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# Artificial Intelligence: Change in Business Models, Workforce and Legal Aspects

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# Table of Contents

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## List of Abbreviations

| | |
|---|---|
| AI.. | Artificial Intelligence |
| AR.. | Augmented Reality |
| ANN.. | Artificial Neural Network |
| BEPS.. | Base Erosion and Profit Shifting |
| DL.. | Deep Learning |
| GDPR.. | General Data Protection Regulation |
| HUD.. | Head-Up Display |
| IR.. | Image Recognition |
| ML.. | Machine Learning |
| MT.. | Machine Translation |
| NLU.. | Natural Language Understanding |

*"It's not what Isaac Asimov promised, but Artificial Intelligence is here"*[1]

[1] Weaver, 2013, p. 3

# 1. Preface

Zurich-based futurologist *Lars Thomson* predicts the end of the Industrial Age. Artificial intelligence, according to Thomson, will change our lives more drastically than the invention of the steam engine in its time.[2]

The *Stanford University* research team led by *Peter Stone* is convinced that by the year 2030, artificial intelligence will have permanently changed our lives, particularly in the fields of medicine, elderly care, mobility, retail, as well as in agriculture and industry.[3]

The *McKinsey Global Institute* estimates that US $20 billion to US $30 billion was invested in artificial intelligence systems in 2016, with 90% of this amount going towards development.[4]

In military technology, the development of autonomous weapon systems is well advanced. Nursing robots are another area that has seen considerable development. Similarly, in the financial sector, we find computer systems that are capable of making purchasing decisions for clients. [5]

Translation software and image recognition software have evolved noticeably thanks to self-learning algorithms.[6]

Speech-based assistance systems such as *Siri* and *Alexa* have found their way into our daily lives.[7]

Autonomous driving is familiar in the media, and the automobile industry is preparing for upcoming changes.[8]

Existing boundaries between industries will change or even disappear.[9]

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[2] Thomson, 2017

[3] Stone, et al., 2016, p. 4

[4] Bughin, et al., 2017, p. 6

[5] Wallach & Allen, 2010, pp. 13-24; Skilton & Hovsepian, 2018, p. XXXIII; Burgess, 2018, p. 78

[6] Barfield, 2015, p. 88; Algorithmwatch, 2017, p. 2; Hellebrand, 2017, p. 105

[7] Brynjolfsson & McAfee, 2011, p. 3; Blum, 2018, p. 26; Coval, 2018, p. 8

[8] Hengstler, et al., 2016, p. 105; Lin, et al., 2017, p. ix

[9] Porter & Heppelmann, 2014, pp. 12-13

This change is not just apparent in the worlds of work and leisure. Rather, a change is emerging that encompasses our social order as we know it today. It does not matter if one sees an opportunity in this change and faces it openly or if they see a threat in it – the change is real.[10]

In addition to the emerging changes in technology, business models are also changing. These changes have implications for the law as well. Our legal systems allow us to regulate our business relationships and our communal lives. This work will therefore focus on these issues. How will artificial intelligence change proven business models and what are the legal implications of the utilization of Artificial Intelligence?

The objective of the present work is not to assess opportunities and risks. It is not to make reliable predictions. It is also not to assess the ethical consequences such as those within society.

For this purpose, it will be explained in the beginning what Artificial Intelligence is and what systems have emerged in this context. Thereafter, application examples are shown. Based on this, effects on business models and business strategies are explained. Another section discusses possible effects on the world of work, and finally, the legal consequences of Artificial Intelligence are discussed.

Alongside to Artificial Intelligence, many terms are used in literature, the media, and public debate that are either part of the overall context or which have certain characteristics that show them to be similar to Artificial Intelligence. It is thus useful to begin by putting a few terms into context.

## 1.1. Defining Artificial Intelligence (AI)?

*John McCarthy* describes AI as a field of research aimed at creating intelligent machines, especially intelligent computer programs. However, it is clearly distinguished from human intelligence, without giving an ultimate

[10] Goldman Sachs, 2015, pp. 2-6; Bughin, et al., 2016, pp. 1-3; Bostrom , 2017, p. 135

definition of AI: „[...] *we cannot yet characterize in generell what kind of computational procedures we want to call intelligent*“.[11]

*Stephen Omohundro* identified AI as a system that aims at goals and strives to achieve those goals through interaction with its environment.[12]

Autonomous action, the recognition of the environment, continuous operation, the ability to adapt to a changed environment, as well as the pursuit of a predefined goal – this sums up the description given by *Russell & Norvig*.[13]

Generally, AI is to be understood as an automated, rule-based and normative system. It works by correlating the norms it is given with the experience it gathers.[14]

There is always an interaction between the system and its environment. The system collects data, i.e. feedback, from its environment. Over time, this means that with increasing environmental feedback, the system becomes more accurate in the achievement of its objectives. Thus, it becomes more reliable, as the name indicates: more "intelligent". A changing environment ultimately leads to the autonomous adaptation of the system to its changed environment, leaving the normatively specified objective unaffected. The activity of an AI system is thus based on its programming on the one hand, but above all on the data it acquires. This makes up the essential difference compared to conventional automated systems. Conventional systems only function within their programmed parameters. AI, on the other hand, expands its original programming using empirical methods, which has an impact on future actions. In addition, AI reacts to changing environmental conditions.

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[11] McCarthy, 2007, p. 2

[12] Omohundro, 2008, p. 1

[13] Russell & Norvig, 2016, pp. 1-5

[14] Algorithmwatch, 2017, p. 3

This expansion of original programming can also be described as a cognitive ability. An AI system is capable of categorizing cause and effect, on which it bases future actions.[15]

In addition to the features of AI characterized above, it should be noted that the term AI is widely used, and that even in scientific literature, the use of the term AI is not always based on the features discussed here.[16]

"*Artificial intelligence is the umbrella term for the entire field of programming computers to solve problems. […] "AI" can be used so broadly as to be almost meaningless, in part because the scope of the phrase is constantly evolving.*"[17]

### 1.1.1. Machine Learning (ML)

An important area in the context of AI is ML. In general, ML is a system that automatically improves itself based on collected data.[18]

ML does not fulfil the characteristics of autonomous action or the pursuit of a specific goal. Nor does an ML system have the ability to adapt actions to a changing environment. The lack of these features is what distinguishes AI from ML.[19]

There is a broad field of application for ML. For example, data mining programs are used to detect fraudulent credit card transactions. Programs, particularly web-based ones, which display content to users based on their preferences, are also widely used.[20]

A good example for understanding ML is the comparison to a learning child. Children receive continuous feedback about what is right and what is wrong. The same goes for an ML system. Based on feedback, further development takes place; in the case of an ML system, optimization. However, in the

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[15] Cohen & Feigenbaum, 2014, pp. 6-7; Etlinger, 2017a, p. 5

[16] Guihot, et al., 2017, pp. 394-395

[17] Daly, 2017

[18] Mitchell, 1997, p. XV; Stone, et al., 2016, p. 12; Mitchell, et al., 2018, p. 103

[19] Guihot, et al., 2017, p. 395; Algorithmwatch, 2017, p. 3; Burgess, 2018, pp. 19-20

[20] Mitchell, 1997, p. XV; Wilson & Daugherty, 2018; p. 120

course of a child's development, he/she learns how to learn and to think critically about external impressions. This exceeds the capability of an ML system.[21]

### 1.1.2. Artificial Neural Networks (ANN)

As an enhanced variation of ML a ANN can be understood as a group of individual algorithms or programs. Each specializes in a specific, relatively simple task. Working in parallel, a ANN can handle complex tasks quickly and efficiently.[22]

An ANN is useful if the evaluation of a very large amount of data leads to an assessable number of evaluation results. The evaluation is split into individual tasks, processed in parallel, and finally merged into one result.[23]

Typical areas of application include text recognition as well as image and facial recognition.[24]

There is an abundance of ANN applications in industry. Sensor data is collected during the time in which a facility, a machine, or a vehicle operates. If the distribution of the recorded data suddenly changes, this might be an indication of an impending malfunction. This method, as is the case in the field of facial recognition, is called pattern recognition.[25]

### 1.1.3. Deep Learning (DL)

Deep learning is a type of ML too. In deep learning, an ANN is created in several layers. There is usually a layer for input signals and a layer for output signals, with additional layers created between them. This results in the creation of an ANN, which processes various tasks across several levels.[26]

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[21] Daly, 2017

[22] Gurney, 1997, pp. 12-16; Burgess, 2018, pp. 20-22

[23] Haykin, 1998, p. 24; Marcus, 2018, p. 5

[24] Vincent, 1995, p. 35; McCarthy, 2007, pp. 8-11; Mitchell, et al., 2018, p. 103

[25] Barfield, 2015, p. 84; Skilton & Hovsepian, 2018, p. 178

[26] Stone, et al., 2016, pp. 8-9; Daly, 2017; Skilton & Hovsepian, 2018, p. 132; Marcus, 2018, p. 3-5

## 1.2. AI: A brief history

Because of the general prevalence of AI in the media, one might conclude that AI was something new. In fact, developments related to AI began soon after World War II. *Alan Turing*, an English mathematician, is repeatedly cited as the first person to study AI. He held lectures on this topic starting in 1947.[27]

The *Massachusetts Institute of Technology* established *CSAIL*, a laboratory for computer science and artificial intelligence, as early as 1959.[28]

In 1975, the development of *MYCIN*, a learning software for the diagnosis of bacterial infections, began.[29]

*NASA* (National Aeronautics and Space Administration) has used *AutoClass II* since 1989, a program that independently classified newly discovered stars.[30]

In 1997, *Deep Blue*, a self-learning chess program developed by *IBM*, defeated multiple world champion *Garry Kasparov*.[31]

An algorithm known as *Amabot* was used to automate part of the *Amazon* website in 2002. Previously, customer recommendations were processed manually. In a test series, it was proven that *Amabot's* sales recommendations were more successful compared to its human counterparts.[32]

In 2011, *Apple* launched its self-learning voice assistant *Siri*.[33]

Finally, in the spring of 2016, *AlphaGo*, a software developed by *Google*, defeated the South Korean winner of numerous international championships, *Lee Sedol*, in the traditional Asian strategy game *Go*. What was especially

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[27] McCarthy, 2007, p.4; Etlinger, 2017a, p. 6; Skilton & Hovsepian, 2018, p. 33

[28] Rus, 2018

[29] Melle, 1978, p. 314; McCarthy, 2007, p. 11

[30] Cheeseman, et al., 1988, p. 54; Mitchell, 1997, p. 3

[31] Roosa, 2009, p. 2; Barfield, 2015, p. 63; Stone, et al., 2016, p. 13; Burgess, 2018, p. 42

[32] Stone, 2013, p. 157

[33] Weaver, 2013, pp. 5-8

remarkable was the way in which *AlphaGo* won. *Lee Sedol* was repeatedly surprised by moves that would not have been expected in that manner by a human opponent.[34]

Parallel to these developments, the economic world has also changed. In the 1950s, in classic manufacturing companies, processes were still restricted to largely manual, if needed be machine-supported procedures. Documentation was done on paper. In the 1970s, information technology successively automated individual steps of the process along the value chain. ERP systems emerged, in addition to semi-automated manufacturing systems, and CAD replaced conventional technical drawing.[35]

Another fundamental change took place in the 1990s with the Internet. New opportunities for networking and communication permanently changed corporate processes. Suppliers and customers could be integrated more closely into the value chain. The process of globalization increased enormously.[36]

These two changes, through the implementation of information technology, have resulted in a significant boost in productivity that has taken hold in all sectors of the economy.[37]

A look at recent history shows how specific AI applications have gradually emerged and how corporate processes have changed simultaneously. Even though certain individual AI applications are not yet practicable, they continue to be developed. It seems reasonable to suppose that AI systems will soon infiltrate corporate processes and that AI applications will permeate our private lives at the same time.[38]

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[34] Stone, et al., 2016, p. 15; Corea, 2017, p. 25; Guihot, et al., 2017, pp. 402-403

[35] Porter, 1986, pp. 35-36

[36] Porter, 2001, pp. 70-71

[37] Brynjolfsson & McAfee, 2011, p. 34; Porter & Heppelmann, 2014, p. 4; Schallmo & Williams, 2018, p. 4

[38] Brynjolfsson & McAfee, 2011, p. 6; Sirkin, et al., 2015, pp. 6-7; Ford, 2015, pp. 6-8

"*Artificial intelligence is poised to unleash the next wave of digital disruption, and companies should prepare for it now.*"[39]

As described, AI has been a topic of science since the 1940s, since the 1950s at the latest. Then why are we experiencing an AI hype now, in the present?

## 1.3. AI: Why now?

The literature mentions various issues driving the development of AI. Repeatedly mentioned is the available volume of data, cheap storage space, faster processors and connectivity.[40]

The miniaturization of technology and the energy efficiency of sensors and batteries are also mentioned.[41]

"*The substantial progress made over the last decade in the capabilities and cost of parallel computing, algorithms, big data and the move to the cloud is set to bring artificial intelligence out of labs and into the real, mainstream world.*"[42]

Thus there are many technological developments taking place at the same time. This makes AI useful and profitable in its application.[43]

Let us then take a brief, closer look at important developments.

### 1.3.1. The Meaning of Big Data

For the autonomous and continuous development of an AI system, the availability of data is essential.[44]

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[39] Bughin, et al., 2017, p. 6; also see Deburba & Neurohr, 2015, p. 9

[40] Zott & Amit, 2017, p. 19; Burgess, 2018, pp. 12-18

[41] Porter & Heppelmann, 2014, p. 6

[42] Goldman Sachs, 2015, p. 1

[43] Porter & Heppelmann, 2014, p. 6

[44] Goldman Sachs, 2015, p. 17; Etlinger, 2017a, p. 18; Burgess, 2018, p. 13

With *Google*, about 3.5 billion search queries are made daily. These search queries are stored and compared. In this way, *Google* enables its search engine to suggest alternative ways to write the search term to the user.[45]

But data analytics also helps companies other than *Google* to better understand their products and services.[46]

*Ocado*, a grocery retailer in the UK, processes around 100 terabytes of data to run its business. Data analysis includes many things, from optimizing delivery routes to predicting what consumers will order. Procurement decisions are made based on the latter.[47]

In Big Data, an important role is played by cloud services. Storing data in a cloud also allows data to be consolidated from different sources. This allows companies offering products and services to collect and consolidate data from their systems operating around the world.[48]

Because of these potentials, the development of a Big Data application is often a company's first point of contact with the fundamentals of AI.[49]

The possibility of collecting and comparing data is therefore a major driver of AI systems. Companies like *Google* did not originate as Big Data companies. In the meantime, however, they generated significant revenue with intelligent software based on their data.[50]

### 1.3.2. The Meaning of Cheap Storage

We have seen that large amounts of data play a significant role in the development of many AI systems. These mass quantities of data must be stored.

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[45] Burgess, 2018, pp. 13-14

[46] Porter & Heppelmann, 2014, p. 7

[47] Bughin, et al., 2016, p. 4

[48] Porter & Heppelmann, 2014, pp. 5-6; Burgess, 2018, pp. 18-19

[49] Lee, et al., 2015, pp. 3-4; Bughin, et al., 2017, p. 14

[50] Moser & Gassmann, 2016, p. 6; Wåge & Crawford, 2017, p. 2; Burgess, 2018, p. 15

In 1980, one had to pay more than US $400,000 for a storage capacity of 1 GB. In 1990, it was still more than US $10,000. In 2010, it was only US $0.09.[51]

The technological development of storage media and the associated price decline are needed to allow large amounts of data to be stored efficiently. This facilitates the handling of Big Data described before and is thus a significant driver of AI development.

### 1.3.3. The Meaning of Faster Processors

Beside the availability and storage of large amounts of data, the data also needs to be processed. Many AI systems depend on quickly delivering the results of calculations. Autonomous vehicles, for example, need to process a large amount of sensor data in real time and react immediately.[52]

In addition to the classic CPU (Central Processing Unit) and the radical advancement it has seen in recent decades, special processors have become established for particular AI applications. An example is the GPU (Graphical Processing Unit). This chipset is particularly suitable for the rapid parallel processing of calculations, as required in an ANN.[53]

### 1.3.4. The Meaning of Connectivity

Large amounts of data, low-cost storage space, and the ability to process data very quickly – these features are now complemented by accessibility, regardless of location.

Nowadays, broadband networks and the expansion of wireless networks allow large volumes of data to be exchanged between servers and end devices.[54]

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[51] Burgess, 2018, p. 16

[52] Burgess, 2018, p. 17

[53] Stone, et al., 2016, p. 15; Bughin, et al., 2017, p. 9; Skilton & Hovsepian, 2018, p. 34

[54] Bughin, et al., 2016, p. 12; Burgess, 2018, p. 17

This does not only apply to smartphone applications. Autonomous vehicles are constantly connected to servers, which allows for route optimization among other operations.[55]

Industrial applications such as condition monitoring of devices, machines, and systems are also dependent on connectivity.[56]

## 1.4. Current capabilities of AI

In section 1.1 it was emphasized that many different technologies are summarized and grouped together under the umbrella term of AI. It therefore seems useful to summarize the possibilities of today's AI. This summary can be made according to technological as well as functional aspects.

Technologically, today's AI systems are capable of the following activities/tasks:[57]

- Collecting and processing data and sensor signals.
- Classifying, combining, learning, and predicting possible future outcomes.
- Interacting with people or with the environment in general.

Also, in terms of their function, current AI systems can be roughly differentiated between:[58]

- Systems with the function of visual, spatial, or acoustic analysis. Examples include facial recognition, image recognition or the recognition and classification of emotions.
- Systems with the function of moving and/or manipulating objects in their environment. Typical applications for this are robots and robotic systems or autonomous vehicles, for example.
- Auditory and linguistic systems with the function of hearing and communicating vocally or via written text. The previously mentioned

[55] Goldman Sachs, 2015, p. 5; Stone, et al., 2016, p. 18

[56] Porter & Heppelmann, 2014, pp. 12-13; Bughin, et al., 2016, p. 14

[57] Etlinger, 2017a, p. 5

[58] Etlinger, 2017a, p. 5; Schallmo & Williams, 2018, p. 55

assistance systems *Siri* and *Alexa*, as well as mechanical translation are examples of this functional area.

Similarly, *Skilton & Hovsepian* classify the capabilities of today's AI applications into four categories: perception, learning, natural language processing, and reasoning.[59]

With these findings, we now take a look at the application of AI in real life.

[59] Skilton & Hovsepian, 2018, p. 80

# 2. Applied AI in different Businesses

The range of applications and solutions in which AI can be employed is broad and quite eclectic. Moreover, certain applications that are counted as AI have nothing to do with AI in its original sense – self-learning and pursuing a goal – or the connection is merely contingent. Both of these were discussed in Chapter 1.

This chapter will provide an overview of the status quo with regard to the use of AI, identifying numerous examples of how AI is used in various industrial sectors. This should make it readily apparent just how widespread AI has become in recent years. At the same time, this chapter will provide a basis for subsequently evaluating the effects of AI on business models, its effect on the world of work and on the legal system.

In a certain sense, ML is mother to an extremely broad range of AI applications, which is why this chapter will begin by discussing this technology. The discussion will then move on to chatbots and intelligent agents, image recognition, augmented and virtual reality, driverless cars, and drones, in addition to robots and robotic systems.

## 2.1. Machine Learning Algorithms

ML is employed in a wide variety of cases, mostly with the objective of producing a recommendation or a prediction.[60]

Companies like *Amazon* and *Netflix* enhance their customer service experience using individualized recommendations based on user behavior. Every search, every purchase is recorded, influencing the assessment of what might appeal to the user. This allows additional revenue to be generated and reinforces customer loyalty.[61]

In certain cases, the data available for this is complemented by information acquired by targeted questions. The clothing retailer *Stitch Fix* bills itself as

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[60] Stone, et al., 2016, p. 35; Etlinger, 2017a, p. 10; Mitchell, et al., 2018, p. 103

[61] Conick, 2016, p. 29; Burgess, 2018, p. 76

“your partner in personal style”. In order to optimize the quality of its recommendations, *Stitch Fix* asks users for their clothing size, style preferences, and access to their *Pinterest Board*. This information builds upon the data collected from user behavior on the *Stitch Fix* website. ML algorithms are then able to optimize their suggestion-making routine. In addition to the sales end, these algorithms are also used to recognize consumer trends early on, influencing the company’s decisions regarding what items to purchase and keep in stock.[62]

*Google* is known for collecting data. With *Google AdWords*, they managed to successfully combine data collection with a mechanism for generating revenue. It allows the display of advertising banners on websites to be optimized based on user information. Every time a user clicks on a web banner, a payment is received from the advertising company.[63]

The *Clydesdale and Yorkshire Banking Group* is a mid-sized bank in the UK. The bank provides an ML-based platform for its customers which generates predictions based on observed user behavior. For example, it will attempt to predict when an account balance is going slip into the red.[64]

One example of ML in industry is *Linde*. *Linde* forklift trucks transmit error codes, times of operation, etc. to a central location, allowing the machines to be serviced more promptly, in some cases even anticipating the necessity.[65]

*General Electric* utilizes ML to optimize the yield of wind turbines. In addition to predictive maintenance like in *Linde’s* case, *GE’s* system also includes numerous other capabilities. It automatically estimates demand on the power grid and sets the wind farm to the appropriate performance level. It also compares current weather data, allowing it to constantly match the amount of power generated to the demand. If a wind farm is unable to meet the

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[62] Ahuja, 2015, p. 3; Lake, 2018, p. 39

[63] Moser & Gassmann, 2016, p. 6; Wåge & Crawford, 2017, p. 2

[64] Burgess, 2018, p. 77

[65] Schallmo & Williams, 2018, p. 2

demand, it can use energy reserves from another wind farm, since all of the turbines are linked to one another in this concept.[66]

Obviously, ML systems hunger for data, and their capacity for continuous development via self-learning, is significantly dependent on a steadily increasing amount of data. Systems that combine data from various sources are at an advantage.[67]

*Matthew Zeiler*, CEO and founder of *Clarifai*, a company that provides AI-based technology for developing various business applications states about the future of ML: "*We're only seeing the tip of the iceberg of what these systems will be able to do.*"[68]

It will be exciting to see which development ML systems will take and which possibilities the cross-linking of these systems opens up.

## 2.2. Chatbots & Intelligent Agents

Another application of AI are Chatbots and Intelligent Assistants. A chatbot is a software program that can hold a conversation with a human being. Depending on the application, the conversation may take place via text or voice simulation. Intelligent or virtual agents are comparable programs, which are able to perform a wide variety of tasks for their users such as reminding them of things they need to do, providing information, or searching for digital documents.[69]

Both chatbots and intelligent agents rely on ML-based natural language understanding (NLU). NLU supplements text and spoken word with inferred meaning.[70]

NLU is also used to recognize emotions.[71]

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[66] General Electric Company, 2016

[67] Li, et al., 2011, pp. 71-72; Schallmo & Williams, 2018, pp. 65-66; Burgess, 2018, p. 56

[68] Tilley, 2017, p. 54

[69] Singh, 2016; Etlinger, 2017b, p. 3; Bennett, 2017, p. 46

[70] Reddy, 2003, p. 84; Korzeniowski, 2017, p. 29; Burgess, 2018, p. 39

[71] Burgess, 2018, p. 40

Chatbots and intelligent agents are being developed in a wide variety of forms for a wide variety of applications. A few have already been released to the public; these include some very sophisticated, mature software programs, but also some that are not very mature.[72]

Large corporations, including *Apple* (*Siri*), *Amazon* (*Alexa*), *Microsoft* (*Cortana*), *Facebook* and *Google*, provide software developers with an API (Application Program Interface), allowing applications to access assistance functions and make use of them.[73]

*Gartner* estimates that, by as early as 2019, 20% of interactions with smartphones will take place via assistance programs.[74]

But the applications of assistance programs are not limited to smartphones. In the field of recruiting, one might imagine intelligent assistants being used to interact with applicants, perhaps for setting appointments or for matching the applicant's profile to the demands of the position. Service requests can likewise be taken over by chatbots. This completely eliminates the issue of limited availability for a call center, since a chatbot is available 24/7 and is also capable of processing several requests at the same time.[75]

In addition to the goal of designing conversation with such programs to be appropriately natural, this form of AI will also be able to adaptively react to human emotions.[76]

In customer service, customer inquiries could be received and, ideally, even replied to – around the clock and independent of office hours or time zones. If the program is unable to answer the inquiry, it might at least be sent along for further processing. Ideally, the whole process could be done in various languages, depending on which language the inquiry was made in.[77]

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[72] Burgess, 2018, p. 74; Blum, 2018, p. 26

[73] Singh, 2016, p. 26; Mitchell, et al., 2018, p. 3

[74] Gartner, 2016; Etlinger, 2017b, p. 4

[75] Singh, 2016, p. 27; Etlinger, 2017b, pp. 6-8

[76] Etlinger, 2017b, p. 13; Keating & Nourbakhsh, 2018, p. 31

[77] Bughin, et al., 2016, p. 42; Korzeniowski, 2017, p. 30

Furthermore, these programs might be able to actively reach out to customers and offer suggestions or provide them with information.[78]

*MasterCard* is following through with plans to offer chatbot services for banks. *KAI* was introduced in 2016 – a bot in the form of a messenger that is meant to make it easier for customers to access financial information and other information on which to base everyday decisions.[79]

Since 2017, *RBS* (*Royal Bank of Scotland*) has operated a chatbot by the name of *Luvo*, based on *IBM's Watson* platform. *Luvo* is used to answer a limited number of customer inquiries. The program has been tested over the course of one year. Over time, *Luvo* is expected to be able to take on more, as well as more complex, inquiries, also on the basis of self-learning algorithms. The primary goal is to automate routine inquiries, leaving the customer service staff with more time to handle more difficult ones.[80]

*SEB*, Sweden's largest bank, provides another example of a chatbot being used in customer service for a bank. *IPsoft*, a US software company, developed a solution for *SEB* based on their own product, *Amelia*. In step one, *Amelia* was implemented for inquiries to *SEB's* internal IT department. Step two saw its expansion to customer service.[81]

The American flower delivery service *1-800-Flowers* implemented a simple chatbot via *Facebook Messenger* that is capable of placing orders. This has allowed *1-800-Flowers* to create a new sales channel. After just two months, 70% of their orders were being made via *Facebook*.[82]

For affordable flights, one may contact *Lufthansa's Mildred*. At *Zalando*, *Emma* offers fashion advice. The city of Vienna operates *WienBot* to respond to questions concerning e-government.[83]

[78] Brynjolfsson & McAfee, 2011, pp. 5, 9-10; Korzeniowski, 2017, p. 30

[79] Mastercard, 2016

[80] Gyton & Jeffery, 2017, p. 26; Burgess, 2018, p. 75

[81] Burgess, 2018, pp. 75-76

[82] Singh, 2016, p. 27; Etlinger, 2017b, p. 2; Bughin, et al., 2017, p. 44

[83] Dürmuth, 2017; Lufthansa, 2018; Magistrat der Stadt Wien, 2018

Whether consumers accept chatbots will depend largely on the function, but also on the naturalness of the interaction between human and machine. The right data, the right use cases, the right design, and also the right cultural context play an important role in this regard.[84]

## 2.3. Image Recognition (IR)

Image recognition is based on ML and requires a large number of reference images in order to function reliably. In turn, this enormous quantity of images requires storage capacity that is likewise as large.[85]

With regard to application, a number of different functions may be differentiated.

In the case of tagging, the objective is to be able to identify the subject of the image. Is it an image of an apple or a pear? Applications for this method include, for example, web platforms that allow users to upload images. Objects in the images need to be recognized so that the image can then be sorted into a category. Images also need to be examined for violent or pornographic content and blocked if necessary.[86]

This principle is now being applied not only to images, but also to videos.[87]

In 2015, *Flickr* became a target of public criticism with a tagging application that was supposed to allocate photos on *Flickr* into different groups. This process did not work completely. For example, some people of black (African) ethnicity were sorted into the "ape" category. Photos showing the entrance to the *Auschwitz* memorial site were tagged with the term "sport". *Flickr* had to take immediate corrective action in order to get themselves out of the public spotlight.[88]

[84] Selwyn, 2003, p. 112; Etlinger, 2017b, p. 4

[85] Simonite, 2016a; Stone, et al., 2016, p. 9; Etlinger, 2017a, p. 7

[86] Tilley, 2017, p. 52; Etlinger, 2017a, p. 7

[87] Simonite, 2015

[88] Hern, 2015; Goldman, 2015

Another application of image recognition is searching for images displaying similar content to a reference image. *Google's* reverse image search is an example of this. When an image is uploaded from a computer, the software searches the web for similar images.[89]

*Pinterest Lens* works on a very similar principle. This program allows the user to take a picture of an object with a smartphone camera; the software searches *Pinterest* for similar objects, which then allows *Pinterest* to offer ideas from other users about what can be done with the object photographed.[90]

In Russia, profile photos on the popular Russian social media platform *VKontakte* are public. This includes profile pictures from over 400 million users. A smartphone app called *FindFace* allows the user to snap photos of people in public places. *FindFace* then compares the photo to those on *VKontakte* and attempts to identify the person photographed. This is certainly disturbing in the context of Western European standards of personality rights and data protection, but it is also another example of the enormous possibilities posed by image recognition.[91]

Finally, it is also possible to search images for differences. This principle is typically used in medicine – the program searches a scan for anomalies such as cancer cells, for example. The reference is made up of scanned images of healthy anatomy.[92]

IR has not been developed very far yet, but several reasonable potential applications can be identified. To a large degree, functionality will depend on the amount of data and the speed of processing.[93]

[89] Burgess, 2018, p. 32

[90] Chaykowski, 2017; Pinterest, 2018

[91] Findface.ru, 2018; VKontakte, 2018

[92] Simonite, 2016b; Suzuki, 2017, pp. 257-258; Ker, et al., 2018, p. 9382

[93] Burgess, 2018, p. 33

## 2.4. Augmented Reality (AR) & Virtual Reality (VR)

AR can be described by three characteristics: it combines the real world with the virtual world, allows interaction in real time, and provides a three-dimensional picture.[94]

Thanks to the large number of recent applications, the definition of AR has also been broadened. Because the potential of AR is far from being exhausted, it is not possible to arrive at an ultimate definition.[95]

A typical example of AR is found in smart glasses. These are glasses with a built-in head-up display (HUD). This display shows personalized information that supports the user by providing a supplement to the real world.[96]

Well-known examples of smart glasses include *Google Glass* and *Microsoft HoloLens*.[97]

The range of applications for AR is decidedly broad in scope. In industry, back in the early 2000s, automobile manufacturers like *Mercedes-Benz* and *Volkswagen* invested in VR centers that allowed for the assembly and optimization of virtual prototypes. Designers move through virtual space, manipulating virtual models. This method of product development has allowed companies to put more products on the market in less time.[98]

Another aspect of this virtual engineering is that it means teams in various locations can work together on a single project in virtual space, allowing for the reduction of travel times and travel costs.[99]

When doing maintenance, a technician can receive instructions on how to perform certain tasks directly on a pair of AR glasses. Likewise, for support.

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[94] Azuma, 1997, p. 3; Craig, 2013, p. 15; Dini & Dalle Mura, 2015, p. 14

[95] Han & Jung, 2018, p. 3

[96] Jenkins, 2006, p. 38

[97] Ro, et al., 2018, p. 169

[98] Jiang, 2011, pp. 173-177, Gausemeier, et al., 2011, pp. 1-2

[99] Roberts, et al., 2003, pp. 644-647

For example, certain components might be highlighted in a particular color or an arrow might indicate in which direction a part needs to be installed.[100]

This principle may also be applied to personal safety. In addition to instructions on how to correctly perform a task, the virtual layer can also provide warnings to help the wearer avoid dangerous situations.[101]

In the field of medical training, AR offers the potential of simulating treatment and procedures, allowing medical professionals to be better prepared to perform these procedures in real life situations.[102]

The goal of developers is to ultimately reach a point where these systems are advanced enough to allow actual operations to be performed within a virtual environment. Once such a system is ready for practical use, the specialist operating will no longer have to be on site.[103]

When this happens, the instruments in the operating room will be wielded by a robotic system.[104]

There are possible applications in the retail sector as well. *IKEA* has had an app developed for mobile phones and tablets that allows users to virtually project pieces of furniture into a photo of their own home. Not only does this feature change the shopping experience – it also changes the point of sale.[105]

*Magic Mirror* is a virtual mirror in the form of a screen located in clothing shops. It allows customers to select articles of clothing digitally and have them superimposed over their own image in the virtual mirror. In the same way, customers can also try out various make-up products.[106]

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[100] Dini & Dalle Mura, 2015, pp. 16-19; Martinetti, et al., 2016, pp. 15-16

[101] Gavish, et al., 2015, p. 782; Dalle Mura, et al., 2016, p. 345; Vignali, et al., 2018, p. 1; Quandt, et al., 2018, p. 1134

[102] Kasurinen, 2017, pp. 347-348; Huang, et al., 2018, pp. 246-247

[103] Wolter, et al., 2011, p. 102

[104] Leenes, et al., 2017, pp. 8-9; Calo, 2011, p. 536

[105] Rese, et al., 2014, pp. 871-872

[106] PM Network, 2017, p. 39

In tourism, there are systems intended to enhance tourist attractions. The head-up display on a pair of glasses overlays historic sites with elements from the era in question, making it easier for the wearer to experience historic places.[107]

The potential of AR in education is significant. Processes can be experienced in three dimensions. The entry into a virtual environment makes it possible to explore things spatially and to make complicated causalities detectable. Learning becomes an experience. An excellent prerequisite for memorizing what someone has learned.[108]

Another aspect of this is the potential for this learning method to become a group experience. This may be done at schools and universities regardless of institutional or national boundaries.[109]

Museums can use virtual elements to appeal to visitors even more.[110]

Finally, the use of AR in the gaming industry is especially interesting. It has been following the trend set by virtual reality for some time now. Developments like *Pokémon GO* indicate the level of attractiveness that AR can achieve in this industry.[111]

AR has the potential to become a part of everyday life. The key for each respective application is content development. Rapid market penetration is especially possible in the fields of education and advertisement. Some AR applications will be created for individuals, others for groups of persons (e.g. in education and entertainment). It is even conceivable that AR might be combined with tactile sensations and smells. Virtual exhibits on display in museums could then also be handled and smelt.[112]

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[107] Westerman, et al., 2011, p. 20; Chung, et al., 2015, p. 588; He, et al., 2018, p. 128;

[108] Fernandez, 2017, p. 4

[109] Chen, et al., 2008, pp. 31-33; Jin, et al., 2010, pp. 143-144

[110] Kuchelmeister, et al., 2009, pp. 1112-1118; Neuburger & Egger, 2018, p. 75;
He, et al., 2018, p. 128

[111] Wingfield & Isaac, 2016; Loveday & Burgess, 2017, p. 17; Rauschnabel, et al., 2017, pp. 283-284

[112] Craig, 2013, p. 265; Serrano, et al., 2016

## 2.5. Driverless Cars & Drones

In both passenger transport and freight transport, enormous investments are being made to promote AI, with the goal of making autonomous driving and autonomous shipping ready for practical use.[113]

Compared to other AI applications, driverless systems and drones are more familiar to the public. The development of these systems is however not as advanced. Nevertheless, various prognoses have been made claiming that this technology will have changed the world around us by 2030.[114]

In addition to the development of this technology, modifications will also have to be made to infrastructure. New transportation systems are expected to appear, as will new means of transport, each of them influencing the other.[115]

The demands that these changes will place on cities and countries will mean that investment decisions have to be taken on a large scale.[116]

*Goldman Sachs* estimates that wealthy regions like Singapore and Qatar will capitalize on this technology very early on.[117]

From a technological point of view, driverless systems are an excellent example of an AI application. A large number of actuators and sensors, robotics, image recognition, machine learning (ML), and, in most cases, virtual assistance are bound together in a single system. This might even be the ultimate AI application.[118]

*Google's* commitment to development in this area is sufficiently well known. A major part of this commitment has been the acquisition of numerous

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[113] Stone, et al., 2016, p. 7; Heilig, et al., 2017, pp. 13-14

[114] Goldman Sachs, 2015, p. 7; Stone, et al., 2016, p. 7; Stocker & Shaheen, 2017, p. 21

[115] Heinrichs, 2015, p. 220; Todorovic, et al., 2017, p. 2336; Berrada & Leurent, 2017, p. 219

[116] Schreurs & Steuwer, 2015, pp. 152-154

[117] Goldman Sachs, 2015, p. 7

[118] Skilton & Hovsepian, 2018, p. 284

technology companies – no less than seven companies in the course of half a year. This has allowed *Google* to pool together the relevant expertise.[119]

Companies like *BMW*, *Tesla*, and *Toyota* invest large amounts of money in the development of robotics and ML that can be adapted for autonomous driving systems. In *Toyota's* case, this includes US $1 billion poured into a relevant field of research.[120]

Several other industrial companies are also investing in ML and robotics – *ABB*, *Bosch*, *GE*, and *Siemens* are just a few examples. The results of these research efforts will also play a role in the development of autonomous driving and transport systems.[121]

A self-driving vehicle must be able to react to the unpredictable. If there are pedestrians crossing the street, the vehicle needs to be able to react on its own. The same goes for drones: if a drone is ordered to a certain location, unforeseen circumstances may also arise on its flight path, to which the drone needs to react.[122]

In 2013, *Amazon* announced that it was investing in the development of drones. The goal was the delivery of parcels, i.e. air transport from the distribution center to the household. According to *Amazon*, 80% of the parcels they deliver weigh less than 2.5 kg and are smaller than a shoebox.[123]

About a year later, *Deutsche Post DHL* announced: "*With the DHL parcelcopter, an unmanned aircraft […] perform deliveries for the first time in a real-world mission.*" For the time being, *DHL* has no plans to use drones to deliver parcels to people's homes. Legal aspects aside, the costs of aerial delivery per drone are quite substantial at this time. Nevertheless, they do intend to offer delivery by drone to places that are difficult to access. An urgent delivery of replacement parts to a drilling platform in the North Sea,

[119] Guizzo, 2011; Markoff, 2013; Corea, 2017, p. 21; CBInsight, 2018

[120] Trudell & Hagiwara, 2015

[121] Goldman Sachs, 2015, p. 11

[122] Calo, 2011, p. 530

[123] Lee, 2013; Peck, 2015, p. 40

for example, becomes financially justifiable as soon as one compares it to the production downtime costs while waiting for a slow conventional delivery.[124]

Much about the uses of self-driving vehicles and drones appears to be visionary. The development of these systems is a complex affair that requires a lot of capital. It is not yet possible to predict when this application will be able to penetrate markets.

## 2.6. Robots & Robotics

Robots and robotic systems come in a very wide variety of different versions and models. This is especially the case in industry when it comes to manipulation tasks, which a robotic system is able to perform more quickly and, typically, also more safely. From a technological standpoint, these robots combine mechanics, electronics, and informatics. But only in very few cases do these systems feature AI elements.[125]

This section is meant to address those developments that are being applied using AI.

Related to the concept of self-driving vehicles is the idea of offering unmanned delivery service. This is the direction in which Estonian start-up company *Starship Technologies* is developing. *Starship's* delivery robots are able to move on three axes, at walking speed. This is expected to allow a variety of different delivery tasks to be taken over in the foreseeable future.[126]

In England, the food delivery service *Just Eat* is experimenting with *Starship's* unmanned vehicle. Deliveries within urban areas are to be made without the involvement of human employees.[127]

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[124] Vasagar, 2014; Kunze, 2016, pp. 291-292; Chang & Lee, 2018, p. 307

[125] Švaco, et al., 2012, pp. 164-166; Parodi & Gerio, 2017, pp. 339-341

[126] Kottasova, 2015; Vision Systems Design, 2017

[127] McGoogan, 2016

Exploration robots are another field of application.[128]

One that has become well known in this context is *Curiosity*, a robotic rover sent to Mars by *NASA*. Due to the distance involved, merely controlling the vehicle remotely would not have been possible. This meant that *Curiosity* had to be equipped with AI features.[129]

Exploration robots can be used specifically in locations that are either inaccessible or dangerous to humans.[130]

Since as early as the 1990s, the *Fraunhofer Institute* has been developing the assistance robot *Care-O-bot*. This device is expected to be used in the home, at hotels, nursing homes, and hospitals. The robot moves on its own and features two multiaxial arms, coming very close to humanoid robots.[131]

The great potential of developments like *Care-O-bot* is widely attested, particularly for future use in the health care sector.[132]

Another similar example from the medical field is the project *ALMA*. Interdisciplinary organizations from Europe are developing an autonomous wheelchair with an intelligent navigation system for elderly and disabled people. For example, the wheelchair should be able to move independently on the road, take patients to the pharmacy or to the hospital, and in some cases even communicate with the doctor.[133]

Honda's *ASIMO* is an example of a so-called humanoid robot. This robot is 1.34 m tall and weighs 48 kg. The capabilities of this bipedal machine are already quite extensive. *ASIMO* recognizes objects, sounds, and faces. The robot is also able to interpret spoken instructions and react to gestures; for example, reaching out to greet it with a handshake. Aside from a certain entertainment value, Honda's development does not yet have any real

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[128] Macedo & Cardoso, 2012, p. 62; Maurtua, et al., 2014, pp. 1811-1812; Chablat, et al., 2018, p. 307

[129] Drake, 2012, p. 18; Gaudin, 2016, p. 1

[130] Macedo & Cardoso, 2012, p. 63; Grossman, 2017; Chablat, et al., 2018, p. 307

[131] Graf, et al., 2004, pp.194-195;
Fraunhofer-Institut für Produktionstechnik und Automatisierung IPA, 2015

[132] Parlitz, et al., 2008, p. 275; Garmann-Johnsen, et al., 2014, p. 2; Taheri, et al., 2015, pp. 898-899

[133] Guzzi & Di Caro, 2015; Scascighini & Hersche Cupelli, 2016, pp. 23-25

practical application. However, efforts are being made to see *ASIMO* employed in reception areas, at hotel front desks and also in the hospital area, especially to play with autistic children.[134]

In order to move about freely, robots must at least possess wheels or continuous tracks. When one compares developments like *Curiosity* and *Care-O-bot* with *ASIMO*, a considerable degree of complexity becomes apparent. The first two is stuck on the ground and quite comparable to self-driving vehicles. *ASIMO* moves on two legs. Developments like this are more flexible with regard to range of movement, but they first need to be given the capability.[135]

Just like with autonomous driving systems, robots bring together a wide range of AI concepts: natural language understanding, machine learning, and image recognition are indispensable for these machines to function reliably. Remarkable developments are being made in this area, but here too, it is difficult to estimate when these systems will break through into broad areas of everyday life.

[134] Obringer & Strickland, 2007; Ferrari, et al., 2009, pp. 110-111; Taheri, et al., 2015, pp. 898-900

[135] Jin, et al., 2018, pp. 1-3

# 3. AI and its Impact on Business Models

In the previous chapter, we saw that ML routines such as *Amazon's Amabot* are designed to increase sales and tie existing customers more tightly to the business. It has become clear how chatbots can enhance customer service. An extension due to helpful assistance functions and unrestricted accessibility. The example of *1-800 Flower* demonstrated how quickly a new sales channel was implemented via *Facebook*. The *IKEA* case has illustrated how the point of sales can be shifted. Possibilities of differentiation by means of AI became tangible on the basis of the examples of the *Magic Mirror* or on the basis of the potential of AR in tourism and education. After all, the example of *DHL* and its *Parcelcopter* proved the meaning of service speed.

Companies can follow completely different strategies with the use of AI. Drawing a complete picture of it would be overdue given that AI applications are at the beginning of their potential. Nevertheless, without any claim to completeness, some strategic possibilities based on AI should be outlined.

## 3.1. Differentiation and Customer Centricity

In the traditional approach of strategic management theory differentiation is an essential competition factor: "*Commodity products encourage rivalry, while highly differentiated products, which are hard to copy, are associated with less intense rivalry.*"[136]

The product or service price is less important for differentiated offers. In other words, the differentiation creates the opportunity to realize higher margins through higher prices, because customers have a higher degree of loyalty to the company due to the differentiation characteristics.[137]

As we saw in the previous section, there are many examples of a differentiation strategy. *Netflix* in the entertainment sector, *Stitch Fix* in the

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[136] Hollensen, 2007, p. 102

[137] Hitt, et al., 2005, p. 179; Mellahi, et al., 2005, p. 80; Johnson, et al., 2008, p. 227

retail sector, *RBS* in the banking sector or *Linde* in the manufacturing industry. By improving or expanding customer service, these models increase customer loyalty and have the long-term potential to contribute to better margin quality.[138]

Unlike traditional differentiation strategies, these models have an important advanced feature. They aim to address customer needs in real-time and react dynamically to changes. Above all, these models capture a wider area of the ecosystem. So, customer needs are addressed that were not addressed in the traditional understanding of the business.[139]

*Babolat*, for example, has been producing tennis rackets for over 100 years. With *Play Pure Drive*, which integrates sensors and network components in the grip of the racket, the company offers an additional service: It helps tennis players to improve their game by evaluating the ball speed, the spin and the impact of the ball on the racket. The collected data is transferred to an app on the player's smartphone.[140]

In addition to achieving better prices as mentioned above, a well-implemented strategy makes it possible to optimize customer loyalty. AI technologies offer numerous opportunities to increase customer contacts (touch points). Whether through useful additional information or consumer recommendations.[141]

Besides touch points the perceived quality of a customer service is determined by the so-called customer journey. If a customer directs a specific concern to a company, the customer journey describes the path of the customer in the interaction with the company. If AI is intelligently embedded in existing communication structures of a company, an additional

[138] Wang, 2016, p. 1007; Schallmo & Williams, 2018, p. 63

[139] Teece, 2010, p. 189; Hui, 2014; Westerlund, et al., 2014, pp. 8-9

[140] Porter & Heppelmann, 2014, p. 20

[141] Richardson, 2010; Bahari & Elayidom, 2015, p. 726; Loshin & Reifer, 2013, pp. 39-40

communication channel is created. This can improve the customer journey and in turn strengthen customer loyalty.[142]

The basis for maximizing touch points and optimizing the customer journey in AI applications is the use of data to better understand the desires and needs of customers. This is essentially the summary of what AI systems can do. Consolidate and process all available data so that customer data is accurate in all areas of customer interaction. What is new about existing methods of customer centricity is that digitization opens new possibilities of data fusion. Social media are just one possible source.[143]

The application of AI is from this point of view a significant possibility of differentiation and strengthened customer centricity. Using AI can help companies better understand their customers. The more precisely a company knows the preferences of its customers, the more precisely an optimized pricing and retention strategy is possible.[144]

Moreover, a differentiated service is a natural entry barrier for potential new entrants. As a result, the use of AI can be targeted to increased strategic deterrence.[145]

## 3.2. Shifted Point of Sale & New Distribution Channels

Let us recall the example of *IKEA* from chapter 2.4. With an AR app, pieces of furniture are projected into a photograph of the home. This creates the opportunity to move the point of sale from a furniture store to a mobile app. In the long term, this shift may enable *IKEA* to reduce the installed shop floor costs.

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[142] Bolton, et al., 2014, pp. 254-255; Maechler, et al., 2016; Stein & Ramaseshan, 2016, pp. 8-9; Voorheesa, et al., 2017, p. 270; Etlinger, 2017b, p. 15;

[143] Westerman, et al., 2011, p. 27; Bolton, et al., 2014, p. 261; Etlinger, 2017c, p. 12; Chopra & Rajendran, 2017, pp. 204-205; Komarčević, et al., 2017, p. 33

[144] Porter, 1986, p. 13; Bolton, et al., 2014, pp. 254, 258; Bughin, et al., 2017, p. 4; Voorheesa, et al., 2017, p. 276; Loshin & Reifer, 2013, pp. 47-49

[145] Porter, 2001, p. 68; Mellahi, et al., 2005, pp. 75, 78; Voorheesa, et al., 2017, p. 279

If a company does not operate its own shops, but operates through a dealer network, the dependency on these partners can be reduced or completely dissolved by using AI.[146]

A classic example of a large sales partner network is the automotive industry. Even at the risk that this may seem surreal, let us take the example of self-driving vehicles. Let us say manufacturers like *BMW* or *Toyota* will have a functioning self-driving vehicle in the near future. What reason would then exist for a potential car buyer to go to a dealership and there to arrange a test drive. Requested over the Internet, the self-driving vehicle can also come right home for the test drive. Completely independent of the opening hours of a dealership.[147]

Moving the point of sale has already worked with the spread of the Internet. 25 years since the internet was released. The early years were bumpy. Little supply, slow data transfer, high prices and limited data volume. Nevertheless, consumer behavior has changed in this relatively short period of time. Much of what was bought along the highstreets of a city 25 years ago is now ordered on the internet.[148]

Although the sales people are an important aspect of customer loyalty has AI the potential to give this change of the past 25 years an additional boost. Further sales structures that have not yet been tackled through the establishment of the Internet can be successively challenged by AI.[149]

Apart from the impact on the place where purchases are made, entirely new sales channels may arise. The case of *1-800-Flowers* and the establishment of an effective sales channel via *Facebook* in only two months indicates which distribution opportunities open up for companies.[150]

For companies pursuing this strategy, this means huge investments at the beginning. However, if the change in the distribution structure succeeds, this

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[146] Porter & Heppelmann, 2014, p. 10

[147] Mohr, et al., 2014, p 28; Kaas, et al., 2016

[148] Brügger, 2012, p. 102; Gerend, 2016, pp. 267-269

[149] Porter, 2001, p. 64; Westerman, et al., 2011, p. 48; Mohr, et al., 2014, pp. 11-16

[150] Singh, 2016, p. 27; Etlinger, 2017b, p. 2; Bughin, et al., 2017, p. 44

ultimately leads to a significant reduction in operating costs and corresponding competitive advantages.[151]

## 3.3. Personalized Prices

With the knowledge of consumption preferences of customers, the buying behavior can be estimated. Algorithms for the purchase or consumption recommendation, as already discussed here (see *Netflix section 2.1*; *Amazon Amabot section 1.2*), address customers to motivate them for further consumption.[152]

Given the potential of digitization, companies may be able to better gauge their customers' willingness to pay. In other words, with correspondingly available data, an individualized pricing could become possible.[153]

Examples of such data sources are information about past shopping behavior, as well as the search behavior on the Internet and also the location. If a company has access to these data sources, by networking that data, it can create individual customer profiles with detailed preference information.[154]

A case of price differentiation, which has received attention, is a test that *Amazon* carried out in 2000. Already at that time it was assumed that Amazon had not set the different prices by chance, as stated later, but rather on the basis of information about the customers. In the specific case DVDs were sold at different prices. The differences were noticed by customers and discussed in online forums. *Amazon* was heavily criticized and agreed after a few weeks to compensate the customers who had paid more.[155]

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[151] Mohr, et al., 2014, p. 24; Burgess, 2018, p. 103

[152] Shiller, 2014, pp. 3-4

[153] Shiller, 2014, p. 21; Richards, et al., 2016, pp. 138-140;

[154] Taylor, 2004, p. 632; Bergemann & Bonatti, 2015, pp. 259-263

[155] Leibbrandt, 2016, pp. 2-3; Jentzsch, 2017, p. 10

The example of *Amazon* shows the limitation of such a model. Consumers may find prices unfair if they have to pay a higher price than other consumers and feel disadvantaged.[156]

## 3.4. New Technologies & New Product or Service Categories

With the development of AI systems, it is conceivable that existing business concepts will be replaced. A tangible example of this is provided by *Amazon*. In Seattle, *Amazon* runs a retail store as a pilot project. Customers carry a virtual shopping cart by mobile phone. Goods taken off the shelf are tracked with sensors and assigned to the relevant virtual shopping cart. Customers leave the store without paying at a cash desk. Billing takes place via the customer's *Amazon* account.[157]

*Amazon* is experimenting with this pilot project to replace the classic concept of a supermarket. Although this concept could be rejected for lack of practicality in the end, this case shows which possibilities are emerging. In this particular example, it would represent a significant threat scenario for the retail sector should the pilot project become operational. An organization with such groundbreaking technology faces a tremendous competitive advantage.[158]

Network connected products and their data are a motor for sharing models. In the field of mobility, car sharing is not new and can exist independently of AI. However, networking and AI increase the availability and reliability of information. When will a vehicle be available at a certain location and what range will the residual charge in the electric vehicle allow?[159]

Apart from the possibility that technologies can revolutionize whole business concepts, completely new product categories can arise. *Pokémon GO* from *Nintendo* is an example of this. With *Pokémon GO*, a computer game using

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[156] Xia, et al., 2004, pp. 1-3; Richards, et al., 2016, p. 140

[157] PM Network, 2017, p. 39; Hofbauer, 2018, p. 72

[158] Hellebrand, 2017, pp. 102-104; Wåge & Crawford, 2017, p. 7; Burgess, 2018, p. 175

[159] Porter & Heppelmann, 2014, p. 13; Goldman Sachs, 2015, p. 8

AR has left the world of game consoles. The monster hunt has been relocated to the real world. Currently, *Nintendo* uses conventional revenue generation. With in-app purchases, the player can acquire virtual features to enhance the gaming experience. Since the game requires players to go to specific locations, sponsored locations can become a massive source of revenue. Local businesses could pay to become a so-called *PokeGym*.[160]

It is difficult to assess which technologies are rapidly gaining ground and which additional technologies are emerging. It is also hard to predict which new product categories will be born. What is certain, however, is that technologies and new products will have a significant impact on existing business models and replace some of them.[161]

## 3.5. Disrupted Negotiation Power

A change in bargaining power through applied AI is foreseeable. In section 3.1 it was demonstrated how AI-based differentiation and the potentially increased customer loyalty can enable a company to achieve higher prices in the long run. This goes hand in hand with an increased bargaining power of the provider towards the consumer.[162]

In contrast, on the consumer side, AI products and services may be even better and faster comparable. Access to one's own user data, perfectly prepared by the service provider, does not necessarily have to be a differiantiating factor. Users may realize that there is another tailor-made offer at a lower price in the market.[163]

These considerations demonstrate that the availability of data and the deployment of tailor-made services can both strengthen the position of the

[160] Zott & Amit, 2017, p. 22; Pan, 2016, p. 411

[161] Corea, 2017, p. 21; Ibarra, et al., 2018, p. 10

[162] Caylar, et al., 2016

[163] Stein & Ramaseshan, 2016, p. 8

provider and the customer. The direction of a shift in bargaining power will depend heavily on the service and the competitive situation.[164]

An entirely different shift in bargaining power is demonstrated by an example from industry. *GE Aviation* is a manufacturer of aircraft engines and uses ML routines to approach airlines directly. For example, data from hundreds of engine sensors has reduced Kerosene consumption at *Alitalia*. In this way, *GE Aviation* has established a relationship with the operators and at the same time strengthens its bargaining power over aircraft manufacturers, the actual customers of *GE Aviation*.[165]

Sharing models for mobility have already been mentioned. These models can also have a significant impact on the negotiation strengh. Apart from rental car companies, a car dealer today basically deals with individual customers. This may change as car sharing providers continue to establish themselves. If these providers also achieve a certain degree of market penetration, their bargaining power vis-à-vis car companies increases.[166]

Conversely, automakers, including *BMW* and *Daimler*, are experimenting with digital sharing platforms. It seems that these companies are preparing for the impending loss of bargaining power as well as the structural changes in their business - pay the ride, not the vehicle - and simply expand their business to “pay for usage” models.[167]

## 3.6. Changed Industry Structures

Hand in hand with the changing bargaining power within industries, entire industries may shift or even dissolve.[168]

Originally a tractor manufacturer, *John Deere* is developing into an entire agricultural business with the use of AI. In a first step, agricultural machines

[164] Porter, 2001, p. 66; Etlinger, 2017a, p. 18

[165] Porter & Heppelmann, 2014, pp. 10-11

[166] Mohr, et al., 2014, p. 28; Stocker & Shaheen, 2017, pp. 8-9, 21

[167] Bughin, et al., 2016, p. 40

[168] Deburba & Neurohr, 2015, p. 17; Evans, et al., 2017, p. 9

were networked together. Then *John Deere* started the integration of various additional data sources, such as weather forecasts and daily updated prices for seeds and pesticides. The use of drones and corresponding image identification algorithms recognize the need for irrigation and pesticide use. Agricultural machines are instructed and directed according to this data. In this way, *John Deere* optimizes the operating costs of agricultural businesses and has become a supplier of complete agricultural systems.[169]

An entirely different but comparable application example comes from the field of living. In the so-called smart homes, the product systems for various areas such as lighting, heating, air conditioning, consumer electronics and security are merged into one system.[170]

Other initiatives, however, go beyond the internal networking of a home. A goal is to connect entire communities. Ventilation, shading, air conditioning, etc. are then centrally controlled and optimized.[171]

In the extended scenario of networking entire municipalities, it becomes clear that a potential system operator is becoming a new player in the building installation industry. Depending on the business model, this system operator could not only provide the operating service, but also offer complete installations. When this happens, the single business of heaters, ventilation, etc. will change dramatically. These companies then no longer deal with individual homeowners, but with a large system provider.[172]

Examples like these are conceivable for almost all industries. Those companies whose product performance has the greatest impact on the overall system can tap into the maximum of total value added and face the highest liklyhood to become a system integrator. Companies that fail to do so will lose influence while system integrators take control. The capabilities

[169] Porter & Heppelmann, 2014, pp. 14-15

[170] Shina, et al., 2018, p. 246

[171] Risteska Stojkoska & Trivodaliev, 2017, p. 1455; Wilson, et al., 2017, p. 72

[172] Porter & Heppelmann, 2014, p. 14

of AI systems can not only change the competition in an industry, but are also able to redefine the whole industry.[173]

Another form of industrial change is the thinning out of an existing value chain. This can be best illustrated by the example of 3D printing. Let us assume an industrial company needs a spare part. As soon as 3D printing is suitable for mass production, the industrial company can only purchase the digital 3D model from the original manufacturer and have the part made by itself or have it printed nearby. Value creation steps in today's supply chain, such as central manufacturing, shipping and delivery are being replaced. The sale and the entire process will be fully digitized. This example is purely digital and does not require an actual AI application. Nevertheless, this innovation has the potential to change entire manufacturing industries, and for this reason should not go unmentioned here. Traditional value chains are being fundamentally changed in this way and the question arises as to how and by whom things will be produced in the future.[174]

## 3.7. A few Additional Considerations

The numerous examples of existing AI applications give an idea of the changes that are emerging. This chapter has outlined implications for business models and industries. To complete this section some additional reflections on the influence of AI on business activities are to be made.

It became apparent that many key AI developments are being driven by large, capital-rich companies.[175]

Pioneering companies often have a key technology advantage. In terms of AI, it could be mainly companies such as *Google*, *Apple*, etc., which already occupy a dominant market position. From an advantageous market position

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[173] Porter & Heppelmann, 2014, pp. 14-15; Harting, et al., 2015, pp. 2, 4

[174] Harting, et al., 2015, p. 2; Caylar, et al., 2016

[175] Goldman Sachs, 2015, p. 17; Etlinger, 2017a, p. 14; Corea, 2017, p. 29

in the present they finance the AI of tomorrow. If these companies do not fail, it can be assumed that they will gain further market dominance with AI.[176]

However, the investment in AI is by no means a guarantee of success in the future. Numerous challenges are associated with the development of AI systems. These go far beyond the programming of software.[177]

Dealing with AI for customers is a kind of additional layer in communicating with companies. Any AI system will fail that does not provide enough benefit to the user, is reliable, and still understands the implicit needs of a customer.[178]

In addition, there is a high demand for transparency and security. Essential criteria of success will therefore go well beyond the mere AI development.[179]

In addition to these risks of misdevelopment, a scenario is conceivable in which even successful AI developments are insufficiently converted into revenue. Due to the intensity of the investment in the development, the costs increase temporarily. However, once an automated system has replaced manual labor, the investment forms the basis for reducing variable costs. Between competitors, a development can occur, in which a race for more and more AI functions takes place. Development increases costs, and part of the improved product or service performance is given away. In this scenario, the result is a reduced profitability of the industry.[180]

In sum, the development of AI costs money and there is no guarantee that the investment will pay off. Both customer acceptance and profitability of innovation are risk factors. This naturally applies to the development of every innovation. However, due to the complexity of AI and the resources required, the risks could probably be greater. Companies that lack the financial strength are at risk.[181]

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[176] Sirkin, et al., 2015, p. 3; Etlinger, 2017a, p. 18

[177] Burgess, 2018, pp. 129-143

[178] Westerman, et al., 2011, pp. 17-20; Hui, 2014; Bolton, et al., 2014, pp. 266-268;

[179] Etlinger, 2017c, pp. 9-15; Gordon-Murnane, 2018, p. 42

[180] Porter & Heppelmann, 2014, p. 11

[181] Etlinger, 2017b, p. 19

# 4. The Impact on the Workplace

In recent decades, automation has replaced many routine jobs. Most of the workers affected were those with lower qualifications. AI is now starting to move into areas of higher qualification.[182]

Apart from the imminent further substitution of human labor, another question is the transformation of work itself? How does AI affect our workplace? Is there a renewed acceleration of processes that have been triggered in the past by advanced technologies such as communication capabilities? Will AI have the opposite effect and relieve us of the workload?[183]

Robots, for example, not only replace human labor, they are also capable of doing heavy, dirty or even dangerous work. Applications like these facilitate human activities.[184]

Other technologies in the field of AR can enable people, for example, to carry out maintenance and repair work more purposefully and safely.[185]

In contrast, technologies such as chatbots are a direct substitute for human labor unless the bot is used for a completely new service. Apart from increasing efficiency, this technology does not add value to society.[186]

For these reasons, we now turn to the question of how AI will affect the world of work. At the beginning it should be discussed, which substitution potential automation can have by AI. Afterwards, the impact on work organization, work processes and required competences in the future is to be assessed. Thereafter, this section concludes with implications for leadership roles.

[182] Brynjolfsson & McAfee, 2011, p. 9; Autor, 2015, p. 3; Frey & Osborne, 2017, p. 268

[183] Dirican, 2015, pp. 570-571; Burgess, 2018, p. 23

[184] Lin, et al., 2011, p. 944

[185] Azuma, 1997; Henderson & Feiner, 2007, pp. 7-11

[186] Bennett, 2017, p. 47; Evans, et al., 2017, p. 1; Burgess, 2018, p. 6

## 4.1. The Replacement of Human Labor

One of the big fears associated with digitization and AI is the loss of a large number of additional jobs following a wave of automation over the past decades. *Forrester* expects that "*technologies such as robots, artificial intelligence (AI), machine learning, and automation will replace 7% of US jobs by 2025*".[187]

Another calculation assumes that 47% of current US workers are at risk. According to the calculation model, this risk group could be replaced by advanced technologies over the next two decades. Not only jobs in the manufacturing industry were considered. All industries and services, from transportation and logistics to financial services, social services and healthcare, are covered by this forecast.[188]

The substitution rate with which AI-driven automation replaces jobs in the US will almost double, according to *McKinsey & Company*.[189]

There are similar results for regions other than the US. *Pajarinen, et al.* estimate that one third of jobs in Finland and Norway are threatened in the next two decades.[190]

Numerous studies have also been carried out for Germany. Different work results predict that more than 40% of jobs are threatened by AI in the near future.[191]

The forecasts mentioned differ both in terms of their data basis and their scope. Nevertheless, they draw a clear trend.

In general, the replacement or change of human labor in these studies is attributed to three factors:
(1) replacing human labor with intelligent software and intelligent machines,

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[187] Forrester, 2016; see also Brynjolfsson & McAfee, 2011, pp. 6-9

[188] Frey & Osborne, 2017, p. 268

[189] Bughin, et al., 2016, p. 28

[190] Pajarinen, et al., 2015

[191] Bonin, et al., 2015; Brzeski & Burk, 2015; Bührer & Hagist, 2017; Rotman, 2017

(2) increasing efficiency through intelligent assistance work, and (3) new employee responsibilities with new business requirements.[192]

A current trend observed in both the US and the EU is that the number of higher and lower incomes is increasing. At the same time, the number of middle incomes decreases. In the context of digitization and AI, a continuation of this trend is expected.[193]

Although many jobs are threatened, there will not be an abrupt job loss. Rather, this transition is creeping, but has already begun. Some industries are already networked and use a lot of robotics. However, it will take years before intelligent machines and intelligent software can prevail and, above all, be mass produced.[194]

The forecasts mentioned raise the question of how society will deal with such a dramatic upheaval in such a short time. Rising unemployment is very likely.[195]

As mentioned at the very beginning, this work does not claim to address these issues. Therefore, we now turn to questions of how the characteristics of work will change.

## 4.2. How does AI affect Work Processes and Work Organization?

AI technologies mean that people can work cooperatively on electronic networks without being gathered together in the same place. They enable and accelerate the fragmentation of the working world.[196]

This development not only promotes home-office models, but also promotes outsourcing processes and enables the emergence of "virtual companies" that were set up only temporarily and project-related via data networks.[197]

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[192] Heinen, et al., 2017, p. 715

[193] Goos, et al., 2014, p. 2515; Degryse, 2016, p. 42

[194] Brzeski & Burk, 2015, p. 3

[195] Haaren van & Schwemmle, 1997, p. 109

[196] Westerman, et al., 2011, p. 52; Degryse, 2016, p. 33-34

[197] Haaren van & Schwemmle, 1997, p. 104; Valsamis, et al., 2015, pp. 25-26

Crowdworking is an example of a modified work organization already used by companies like *Google*, *Facebook* or *Apple*. A web page employs people who are mainly responsible for simple recurring tasks, such as data entry, transcribing records, or tagging photos.[198]

Another variation in the context of digital work models is the so-called sharing economy. Online platforms bring people or companies in need of a specific service into contact with people who offer special services or special competencies.[199]

Such flexibilization influences conventional working conditions in a wide variety of ways. Compensation based on attendance would increasingly be made through a payoff based on outcomes. A defined working time is then no longer necessary.[200]

Likewise, different forms of organization of work arise. They are somewhere between employment and entrepreneurship, full-time and part-time, permanent employment and short-term, project-related cooperation.[201]

What on the one hand means a flexibilization of the working world also changes the structure of the labor market. If today the possibilities are limited to move work abroad, AI technologies should open up completely new possibilities. In numerous sectors the current regional labor markets could thus develop into a global labor market.[202]

The confrontation with a global labor market, which already partly exists in the area of the Internet and communication technology, points to a completely new competitive situation which arises for both the employees and the employers.[203]

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[198] Robertshaw, et al., 2015, p. 11; Apt, et al., 2016, pp.21-24; Stewart, et al., 2017, p. 736; Kost, et al., 2018, p. 101

[199] Valsamis, et al., 2015, pp. 32-33; Degryse, 2016, pp. 28-31

[200] Valsamis, et al., 2015, p. 25; Degryse, 2016, p. 35

[201] Haaren van & Schwemmle, 1997, p. 106; Valsamis, et al., 2015, pp. 25-34; Degryse, 2016, pp. 33-34; European Economic and Social Committee, 2017, p. 44-48

[202] Haaren van & Schwemmle, 1997, p. 102

[203] Valsamis, et al., 2015, pp. 23-24

If a worker has a specific competence, a higher salary could be achieved through a regionally unrestricted offering. For companies that need this competence, higher costs could be incurred because there is more competition for specific competences.[204]

On the other hand, the price for readily available services could be reduced. This, in turn, could undermine the problem of wage and social dumping.[205]

Regardless of these scenarios it is obvious that the structural shifts of the past decades from simple production to more knowledge-intensive activities will continue.[206]

The areas in which modern technologies are complementary to human work will become more important. Although there are even fewer routine tasks than before, there are even more diverse work, characterized by human creativity and cooperation.[207]

But if employment is to emerge in the future in such knowledge-intensive fields of activity characterized by human interaction and innovation, then it will be important to create favorable conditions for learning and innovation-friendly work processes. This has considerable consequences for the operational organization of work and the design of the working world as a whole.[208]

This section is only a brief summary of likely changes in work processes and work organization. But it makes tangible how flexibilization and decentralization can change the world of tomorrow's work. This, and the awareness of an increasing number of creative and cooperative tasks, raises the question of what qualifications are needed in a working world of tomorrow?

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[204] Komarčević, et al., 2017, p. 42

[205] Haaren van & Schwemmle, 1997, p. 103; Degryse, 2016, pp. 35-36; Komarčević, et al., 2017 pp. 42-43

[206] Valsamis, et al., 2015, pp. 22-23

[207] Eichhorst & Buhlmann , 2015, p. 9; Buhr, 2017, p. 17; Wilson & Daugherty, 2018, pp. 117-118

[208] Hofmann, 2013, pp. 216-217; Eichhorst & Buhlmann , 2015, pp. 9-10

## 4.3. Which Competencies will be Needed?

Literature on the future of the work often discusses the change of employment in combination with a change of value creation and business models. For the study "*The Future of Work: A Journey to 2022*", 10,000 employees and 500 personnel managers in China, India, Germany, Great Britain and the USA were asked about the future of work. As a result, the change in work is associated with a change in values and attitudes that affect both the individual and the collaboration. The focus is on soft skills that enable virtual cooperative work.[209]

To a comparable result comes *Bollier 2011*: "*In the networked environment, the mindset and disposition of workers will matter more than ever.*"[210]

Without question, qualifications such as intercultural competences, linguistic skills, social intelligence, creativity, etc., are very important in a future working world.[211]

Remarkably, these are not qualifications related to the execution of specific activities, but can be understood as a functional toolkit to respond to changing challenges and content. This is in line with the expectation that today's organizational structures will become more flexible over time and enable an individual design. Instead of a strong division of labor in departments, more comprehensive and flexible, changing project teams could be at the center.[212]

The loss of a large number of jobs, as described in section 4.1, raises a key issue. Can people adequately have equipped for the future challenges? Can a transformation of the endangered work towards the new work be achieved? Many authors write in connection with AI about the need for "reskilling" or "upskilling".[213]

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[209] PwC, 2014

[210] Bollier, 2011, p. 22

[211] Frey & Osborne, 2013, pp. 26-27; Frey, 2014; Mclaughlin, et al., 2014, p. 6

[212] Valsamis, et al., 2015, p. 8; Eichhorst & Buhlmann , 2015, p. 12; Degryse, 2016, p. 53

[213] Mclaughlin, et al., 2014, p. 6; Degryse, 2016, p. 26; Bughin, et al., 2016, p. 39

The process of "reskilling" sounds exciting but raises many questions about its limits. People could lag behind technological change.[214]

Regardless of individual willingness to change, in addition to the above mentioned competences, such as creativity or social skills, another competence will have fundamental importance: the ability to develop, the willingness to adapt to new demands. Lifelong learning and personal adaptability could become even more important than in the present.[215]

*Brynjolfsson & McAfee* argue in this context that a human cannot win the race against the machines. But a person could learn to walk with the machines.[216]

## 4.4. What does AI mean to Leadership Roles?

In view of the changes in the organization of work and the changing demands on competencies outlined, it is obvious that changes in the requirements for leadership roles should also be considered.

When asked how AI will affect leadership, which tasks or characteristics executives have to have in an AI world of work, another question should first be allowed. Are managers still needed?[217]

*Fredmund Malik* divides leadership into five tasks: (1) defining goals, (2) organizing, (3) deciding, (4) controlling and (5) developing employees. Which parts of these tasks could be taken over by AI systems?[218]

Can AI (1) set goals, (2) organize or (4) even control? It has been repeatedly mentioned that AI lives from the database. The real-time access to different data sources in the company, for example from the operational area, finance

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[214] Brynjolfsson & McAfee, 2011, p. 10; Anthes, 2017, p. 319

[215] PwC, 2014, p. 30; Mclaughlin, et al., 2014, p. 6; Valsamis, et al., 2015, pp. 11-12; Bughin, et al., 2017, p. 39

[216] Brynjolfsson & McAfee, 2011, p. 35

[217] Hofmann, 2013, pp. 218-222

[218] Malik, 2014, pp. 167-250

or HR, will enable AI systems to make recommendations or to check results very quickly and even detect hidden patterns.[219]

As such, AI can become part of these leadership tasks. Perhaps not fully automated, but in close relationship with the human counterpart, as an instrument of analysis and recommendation.[220]

Can AI (3) take decisions from a manager? AI is unbeatable in situations where a decision requires extensive data analysis. Also, an AI algorithm is useful for decisions that have clear structures and norms.[221]

When pricing digital marketing or fixing lending rates in the real estate market, AI algorithms are already being used for decision-making in organizations.[222]

Also in decision-making situations that require immediate response. For example, *HSBC* operates an AI solution to check credit card transactions for fraud.[223]

In case of leadership decisions much will likely depend on the nature of the decision. Beside decisions that are subject to clear standards or extensive data analysis, there are also those whose decision-making basis is uncertain or ambiguous. Moreover, decisions are often about breaking patterns of experience. Those decisions that require human intuition will hardly replaced by AI. However, in such cases AI can make a valuable contribution to the analysis.[224]

Ultimately, the task of (5) development and promotion of employees remains. This can be an increasingly challenging leadership task when faced

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[219] Dewhurst & Willmott, 2014; Jarrahi, 2018, pp. 580-581

[220] Jarrahi, 2018, p. 583

[221] Parry, et al., 2016, p. 572; Jarrahi, 2018, p. 581

[222] Jarrahi, 2018, p. 581

[223] Agrawal, et al., 2017; Wilson & Daugherty, 2018, p. 120

[224] Parry, et al., 2016, pp. 576, 582; Jarrahi, 2018, pp. 579-580, 583; Wilson & Daugherty, 2018, p. 122

with flexibility and decentralization of the workplace. The relationship between manager and employee then exists more on a virtual level.[225]

That's why tomorrow's executives need to focus even more on defining visions, building relationships, and building identification with the company and its goals.[226]

In the totality of these considerations it may be assumed that while AI systems take over parts of the leadership, in other areas of leadership the human factor will become even more important. A shift from the harsh management aspects of *Malik's* model to the soft leadership aspects will be necessary.[227]

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225 Hofmann, 2013, p. 224; Apt, et al., 2016, pp. 24, 80

226 Hofmann, 2013, pp. 220-221

227 Chamorro-Premuzic, et al., 2018

# 5. The Legal Dimension of Applied AI

After reviewing where and in which areas AI systems are used, in the previous two chapters we have explored the impact this will have on business models and the world of work. This section now serves the legal aspects that can be derived.

Legal issues related to AI are diverse. Product liability issues are raised. The use of AI, for example in health care, places aspects of application security in the foreground. These legal issues are not less complex in the area of self-driving vehicles. Is the owner or the manufacturer responsible for an accident? If the manufacturer is responsible, which one is actually responsible along the production chain? If the AI system continues to develop autonomously, it will not be easier to answer these questions. Economically interesting is also whether results of an AI system can be patented? Who owns the generated data? And what role does privacy play in the collection of personal data?

In order to approach the answers to these questions, selected legal implications are taken up and discussed.

## 5.1. Problems Associated with Current Applications of AI

*Matthew Scherer*, in connection with legal issues in the development of AI systems, presents a model that distinguishes four basic problems:[228]

(1) Discreetness: AI projects can today be developed, so to speak secretly, without any institutional framework.

(2) Diffuseness: AI projects can be carried out very scattered, on different continents.

(3) Discreteness: AI projects can be executed independently in subprojects. The big picture then arises only when merging the sub-components.

[228] Scherer, 2016, pp. 369-373

(4) Opacity: The underlying technology is often bought as a platform. An insight into the basic technology is usually not possible.

Looking at these aspects, the complexity of the problem becomes obvious. Completed subcomponents that have been developed on different continents are grouped together into a functioning overall system. Operations in this overall system are then hardly verifiable in the legal sense.[229]

The speed of development, especially in the software sector, is enormous. Legislation usually lags behind innovation. Where existing rules are too unspecific, a decoupling of rules and reality is the consequence.[230]

Late or too general legislation also creates uncertainties among developers, companies and investors. These stakeholders are left in the dark on many of today's AI application-related issues.[231]

In addition to the legislative speed, legislators face an information asymmetry. In the development environment of AI very special knowledge is generated. Attempting lawmakers to understand this knowledge is time consuming and involves a risk that non-software experts will overlook essential parts and derive inadequate rules.[232]

In addition, it will be difficult for courts to understand cases accordingly and to classify them in the rules.[233]

Another problem arises from the already discussed internationalization character of numerous AI applications. Wherever technology goes beyond national borders in its development or in its application, these processes often raise legal questions. For this reason, legislative authorities will have a high need for coordination with other legislative authorities.[234]

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[229] Scherer, 2016, pp. 369-373

[230] Brownsword, 2008, pp. 3-7; Marchant, 2011, pp. 19-20, Fenwick, et al., 2017, p. 5

[231] Braeutigam, 1979, p. 98

[232] Mandel, 2009, p. 9; Brownsword, 2008, p. 162

[233] Stephenson, 2011, p. 1460

[234] Benjamin & Rai, 2008, pp. 3-5; Moses, 2011, p. 767; Hecker, et al., 2016, pp. 27-28

As we see, many problems and challenges. For this reason, we now look at a few selected aspects that seem particularly relevant in the context of AI.

## 5.2. Bias

"*Forget Killer Robots—Bias Is the Real AI Danger […] John Giannandrea, who leads AI at Google, is worried about intelligent systems learning human prejudices.*"[235]

In Section 2.1 we saw the potential of ML and big data applications. With the growing amount of data, these systems continue to develop independently. In the self-optimization of these systems there is the possibility that unintentional discrimination or sexism arises.[236]

Let us recall the example of *Flickr* from chapter 2.3. An algorithm had arranged photos of some people of black (African) ethnicity in the group of monkeys or assigned the entrance to the *Auschwitz* memorial in the category sport. The system has made the correct decision based on its capabilities and its available data. For those affected, these assignments were offensive and discriminatory.[237]

Such algorithms are supplied with data and on this basis build their own reality of the world.[238]

And even more than that. The problem is not just self-optimization. When artificial intelligences are trained with texts to understand human language, they also adopt and consolidate prejudices and stereotypes.[239]

It turned out that algorithms develop similar prejudices, as they have been proven in various social psychological studies. For example, women's names are more strongly associated with terms such as "parents" and "wedding", while male names are more associated with "professional" or

[235] Knight, 2017

[236] Zhao, et al., 2014; Crawford, 2016; Coval, 2018, p. 8; Botelho, 2018

[237] Hern, 2015; Etlinger, 2017c, p. 6

[238] Crawford, 2016; Etlinger, 2017a, pp. 15-16

[239] Barocas & Selbst, 2016, pp. 680-684; Botelho, 2018

"salary". When we give the systems our own implicit value judgments, they take over.[240]

Legislators are therefore required to give this problem a framework. Where should the limits for such applications lie? Must be made transparent which database was used to train an ML system? How to react when discrimination comes to light? Is it necessary to prescribe certain check routines to proactively detect and remove discrimination in the data?[241]

## 5.3. Privacy

That AI has arrived in our everyday lives; we have discussed sufficiently. Whether in the field of search engine optimization, where algorithms help to display personalized search results, or in the living room where *Amazon's Alexa* assists. We also found out that more and more companies are using ML to optimize processes, generate forecasts or run autonomous diagnostic procedures.

The basis for these technologies is data. It is known that the storage and processing of data is subject to legal regulations, in particular with regard to personal data. After two years, since May 2018, *the General Data Protection Regulation (GDPR)* of the *European Union* has become fully effective. This regulation significantly restricts the legal framework for dealing with the data of individuals.[242]

In terms of ML routines, this raises several questions. For example, *Article 22 (1)* of the *GDPR* formulates:

"*The data subject shall have the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her.*"[243]

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[240] Bolukbasi, et al., 2016, p. 4356; Caliskan, et al., 2017,

[241] Caliskan-Islam, et al., 2016; Knight, 2017; Guihot, et al., 2017, p. 405

[242] Regulation (EU) 2016/679, 2016, Article 3, 4, pp. 32-35; Etlinger, 2017c, p. 12; Lindroos-Hovinheimo, 2017, p. 34; Kingston, 2017, p. 431

[243] Regulation (EU) 2016/679, 2016, Article 22(1), p. 46

In other words, the automated decision-making process is not allowed without the explicit consent of the person, should the decision have a legal effect or affect the person in a similar way.[244]

Making an automated decision is the fundamental foundation of any AI system. Without this foundation, no AI system could operate autonomously. The question is, when does the automatically made decision affect or exceed the red line, which is outlined by the *GDPR*. Years could pass before the *European Court of Justice* has made the red line more tangible through case decisions.[245]

Another aspect concerns the right to data erasure. Under the terms of *Article 17 (1)*, the *GDPR* contains a right that individuals may, under certain conditions, require data to be deleted.[246]

Implementing this can be difficult if companies use personal data for ML routines or several of these systems are networked together. In practice, companies rely on ML platforms. *Watson* from *IBM* is just one example. By putting their data on an out of the box platform and by the fact that manufacturers like *IBM* protect their know-how, user companies do not fully understand their ML system. If several systems are networked to form an overall system, the lack of understanding of functionality will be reinforced. In view of this, the question arises as to how companies will effectively comply with this requirement?[247]

In a similar context is the so-called right to information, which was standardized in *Article 15* of the *GDPR*:

„*The data subject shall have the right to obtain from the controller confirmation as to whether or not personal data concerning him or her are being processed …*"[248]

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[244] Regulation (EU) 2016/679, 2016, Article 22(1), p. 46; Kingston, 2017, p. 439; Wilson & Daugherty, 2018, p. 118

[245] Lindroos-Hovinheimo, 2017, p. 34

[246] Regulation (EU) 2016/679, 2016, Article 17(1), pp. 43-44

[247] Etlinger, 2017c, p. 5

[248] Regulation (EU) 2016/679, 2016, Article 15(1), p. 43

With regard to information, individuals have not only a right to know which personal data is processed. They also have the right to obtain meaningful information about the logic and the scope of such processing.[249]

If these rules of *Article 15* are interpreted in a restrictive way by the judicature in future, it may be difficult for companies with a growing ML system to comply with these obligations.[250]

Especially with ML it is important that the input, the processes and the results are critically reviewed. In this regard, the implementation of a privacy impact assessment fulfills a requirement of the GDPR: data protection through "*privacy-by-design*".[251]

The implementation of the requirements of the *GDPR*, in particular the obligations of transparency and the rights of persons, with regard to the development and use of AI will be a great challenge. Clear guidelines for balancing personal interests on the one hand and the interest of the data processing company on the other hand could be helpful.[252]

## 5.4. Ownership of Data and IP

In the agricultural example, where *John Deere* (see chapter 3.6) equips commercial vehicles with GPS technology and sensors, a value-added service is offered by analyzing the data. However, the contractual relationships between the manufacturer and the customer must then be designed in such a way that the manufacturer has access and usage rights with regard to the data. At the same time, the manufacturer will have an interest in excluding access rights of the customer. In such case, copyright, contract and competition regulations must be taken into account.[253]

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[249] Regulation (EU) 2016/679, 2016, Article 15(1), p. 43; Kingston, 2017, p. 439

[250] Burt, 2017; Kingston, 2017, p. 439

[251] Regulation (EU) 2016/679, 2016, Article 35, pp. 53-54; Kingston, 2017, pp. 436-438

[252] Burt, 2017; Kingston, 2017, pp. 434-436

[253] Hecker, et al., 2016, p. 27

In addition to the aspect of the right to use or possess data, AI systems independently develop new processes. This raises the question of who has the right to these developments should the development have the character of an invention.[254]

Furthermore, an AI system may act in a manner that violates IP rights of other parties. Who is accountable for that?[255]

Most users only acquire the right to use the system, but they contribute to enriching data, and thus perhaps to a unique development. Then there was a party that trained the system with data at the beginning. At the same time AI systems consist of many different algorithms. Different people and companies may have participated in the system development. In such a case, the responsibility for a result is hardly unique to anyone.[256]

Finally, AI systems can also create new works that can be copyrighted, such as creating new artwork or making music.[257]

However, most copyright laws do not clearly define who owns machine-generated works. For this purpose, contracts should clarify ownership in advance.[258]

This brief section only gives a rough idea of a legal issue that is compounded by AI. It is all the more important to pay particular attention to data ownership and intellectual property when someone should be involved in the use or development of an AI system.[259]

## 5.5. Employment

A key finding on the question of changes in the world of work was decentralization, driven by the possibility of progressive networking and

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[254] Firth-Butterfield & Chae, 2018, p. 14

[255] Hallevy, 2015, pp. 1-4

[256] Yanisky-Ravid, 2017, pp. 691-692

[257] Hochberg, 2014; Etlinger, 2017a, p. 12; Yanisky-Ravid, 2017, pp. 678-682; Allen, 2018

[258] Denicola, 2016, p. 286

[259] Hecker, et al., 2016, p. 27; Denicola, 2016, pp. 286-287; Firth-Butterfield & Chae, 2018, p.14

cross-border cooperation. In this context, the possible dissolution of rigid employment concepts in favor of flexible and alternating occupations was discussed (see section 4.2).

Labor law is enshrined in national legislation within the European Union. Within many nation states, so-called collective agreements regulate additional sector-specific provisions as a supplement to national legislation.[260]

The internationalization of work challenges the existing rules of law. And more than that. Essential principles, such as that of employee participation or the representation of interests by a works council could be omitted in a "virtual enterprise" of the future. Even in the present, digital platforms such as *Uber* or *TaskRabbitt* are only hiring for specific tasks, not for a long-term employment relationship.[261]

With Blockchain-based, so-called “*decentralized autonomous organizations*”, which consist only of code, possibilities of a completely new form of organization became visible. This form of organization has neither a physical seat nor a boss. It is difficult to enforce individual interests against machine determinism. Although the best-known example of this form of organization "*The DAO*" has failed, it becomes apparent which possibilities have already been devised and implemented.[262]

In addition to the risk that essential protective functions for employees disappear, there is another risk. The transformation of the worker into a growing sole proprietor, as discussed in section 4.2, could entail many social risks. Wage dumping due to asymmetric bargaining power is just one of them.[263]

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[260] Franssen, 1998, pp. 53-54; European Economic and Social Committee, 2017, p. 41; Janda, 2017, p. 145; Guibonni, 2018, p. 175;

[261] Davis, 2016, pp. 511-512; Drahokoupil & Fabo, 2016; Alexander & Tippett, 2017, pp. 974-975; Hirsch & Seiner, 2018, p. 1729

[262] Chohan, 2017, pp. 1-4; DuPont, 2017, pp. 157-159

[263] Baker, 2015, pp. 4-5; De Groen & Maselli, 2017, pp. 10-14; European Economic and Social Committee, 2017, p. 53

It will be necessary to clarify how the necessary and reasonable degree of flexibility, which also derives from the interests of employees, can be linked to the objectively given need for protection and security.[264]

Another consideration goes in a completely different direction. How would the employee react when the software says, "You are no longer responsible for the project." or, "You are fired!" Would you accept that? Can the employer's right to direct be transferred to machines?[265]

Basically, the *Uber* drivers are also commanded by a computer, which sends them on specific routes and sets the wage by an algorithmic pricing.[266]

Even so-called pop-up employers such as the *Gigster* platform, which brings together freelancers (especially software programmers) to form software teams, manages to recruit without a boss.[267]

It will probably depend on the nature of the instruction and on its context. Likewise, the cultural context can play a role. In a culture of great power distance, the acceptance rate of a machine command might be higher than might be the case in a low power distance environment.[268]

## 5.6. Safety

In addition to the topics discussed so far, AI safety is a frequently discussed topic. What if something goes wrong, especially when we think of robots, drones and self-driving vehicles?[269]

It is argued that systems such as self-driving vehicles would increase traffic safety. Aspects such as human error, excessive risk taking, etc. would be eliminated.[270]

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[264] Drahokoupil & Fabo, 2016, p. 5; De Groen & Maselli, 2017, pp. 20-24

[265] McClure, 2018, p. 140

[266] Davis, 2016, pp. 511-512; Alexander & Tippett, 2017, p. 975

[267] Adams, 2016; Scheiber, 2017

[268] Hofstede & Hofstede, 2005, pp. 45-46; Li, et al., 2010, pp. 176, 184-185

[269] Simshaw, et al., 2016, pp. 2-3; Lin, et al., 2011, pp. 945-946; Weaver, 2011, pp. 17-18

[270] Stone, et al., 2016, pp. 19-21

As soon as these systems, whether in road traffic, medicine or other areas, are mature enough, these arguments cannot be denied. On the other hand, a technical product will never be fully developed and safe. In addition to mechanical and electrical defects, the software may have errors.[271]

In section 2.6 the example of the *ALMA* project was described. This project is developing an intelligent wheelchair that navigates independently to the doctor's office or the pharmacy and also handles communication with doctors. Many mistakes can happen with this application. The wheelchair could cause a crash or malfunction in an emergency. Such a device also has access to highly sensitive health data. What if they circulated?[272]

In the case of a failure of such an autonomous AI system traditional liability approaches are limited. Can the common approach of causality, cause and effect, still be effective, when a AI system has started to create its own new decision making processes?[273]

In these cases, it is primarily about a financial compensation and, if necessary, to the preventive securing of compensation payments.[274]

Manufacturers of autonomous machines could be required to bring them on the market only with appropriate insurance cover.[275]

It is also important to introduce technical safety standards during the development process. This, among other things, with regard to data protection.[276]

In this context, *Matthew Scherer* proposes an agency that according to the relevant guidelines certifies the AI system and thus declares it to be safe.[277]

Added to this is the question of how an automomes system reacts in a situation in which damage can no longer be averted, but alternative courses

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[271] Lin, et al., 2011, p. 945; Brozek, et al., 2017, pp. 251-252; White & Baum, 2017, p. 67

[272] Guzzi & Di Caro, 2015; Scascighini & Hersche Cupelli, 2016, pp. 23-25

[273] Johnson, 2015, pp. 708-709; Barfield, 2015, p. 148

[274] Gurney, 2017, pp. 57-59

[275] Leenes, et al., 2017, p. 16

[276] Scherer, 2016, pp. 395-397

[277] Scherer, 2016, pp. 395-397

of action exist. Should person A or person B be harmed? Who is worth more? These questions quickly lead to an ethical debate.[278]

Furthermore, to the possibility of physical damage, the possibility of non-physical suffering should also be considered. Dehumanization is an example of this. Let's think about the nursing area. Can a robot embody compassion similar to that of a human caregiver? If not, what is the consequence, especially in medical terms?[279]

## 5.7. Systemic Problems

So far, besides general legal challenges around AI, we looked at bias, privacy, data and IP ownership, employment, and security issues. These aspects mainly affect companies, their employees as well as consumers.

Some of these aspects may be covered by existing legislations, in some cases an extension or concretization of existing legal obligations is required.[280]

In addition to these areas, finally, possible problems are sketched, which are more in the light of the enforceability of existing concepts by government authorities.

### 5.7.1. Compliance Enforceability

Regarding bias, it was discussed how difficult the traceability of AI-driven processes can be (see section 5.2). At the same time, there are legal frameworks in the handling of personal data. The example of the *GDPR* has explained some burdens on businesses. Given these considerations, it is clear that companies will be exposed to significant compliance costs as soon as they operate a corresponding AI system.[281]

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[278] Lin, et al., 2011, p. 945; Contissa, et al., 2017, pp. 365-368

[279] Luxton, et al., 2016, p. 255

[280] see Moses, 2011, pp. 764-766; Scherer, 2016, pp. 373-376

[281] Wallace & Castro, 2018, pp. 1-4, 25-27

Section 5.1 reported on the information asymmetry and the difficulty of understanding AI data processes which authorities are facing to. Companies that do not comply with the rules of data protection may be preferred to those who take compliance seriously.[282]

Due to the globalized nature of digitization, years could pass before regional authorities could effectively tackle rule violations. And more than that. The question must be allowed, if in a world of increasingly non-transparent data flows that are propelled by AI systems, existing rules will finally be enforceable?[283]

### 5.7.2. Abuse of Dominance

Related to these aspects, another problem area may arise. In section 3.7 was highlighted that mainly market-dominant companies invest in AI and thus create the best conditions to gain even more dominance.

Undertakings that hold a dominant position face the rules of conduct of Article 102 TFEU under European competition law.[284]

Essentially, these rules aim to ensure that other market participants can only be forced out of the market under certain conditions, or that potential new entrants have a realistic chance of entering the market.[285]

In the light of a possible further concentration of the dominance of a few large digital companies, enforcing the existing competition rules for the authorities could become increasingly challenging.[286]

Similar rules apply in the US under section 2 of the *Sherman Act*.[287]

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[282] Mandel, 2009, p. 9; Brownsword, 2008, p. 162

[283] Humerick, 2018, p. 393

[284] European Commission, 2009; European Union, 2012, p. 89

[285] Peeperkorn, 2016, pp. 390-393

[286] Gorp van & Batura, 2015, pp. 29-33, 69-71

[287] U.S. Department of Justice, 2015

### 5.7.3. Tax Erosion

Today, in view of international taxation systems, there is a broad consensus to avoid double taxation. For this reason, tax systems usually distinguish between residence and source country. Residence is where a legal or natural person receives profit. In the source country the economic activity takes place. Very broadly speaking, income is taxed in the country of origin (active income), while the country of residence levies taxes on interest and dividends (passive income).[288]

The development of a software, for example, can be done easily by employees in different countries. Increased digitization in the near future, will even allow the co-development of physical products beyond national borders. This has been mentioned in section 2.4. In such situations, it becomes increasingly difficult for the authorities to allocate taxable profits.[289]

Another effect of digitization is the fact that profits can be shifted more easily. The establishment of a subsidiary abroad or the transfer of payments has become easier and faster as a result of digitization.[290]

A further consequence of digitization is the ability of a company to sell products abroad without physical presence. This is particularly noticeable in companies that sell software or offer content streaming, such as music or video programs. These providers can generate value at the point of sale without having employees there.[291]

Finally, digitization increases the geographical gap between a company and its shareholders. In 1965, US citizens held 84% of US shares, and only 24% by 2015. International investment portfolios easily break the link between companies and shareholders.[292]

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[288] Avi-Yonah, 2007, p. 1

[289] Jiang, 2011, pp. 175-176

[290] OECD, 2015, pp. 98-99

[291] Devereux & Vella, 2017, p. 6

[292] Rosenthal & Austin, 2016, p. 923

As a result of a first wave of digitization, through the spread of the Internet and modern communication technologies, present national governments face enormous challenges. How are corporate profits to be taxed? To what extent is cooperation with foreign tax authorities necessary?[293]

The increasing establishment of AI technologies represents another wave of digitization.[294]

The AI wave will potentially further increase existing problems of corporate taxation in an international context. As a reaction of the ongoing internationalization of companies, the *OECD* launched a reform project called "*Base Erosion and Profit Shifting*" (*BEPS*) in 2013. Action 1 of the *BEPS* deals with digitization.[295]

Several ways of tax avoidance are closed by the results of *BEPS*. However, this does not mean that technological changes in the field of AI will not create new gaps.[296]

At least, the OECD report reflects the intention to observe further technological changes.[297]

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[293] European Commission, 2014, p. 5

[294] see Brynjolfsson & McAfee, 2011, pp. 33-34

[295] OECD, 2015

[296] Devereux & Vella, 2017, p. 9

[297] OECD, 2015, p. 13

# 6. Abstract


A 1942 short story by *Isaac Asimov* titled "*Runaround*" has narrated 3 laws that describe how a robot must behave towards people. This short story was written at a time when AI's development began. *Asimov's* science fiction scenario has not come true until today. Nevertheless, AI has arrived in our society. Not so much in the form of robots, but rather in the form of software.[298]

Driven by the price erosion of storage space, the disproportionate increase in computing speed of processors as well as the global networking of servers and other computing units, AI has made its breakthrough and will sustainably change our lives over the coming decades. AI applications are already diverse today, with up to four abilities depending on the application: perception, learning, natural language processing, and reasoning. Based on these characteristics, an AI system is capable of self-development and autonomous decision-making.[299]

In business, the application of AI will provide far-reaching opportunities for strategic differentiation across all industries. There will be new products and services. Likewise, new sales channels will emerge, and the point of sale will shift in many cases. All that will change whole industries.

The world of work is also undergoing major changes. Existing jobs are replaced or modified, others arise. Work processes and work organization become more decentralized and more international. Competency profiles will change, especially regarding leadership roles.

Ultimately, there are many legal issues to clarify. How do we as a society deal with it, when decisions taken by AI discriminate or the affected person is harmed? Will we be able to stick to our privacy principles in a world of AI? How do we regulate labor law in an increasingly decentralized, internationalized world of work? How do we fix security issues when an AI system has caused damage? And finally, authorities may find it increasingly difficult to enforce existing principles of data protection, competition law, and corporate taxation.


[298] Asimov, 1950

[299] Skilton & Hovsepian, 2018, p. 80

## Curriculum Vitae

Patrick Steinwendner has been working continuously in various machine and plant construction companies since 1991. At the beginning in the design environment, subsequently in project management and since 2011 in various management functions in sales, after-sales and product management.

After an apprenticeship as a technical draftsman from 1991 to 1995, Patrick Steinwendner attended a further education in mechanical engineering (1995-2000), which was offered as an evening school. From 2006 to 2011 he studied business administration at the Johannes Kepler University Linz with a focus on international and strategic management. During this period, he worked as an individual entrepreneur.

## Declaration of Authorship

I hereby declare

- that I have written this paper without any help from others and without the use of documents and aids other than those stated above,
- that I have mentioned all the sources used and that I have cited them correctly according to established academic citation rules,
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Patrick Steinwendner