

The Digitalisation of the UK Automotive Industry

The digital revolution of the automotive industry is already underway. As a result of digitalisation, vehicle manufacturers and suppliers will benefit from increased productivity, greater flexibility and shorter times to market. Customers will also benefit from personalised, higher-quality vehicles.

Source: https://www.smmt.co.uk/reports/the-digitalisation-of-the-uk-automotive-industry/
All in all, Digital Transformation brings people... Germany

<table>
<thead>
<tr>
<th></th>
<th>... more advantages</th>
<th>... more disadvantages</th>
<th>... both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>45 %</td>
<td>8 %</td>
<td>46 %</td>
</tr>
<tr>
<td>Men</td>
<td>49 %</td>
<td>8 %</td>
<td>41 %</td>
</tr>
<tr>
<td>Women</td>
<td>41 %</td>
<td>8 %</td>
<td>50 %</td>
</tr>
<tr>
<td>18 to 29 years</td>
<td>67 %</td>
<td>5 %</td>
<td>29 %</td>
</tr>
<tr>
<td>30 to 44 years</td>
<td>51 %</td>
<td>5 %</td>
<td>43 %</td>
</tr>
<tr>
<td>45 to 59 years</td>
<td>37 %</td>
<td>6 %</td>
<td>55 %</td>
</tr>
<tr>
<td>60 years and older</td>
<td>37 %</td>
<td>12 %</td>
<td>48 %</td>
</tr>
<tr>
<td>General secondary school</td>
<td>33 %</td>
<td>8 %</td>
<td>56 %</td>
</tr>
<tr>
<td>Intermediate secondary school</td>
<td>46 %</td>
<td>9 %</td>
<td>44 %</td>
</tr>
<tr>
<td>High school or university</td>
<td>55 %</td>
<td>7 %</td>
<td>38 %</td>
</tr>
</tbody>
</table>

Can Digital Technology Make the World a Better Place?

Based on a survey of 20,000 people from 10 countries conducted in the summer of 2017.

Source: www.statista.com, Dentsu Aegis Network
Digital Optimism?

Percentage of the population that believes that new technologies offer more opportunities than risks

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>80%</td>
</tr>
<tr>
<td>India</td>
<td>79%</td>
</tr>
<tr>
<td>UAE</td>
<td>76%</td>
</tr>
<tr>
<td>Morocco</td>
<td>74%</td>
</tr>
<tr>
<td>Philippines</td>
<td>74%</td>
</tr>
<tr>
<td>Kenya</td>
<td>72%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>71%</td>
</tr>
<tr>
<td>Turkey</td>
<td>70%</td>
</tr>
<tr>
<td>Argentina</td>
<td>68%</td>
</tr>
<tr>
<td>Thailand</td>
<td>68%</td>
</tr>
<tr>
<td>South Africa</td>
<td>66%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>65%</td>
</tr>
<tr>
<td>Singapore</td>
<td>62%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>61%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>61%</td>
</tr>
<tr>
<td>Ireland</td>
<td>60%</td>
</tr>
<tr>
<td>Australia</td>
<td>58%</td>
</tr>
<tr>
<td>Brazil</td>
<td>58%</td>
</tr>
<tr>
<td>China</td>
<td>58%</td>
</tr>
<tr>
<td>Sweden</td>
<td>57%</td>
</tr>
<tr>
<td>Mexico</td>
<td>57%</td>
</tr>
<tr>
<td>Spain</td>
<td>57%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>56%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>56%</td>
</tr>
<tr>
<td>UK</td>
<td>54%</td>
</tr>
<tr>
<td>USA</td>
<td>54%</td>
</tr>
<tr>
<td>Italy</td>
<td>53%</td>
</tr>
<tr>
<td>Portugal</td>
<td>52%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>49%</td>
</tr>
<tr>
<td>Canada</td>
<td>48%</td>
</tr>
<tr>
<td>Russia</td>
<td>48%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>46%</td>
</tr>
<tr>
<td>Japan</td>
<td>44%</td>
</tr>
<tr>
<td>South Korea</td>
<td>43%</td>
</tr>
<tr>
<td>France</td>
<td>41%</td>
</tr>
<tr>
<td>Poland</td>
<td>41%</td>
</tr>
<tr>
<td>Belgium</td>
<td>38%</td>
</tr>
<tr>
<td>Germany</td>
<td>37%</td>
</tr>
</tbody>
</table>

Sources:
Google Consumer Barometer, January 2018.

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Economic Growth, Digitisation and Life Satisfaction Germany

Data:
GDP per capita – Federal Statistical Office of Germany (Statistisches Bundesamt)
Risks and Challenges

Digitisation

- Energy and Resources
- Recycling of Electronic Waste
- Society, Education and Employment
- Privacy
- Security
Global M2M Traffic Growth

Source: Cisco VNI, 2018.
Self-driving cars ... are data-intensive cars

- **Radar**
  - approx. 10 \ldots 100 \text{ kB/s}

- **Sonar**
  - approx. 10 \ldots 100 \text{ kB/s}

- **GPS**
  - approx. 50 \text{ kB/s}

- **Cameras**
  - approx. 20 \ldots 40 \text{ MB/s}

- **Lidar**
  - approx. 10 \ldots 70 \text{ MB/s}

- *up to 4,000 GB per day*

Figure adapted from S. Lange and T. Santarius, "Smarte grüne Welt? Digitalisierung zwischen Überwachung, Konsum und Nachhaltigkeit", p. 69, Oekom, Munich, 2018.
CT Electricity Expected Case Scenario

Data:
Since 2007 (first iPhone)...

38,000 t Co 107,000 t Cu 157,000 t Al

... were used for the production of smartphones.


Periodic table of elements created by Siyavula Education, Flickr, CC BY 2.0

© Andreas Aßmuth
Electronic Waste

Images (LTR): George Hotelling, Wikimedia Commons, CC BY-SA 2.0; Ondřej Martin Mach, Wikimedia Commons, CC BY-SA 3.0; BRS MEAS, Flickr, CC BY-NC-SA 2.0; pxhere.com, CC Public Domain
Living at the Expense of the Next Generations

Earth Overshoot Day
1969-2018

Source: Global Footprint Network National Footprint Accounts 2018

Created by Footprint123, Wikimedia Commons, CC BY-SA 4.0

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Possible Solutions

- Energy???
- Use of digitisation technologies to achieve sustainability
- Modular design of devices
- Circular economy for recyclable materials
- Ecological mining and production techniques
- Fair trade and participation

Fairphone 2 (top): Created by Fairphone, Wikimedia Commons, CC BY-SA 2.0
Shift 6m (bottom): Created by Joschka Althoff, Wikimedia Commons, CC BY-SA 4.0

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Find the solutions of the following equation:

\[ x^2 - x - 2 = 0 . \]

- □ \( x = 1 \)
- □ \( x = -1 \)
- □ \( x = 2 \)
- □ \( x = 5 \)
- □ There are no real solutions for this quadratic equation.
There is no royal way to knowledge!
Income Inequality Gini Measure, mid-1980s and 2013

Surveillance … some years ago…

Sources: Federal Commissioner for the Records of the State Security Service of the former German Democratic Republic, BStU, MfS, HAVI, Fo, Nr. 313, Bild 4 and BStU, MfS, HAVI, Fo, Nr. 313, Bild 78.
Surveillance ... today...

... and many more!

... and many more!
“We also need to start a social debate about data being the resource of the future and that the principle of data economy, which was once imposed by the Federal Constitutional Court, no longer meets the demands of today’s businesses. Data must be processed to new products. Those, who don’t participate in this type of business, will not be able to create new jobs of the future.”

Source and original statement (German): Dietmar Neuerer, "Datensparsamkeit gefährdet unseren Wohlstand", handelsblatt.com, 2016-11-02.

Photo by Sandro Halank, Wikimedia Commons, CC BY-SA 3.0
Human rights laws will be changed “if they get in the way” of the country’s fight against terror.


Photo by UK Home Office, Wikimedia Commons, CC BY-SA 2.0
Internet Bill of Rights

You should have the right:

(1) To have access to and knowledge of all collection and uses of personal data by companies;
(2) To opt-in consent to the collection of personal data by any party and to the sharing of personal data with a third party;
(3) Where context appropriate and with a fair process, to obtain, correct, or delete personal data controlled by any company and to have those requests honored by third parties;
(9) Not to be unfairly discriminated against or exploited based on your personal data; and
(10) To have an entity that collects your personal data have reasonable business practices and accountability to protect your privacy.


© Andreas Aßmuth
Article 1  Human dignity shall remain inviolable in the digital age. Human dignity must be respected and safeguarded. No technological development may be allowed to encroach upon it.

Article 2  Every person has the right to freedom of information and communication. This includes the personal right not to know.

...  

Article 7  (1) Every person has the right to the protection of his or her data and the right to privacy.

...  

(5) Every person has the right to a home life free from surveillance.
(6) Every person has the right to take suitable measures to protect his or her data and communications from third-party access.
(7) There may be no acts of unjustified and unauthorized surveillance.

...  

...  

Further information: https://digitalcharta.eu/
<table>
<thead>
<tr>
<th>Risk</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Business interruption</td>
<td>37 %</td>
<td>42 %</td>
</tr>
<tr>
<td>2 Cyber incidents</td>
<td>37 %</td>
<td>40 %</td>
</tr>
<tr>
<td>3 Natural catastrophes</td>
<td>28 %</td>
<td>30 %</td>
</tr>
<tr>
<td>4 Changes in legislation and regulation</td>
<td>27 %</td>
<td>21 %</td>
</tr>
<tr>
<td>5 Market developments</td>
<td>23 %</td>
<td>22 %</td>
</tr>
<tr>
<td>6 Fire, explosion</td>
<td>19 %</td>
<td>20 %</td>
</tr>
<tr>
<td>7 New technologies</td>
<td>19 %</td>
<td>15 %</td>
</tr>
<tr>
<td>8 Climate change/increasing volatility of weather</td>
<td>13 %</td>
<td>10 %</td>
</tr>
<tr>
<td>9 Loss of reputation or brand value</td>
<td>13 %</td>
<td>13 %</td>
</tr>
<tr>
<td>10 Shortage of skilled workforce</td>
<td>NEW 9 %</td>
<td></td>
</tr>
</tbody>
</table>

Controlling a Machine via HMI

Remote Maintenance over the Internet Explorer

Internet Explorer 6.0 SP1 or higher is required for remote maintenance. For further information, refer to the service downloads.

Service Downloads

Java Update

Remote maintenance of SIMATIC HMI systems is possible using the Internet Explorer. This requires a Java Applet plugin that is installed automatically by the relevant HMI systems and started in the Internet Explorer.

For optimum access to the HMI systems, we recommend that you install the latest Java Runtime Environment (JRE)™ from Sun Microsystems. The Java Runtime Environment (JRE)™ includes the Java plug-in components necessary to run Java applets in your Internet Explorer.

The current version can be downloaded at www.java.com.

Write2Client Application

This program allows remote functionality for "remote maintenance over the Internet Explorer". The program is available on WACO's flexible (COD) SupportServer (Client) and can be run as a separate application on your computer.

In addition to the server, this application also displays the layout of the HMI system requiring maintenance. The advantage here is the additional access to the locally available softkeys and function keys of the SIMATIC Panel.

This site contains hyperlinks to the web pages of third parties. Siemens shall have no liability for the content of such web pages and does not make representations about or endorse such web pages or their content. As such, Siemens does not control the information on such web pages and is not responsible for the content and information given therein. The use of such web pages shall be at the sole risk of the User.
Smart Homes in the Real World Snapshot (10th August 2017)

1358

135

63

1349

92

HTTP

HTTPS

© Andreas Aßmuth
Smart Homes in the Real World

Bad Configuration

status of windows shutter contacts
### Smart Homes in the Real World: Bad Configuration

#### Lock, Unlock or Open Entrance Door

<table>
<thead>
<tr>
<th>Name</th>
<th>Gewerk</th>
<th>Letzte Änderung</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flur Keller 2</td>
<td>Filter</td>
<td>Filter</td>
<td></td>
</tr>
<tr>
<td>Flur OG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hauseingang</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heizungsraum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klingel: 1</td>
<td>Sicherheit</td>
<td>11:18:38</td>
<td>Aus, Ein</td>
</tr>
<tr>
<td>Klingeltaster: 1</td>
<td>Taster</td>
<td>09.08.2017 11:18:09</td>
<td>Offen, Verschlossen</td>
</tr>
<tr>
<td>Taster Haustür schließen</td>
<td>Taster</td>
<td></td>
<td>Kurzer Tastendruck, Langer Tastendruck</td>
</tr>
<tr>
<td>HM-Sc-Key KEQ00856661:1</td>
<td>Verschluss</td>
<td>10.08.2017 05:41:58</td>
<td>Zu, Auf, Tür öffnen, Zustand unbestimmt</td>
</tr>
</tbody>
</table>
**Smart Homes in the Real World**

**Bad Configuration**

Admin password not set, automatic login

<table>
<thead>
<tr>
<th>Benutzername</th>
<th>Kennwort</th>
<th>Recht mit Anmeldung</th>
<th>Berechtigung</th>
<th>E-Mail</th>
<th>Telefonnummer</th>
<th>Automatisches Anmelden</th>
<th>Aktion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>nicht gesetzt</td>
<td></td>
<td>Administrator</td>
<td></td>
<td></td>
<td>aktiv</td>
<td></td>
</tr>
<tr>
<td>Katrin</td>
<td>nicht gesetzt</td>
<td></td>
<td>Benutzer</td>
<td>...</td>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

personal details
Attack Platform and Tools

USB DVB-T SDR Dongle
RTL2832U+R820T2
15 €

YARD Stick One
120 €

HackRF One
290 €
Smart Homes in the Real World Lab Setup

- Wireless switch actuator
- USB dongle
- Central control unit
- Wireless motion detector
- Wireless door lock actuator
- Wireless siren with signal light
BidCoS = Bi**di**rectional Co**mmunication** Standard

Further reading: http://www.uni-saarland.de/fileadmin/user_upload/Professoren/fr11_ProfSorge/Paper-Downloads/WiSec-2014.pdf
Many Smart Homes still use the default AES key!!

Further details: https://blog.ploetzli.ch/2015/on-the-security-of-aes-[
https://git.zerfleddert.de/hmcfgusb/AES/

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Technology is great!! (I know.)

There needs to be more than just technology to tackle these risks and challenges!
The future depends on what we do in the present.

Mahatma Gandhi
Prof. Dr. Andreas Aßmuth
Professor of Computer Networks and Mathematics

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Department of Electrical Engineering, Media and Computer Science

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Email: a.assmuth@oth-aw.de
PGP: 0xCF2E1A6
Web: https://www.andreas-assmuth.de

https://www.oth-aw.de