

10 theses about AI

A companies' eye view
of the future of AI

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AI calls for strong human leadership

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In the age of AI, corporate strategy makes the difference

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Executive summary

Artificial intelligence (AI) has evolved from a mere buzzword to a veritable megatrend – a game changer for the industrial era. More and more companies have become aware of the opportunities afforded by AI and are grafting the technology into their existing businesses or using it to create new business models. Globally, the US is still the leader, hosting not only the digital giants that are investing in AI on a grand scale, but also the largest number of AI startups. That said, China too is investing heavily in AI. Indeed, it is plotting a clear path to overtake the US by 2025 and dominate the global AI market by 2030. European countries have some catching up to do. In April 2018, the European Commission therefore announced the outlines of a European strategy, details of which should be made known by the end of the year.

This study formulates ten theses from a companies' eye view. First of all, we are convinced that in an environment full of intelligent machines, human guidance and leadership will be a more important factor than ever. Second, AI is not about to replace human strategic thinking any time soon, so corporate strategy will remain a powerful competitive differentiator. Third, the dominance of the internet giants and platforms will increase even further in the short term, precisely because of AI. Fourth, this dominance will end with the advent of "portable AI": AI that runs on portable devices and gives consumers direct connectivity to providers of goods and services, as well as to friends and family. This development will render intermediaries such as Google, Amazon and Facebook obsolete, thus shifting the power back into the hands of the consumer instead of big business. Fifth,

AI will replace corporate silos with powerful networks: Decreasing transaction costs will translate the vision of virtual and lean companies into reality. Sixth, the use of AI presents systemic risks to the financial sector. Banks and insurance companies are faced with two kinds of new competitors: on the one hand the internet giants, analyzing their huge stockpiles of data with AI to develop financial products; and on the other hand a myriad of small fintechs offering AI-based niche products. The stock market too could find itself strongly influenced by AI algorithms. One key question is how to regulate these new developments in the financial sector. Seventh, colluding AI algorithms could open the door to deliberate wrongdoing and illicit price setting – another new scenario for regulators to deal with. Eighth, AI can, in cooperation with humans, accelerate and enhance the innovation process. Ninth, it must be made crystal clear that, for all actions initiated by intelligent machines, human managers will be held accountable. AI algorithms must be transparent to customers, such that the latter know how they work, at least in principle. Lastly, in an AI world that facilitates completely new links between personal data, a fair balance between data protection and AI progress will be necessary. Future AI applications will succeed only if data protection rules champion data sovereignty rather than tread the path of data minimalism.

Introduction

AI is no longer a buzzword, but a deep-rooted trend. The technology is entering its industrial era and the global race for AI dominance has long since begun. To benefit from AI, companies must prepare now.

Artificial intelligence is the new megatrend. Radically new business models, and also huge efficiency gains, are attracting investors and corporates alike. In 2017, more than USD 15 billion was invested in nearly 1,400 AI startups. The technology is now reliable enough to be embedded in the systems we use every day. AI, in other words, is going mainstream. This study formulates 10 theses on the subject of AI from a company perspective. Before we explore these theses, however, let us first set the scene by briefly describing the current status of AI evolution and discussing the global race for AI domination.

FROM BUZZWORD TO LONG-TERM TREND

About two-and-a-half years ago, Microsoft declared that 2016 would be the year of AI. It was indeed a turning point in the general craze for AI. In 2017, we marveled at the prowess of AlphaGo Zero, which plays Go without having memorized parts of the game beforehand. And we were frightened by the idea that algorithms could eventually destroy millions of jobs. Meanwhile, the term "AI" has become a magic formula that all companies must claim to master (even if they don't) at the risk of otherwise finding themselves out of the game. We are now getting used to the idea that AI is no longer a mere buzzword, but a deep-rooted trend that is here to stay.

FOURTH WAVE OF RECENT TECHNOLOGICAL DISRUPTIONS

Today, organizations and governments find themselves confronted by an abundance of new technologies. Three waves of technological disruption have swept across our economies and societies in less than three decades. The first concerned hardware, with IBM and Intel coming through as the big winners. The second centered around the development of software and operating systems, which Microsoft largely pioneered.

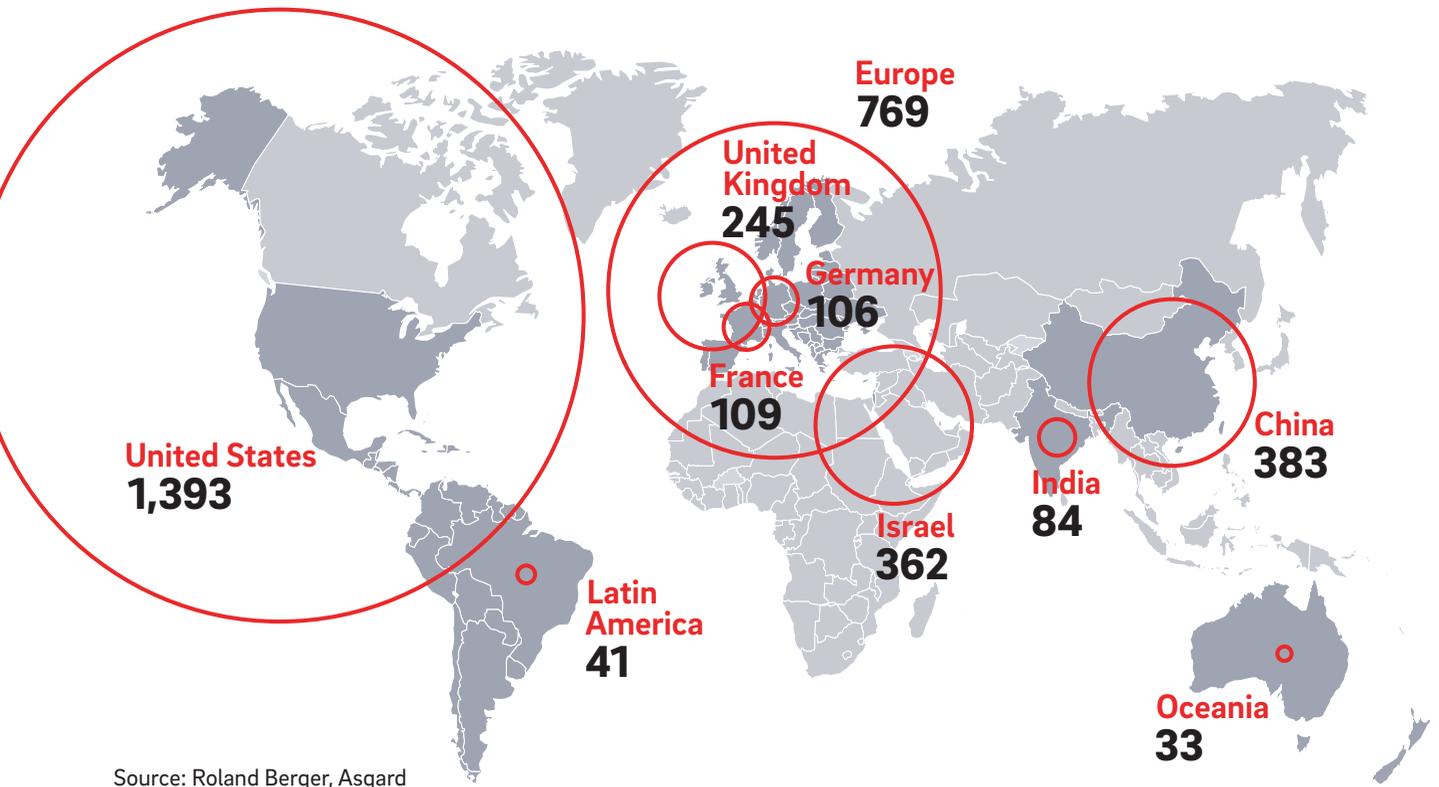
The third was the smartphone app revolution, triggered by Apple's iPhone mobile device. Smartphones have since become the remote control of our lives. Today, we are on the cusp of a fourth wave that draws its energy from ever greater computing power (cloud computing, graphics processing units), an abundance of data and ever more powerful AI algorithms. AI is at the core of tools we use daily like navigation systems or smart personal assistants as well as of technologies under development like autonomous driving or facial recognition. Soon, it could endanger even the business models of the internet behemoths.

AI IS ENTERING ITS INDUSTRIAL ERA

Dovetailing with other technologies is helping AI to enter its industrial era. Three levels of AI maturity can currently be observed in the corporate sector. The first of these is the "orientation phase", in which companies learn about the opportunities and cost of AI and about real AI applications. At this stage, companies try to get a grip on how AI will affect their profit and loss in the future. They assess their own AI readiness and ask themselves how to keep AI from becoming the "next big IT project" that is doomed to failure. The second maturity level is where AI is integrated in corporate processes – not as a one-off proof of concept, but in a coordinated and holistic effort focused on those areas where AI can genuinely add value today. AI capabilities are incorporated in existing business. Companies run robotic process automation (RPA) projects that are powered by AI. They hire the right talents and analyze the implications of implementing AI applications for management, for employee motivation and for corporate KPIs. The third maturity level is where new business models are developed on the basis of AI. Here, corporate silos are replaced by value networks. Customer front-ends are automated and improved, taking customer

Global distribution of AI startups 2018

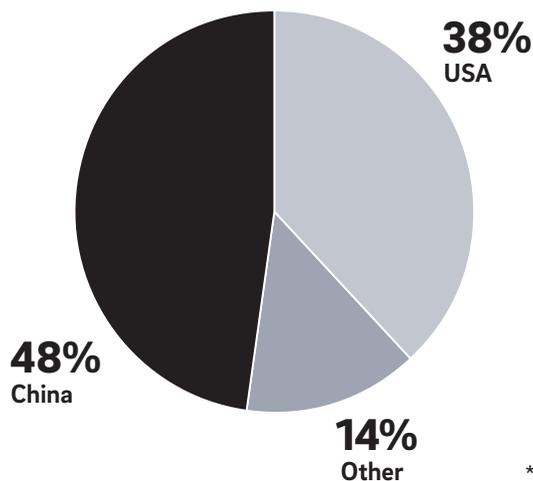
Countries and regions by number of startups



Source: Roland Berger, Asgard

Equity funding to AI startups 2017

Share of global equity funding



USD 15.1 billion*

Global equity funding

Source: CB Insights

* As the amounts of some equity deals are not disclosed, this is the lower limit

relationships to a new level. The innovation process is rebuilt, and new forms of human-machine interaction are developed. At this stage, companies also anticipate the move from weak AI (i.e. machine learning) to strong AI (i.e. systems that can think and perform tasks on their own, like humans can).

AI: THE GLOBAL RACE IS ON

Just how high expectations regarding AI are can be seen from the fact that the global race for AI dominance has long since begun. The US currently leads the AI ecosystem with 1,393 startups – 40 percent of the total number of AI startups worldwide (see figure left). Europe as a whole occupies second place with 769 AI startups (22 percent of the global total), while China ranks third with 383 startups (11 percent). Thanks to its leading digital players – most notably the GAFA companies (Google, Apple, Facebook and Amazon), which cumulatively acquired close to 40 AI startups in the period from 2010 to 2018 – and its top-quality universities, the US has the perfect foundation for developing and implementing AI applications. It publishes the most AI papers in the world, has the most people working in AI (approximately 850,000) and in 2017 accounted for 50 percent of all equity deals in AI startups globally.

Yet China too is investing heavily in AI, aiming to break the US' dominance. Although China's AI startups acquired only 11 percent of global funding in 2016, a year later the country accounted for 48 percent of all dollars going to AI startups globally – surpassing the United States for the first time in terms of share of dollars (see figure left). AI is a strategic priority for the Chinese government, which is heavily subsidizing the rise of Chinese AI companies. By as early as 2020, China wants to draw even with the the US' AI capabilities. By 2025, it plans to have taken the lead. And by 2030, it aims to dominate the global AI market.

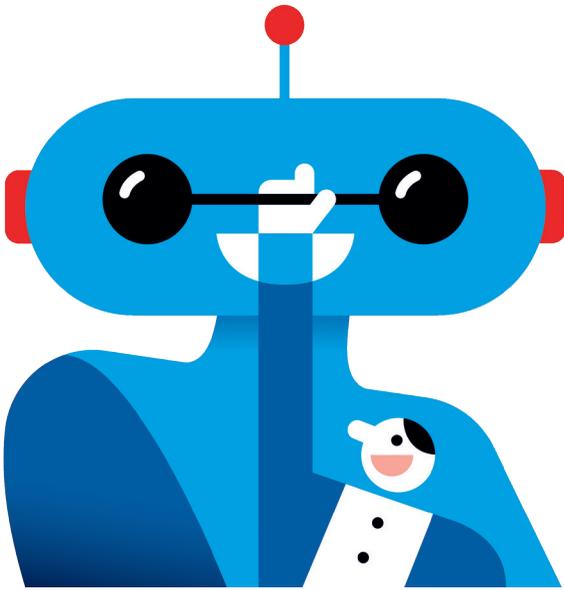
Europe must take care not to lose touch with the race for AI. Europe's AI assets are fragmented. As always, talent, capital and research are spread widely across the continent. Most universities with AI departments are located a long way away from the leading AI innovation hubs in Paris, London and Berlin. And as things stand, few activities specifically target AI at a European Union level. There is, however, some evidence that such moves are now being tackled. In April 2018, the European Commission announced the outlines of a European strategy, to be fleshed out by the end of the year. To catch up with the US and China, both joint EU action and substantial public funding are necessary.

NOW IS THE TIME TO PREPARE

If they want to benefit from AI, companies need to do some basic (but crucial) homework, such as defining the quality of data they want to feed into AI systems. They also need to ask the right questions that will guide AI toward meaningful answers. As mundane as these tasks may be, they highlight one important point: Popular beliefs notwithstanding, AI will not replace humans in the foreseeable future. On the contrary, it will increase the need for human judgment and guidance. Humans will once again move center stage and become choreographers of an AI-supported environment. The ten theses about artificial intelligence that follow examine the topic from the perspective of the corporate community. They point to the specific challenges and major developments for which CEOs must prepare – developments that will take place in the mid term, after the imminent large-scale implementation phase, but way before any notional moment of technological singularity when superintelligence starts to upgrade itself and outpace the human brain.

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1 AI calls for strong human leadership

While more and more analytical work and other business tasks will be done by AI-empowered systems, leadership will, in the foreseeable future, remain the exclusive preserve of the human being. It is in their relationships with others that human beings develop trust, a sense of belonging and purpose. In an environment full of intelligent machines – an unsettling scenario for many – human guidance will be needed more than ever. People will follow others if they trust them: They will not want to follow computers and their decisions. In the companies of the future, leaders will need formidable interpersonal skills, a sense of responsibility and a strong ethical grounding. At the same time, they will also need strong intellectual skills to partner with the machines. They will have to know how to use machines as advisors, how to employ them for the good of the company – and when to decide against their advice, if necessary. That is why it is crucial to control the quality of the data fed into AI and to ask the questions that AI is supposed to answer. If you don't ask the right questions, you get the wrong answers. When that happens, AI is of little use.

2 In the age of AI, corporate strategy makes the difference

Assuming they are well guided, AI systems will be able to predict business opportunities. They will provide valuable advice for specific problems. But they will not replace human strategic thinking any time soon. Markets are influenced by the social, political, cultural, environmental and other frameworks within which they operate. They are so complex that no AI will be able to simply crunch the numbers and spit out the "right" (i.e. most rational) step to take next. Intuition will be needed for bold strategic decisions in complex situations, and that is a human core competency that will become even more important in the future. Why? Because, in a market that is "analyzed to death" by machines and algorithms that are available to everyone, strategy will be the main differentiator between competitors. It will thus be of tremendous importance to access the best human thinking available, not its artificial counterpart. The relevant aspects here are diversity, a wide opinion spectrum, collective intelligence and the combined power of human brains. The development of strategy must be reinvented. What is needed is more speed, greater flexibility and an understanding of organizations as ongoing processes that are also AI-enabled.



3 In the short run, AI will further increase the dominance of internet giants and platforms

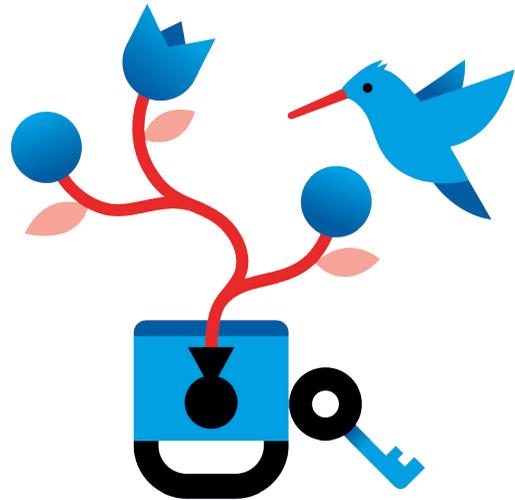
Digitalization has fueled the rise of internet giants such as Google, Facebook, Amazon and Tencent, as well as other platforms like Uber, Airbnb and Ant Financial. By effectively bundling and satisfying consumer demand, they are threatening the supply-side-driven business models of traditional players. Many current AI use cases still rely on relatively simple deep learning technologies where a machine is fed with huge amounts of images, text or soundbites to recognize patterns. This plays to the strengths of the American and Chinese tech giants, because data is the lifeblood of these technologies: the more, the better. Eventually, AI

could form a landscape in which a handful of global digital players could dominate a wide array of industries. Today's traditional players survived the first wave of digitalization and are therefore better prepared to compete with both the Googles of this world and newly emerging AI platforms. Yet they will still be threatened by the AI power used in multi-faceted, platform-based business models. Consumers thus find themselves in a dilemma: They benefit from the effectiveness of the platforms, yes, but they lack choice across a broad range of different players. Meanwhile, the dominant platforms collect more and more personal data. An oligopolistic world limited to a small number of digital players also entails further risks: Dominant players can dictate prices. They can misuse their enormous power in their dealings with suppliers. And given their global footprint and their ability to shift their business to countries where regulation is weak (and taxes are low), regulators are often helpless. Moreover, legislation lacks adequate rules to regulate digital business models – a situation that will become even more dramatic when digital business models are AI-based.

4 Portable AI could render the likes of Google irrelevant

An AI-driven world dominated by today's internet giants doesn't sound like a very appealing prospect. But as we gradually move from deep learning technologies to machine reasoning and genetic algorithms, there will also be progress in the development of new forms of AI solutions and technology – such as personal, portable AI devices –

that could be highly disruptive even to today's internet behemoths. These new personal assistants will feature new protocols and peer-to-peer technologies. They will be intuitive, relatively inexpensive for consumers (a mass product, in other words) and will be able to protect privacy, as consumers' data is stored in a private cloud. By building continuously self-learning profiles, consumers will receive hyper-personalized advice based on stated, observed and inferred behaviors. Portable AI will re-empower consumers and help traditional companies regain direct access to them. For example, apartment owners will be able to connect directly to their short-term tenants, whereas Airbnb manages everything for them today. Hence, existing monopolies will be shaken up. The end of the tech monoliths and the end of platforms such as Uber or Airbnb could be nearer than we think! Although still a kind of moonshot project, portable AI is technically feasible. Whether or not it becomes reality is a question of whether enough money is invested. Who will provide portable AI? In a world of portable AI, network effects will not be important (your device is your "platform"), so platforms will no longer have a competitive advantage. A broad range of AI solution providers will emerge, competing for the best-performing algorithms so that their devices provide the best solutions to consumer demand. When will that happen? Considering that it took 10 years from the launch of the first mobile phones to the arrival of smartphones, we can expect portable AI to unleash its disruptive force in a similar period.

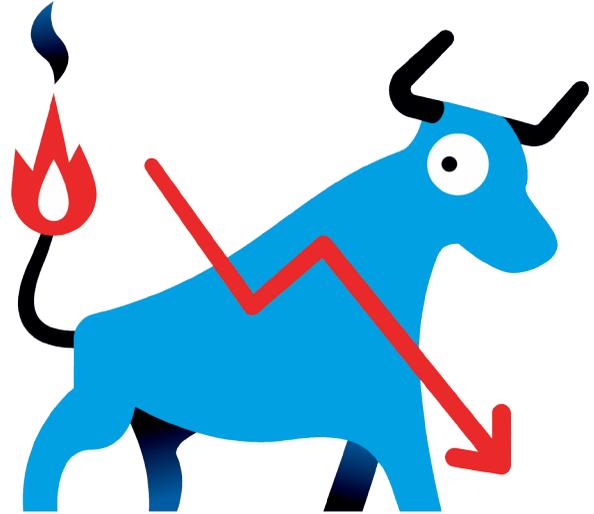


5 AI will replace company silos with powerful value networks

With AI, the 20-year-old promise of the emergence of powerful virtual companies will come true. The vertical value chain will be broken down and transformed into a value network. The more customers and their behavior become transparent and predictable through AI, the greater will be the opportunity to target them across the entire consumption spectrum: Someone who smokes or loves extreme sports might be interested in getting a bespoke health insurance plan. Someone who lives alone and has little social contact could be open to TV subscriptions and food delivery. It will make sense for companies to partner with other companies and target customers as a network. Customers could end up buying only within one specific network (comparable to today's airline alliances) – knowingly or not. Several large networks might emerge, or many smaller ones.

Either way, it will be more efficient for all companies involved to divide labor and focus on their core competencies. They will be lean, sharply focused and constantly feeding the underlying AI system with customer data for

all partners to use. By doing so, they will constantly improve their aim. Within company networks, data sharing will become particularly important: One company alone does not see the "big picture" of its business sphere (including markets, supply chains, investors, regulators, etc.) as the basis on which to develop AI applications. But networks will benefit by pooling their data in new platforms. By working in AI-supported company networks, they can significantly reduce transaction costs (the costs incurred to coordinate economic transactions). To take just a few examples: Legal costs will decline because documents such as contracts can be prepared by AI. Communication costs can be lowered thanks to the AI-powered translation of documents, for example. Information costs will decrease with the aid of AI-based algorithms that search for best prices and the fastest delivery of intermediates, or for markets with highest demand.



most of whom so far come from non-financial sectors – can be regulated. At the same time, AI is facilitating specialization in small market segments and thereby enabling the emergence of a myriad of similarly unregulated smaller firms (fintechs) that offer very specific solutions. All this makes the market highly complex. And like the competition between the new oligopolists we just mentioned, that too can impact financial stability. The question remains open: How do regulatory authorities keep control?

Another systemic risk stemming from AI could affect the stock markets as algorithms increasingly take over asset allocation and trading. Today, there are millions of market participants with at least as many strategies and decision-making patterns. In the future, with only a few AI providers available, only a handful of the "best" algorithms could end up participating in stock trading. That in turn could trigger extreme market movements – or even a collapse – if they all react in the same way. And there are other dangers: How does an algorithm that was originally fed with data in periods of calm react in a sudden moment of shock or crisis? What if one of the big AI platforms gets infected by AI malware, corrupting the algorithms? What happens when algorithms get better and achieve nearly 100 percent accuracy in their market predictions? Would that result in perfect markets without arbitrage, effectively doing away with "markets" altogether?

6 AI drives systemic risks

AI brings with it uncertainties and new challenges for the established financial system. Banks and insurance companies are only now starting to use it, and their competitors are already gaining ground. The internet giants, for example, are harnessing both their data analytics prowess and their AI power to develop products that will let them further penetrate the financial service industry. These products could either be financial products that target consumers directly, or products (such as prepared data sets) that target banks and insurers. In this context, banks and insurance firms are confronted with oligopolistic players of systemic relevance. The question is how these competitors –

7 When AI algorithms collude, companies pay the price

Prices are increasingly being set in the opaque realms of algorithms. In a fully AI-driven price setting system, consumers would no longer be able to compare prices or understand what costs how much and when. That would open the door to deliberate wrongdoing and price collusion. Consider this too: Algorithms written specifically to set prices that use every possible means to exploit customers' willingness to pay to the full could push each other up without human instruction, because they have "learned" that they will all benefit from collaboration (again, read: collusion). And who would be to blame if algorithms decided to collude? In this case, it is likely that CEOs and advisory boards would be held liable for decisions made within the black boxes of their AI systems. What if it cannot be proven that algorithms were colluding? Antitrust authorities might then resort to fining companies without proof, merely on the basis of unusual price hikes – effectively reversing the burden of evidence. Companies would then have to show that their algorithms were not colluding with others.

8 Humans and AI will team up to innovate

Looking back over history, it is incredible how human innovations have shaped the modern world. Think back to life 200 years ago, with no electricity. 150 years ago, with no

cars. 100 years ago, with no TV. 20 years ago, with no smartphones or social networks. So how should we expect AI to influence innovation? In two ways: First, AI will powerfully accelerate many innovation processes. AI is capable of accurately predicting the outcome of real-world experiments, so it can significantly speed up the invention of new products and solutions (such as new drugs). Second, AI applications will raise innovation processes to new levels, because they have the potential to change the very nature of the innovation process. AI will itself become creative, but not in isolation. To unleash its full power, it will still need humans. We are needed to provide input and guidance. We have to control the process, judge the results and draw the right conclusions from them. We will remain the masterminds of innovation and creativity.

9 Managers will be held accountable for AI's wrongdoings

Ultimate responsibility for all a company's activities – including those influenced, prepared or driven by AI – will remain with humans, i.e. with the managers/leaders of that company. Regulators have already made that clear. Top management will be held responsible for any wrongdoings or accidents triggered by their AI systems. This poses a considerable risk to management, as algorithms in the future will tend to self-learn and self-change in an opaque manner. Companies therefore have a vested interest in preventing AI from becoming a black box. Accountability functions must be built into AI – also with a view to AI's impact on customer relationships. People are afraid of the

idea of a depersonalized black box deciding on many aspects of their lives. (Who gets a bank loan? How much does my health insurance cost? What defines the price of the things we buy?) Many people will want to know (at least in principle) what is driving the algorithms. If they feel treated unfairly, that could lead to countless legal disputes. Here, however, company and customer interests coincide. And this fact can lead to a new relationship of trust. The name of the company, its brand, will guarantee protection and fair play.

10 A new balance in data privacy must be found

AI will challenge our current consent-based privacy rule setup. Artificial intelligence can reveal unexpected relationships between data and identify completely new links. Before we have something like the portable AI described in our fourth thesis, the use of personal data will thus become harder to control. At the same time, data collection will be more ubiquitous than ever. A fair balance between data protection and the progress of AI will therefore be necessary. Effective and fair forms of privacy reconcile the interests of citizens with those of the economy. They enable businesses to offer customers a broad spectrum of innovative and secure products and solutions. They also give citizens sovereignty over their personal data. That is of pivotal importance: Future AI applications will succeed only if data protection rules champion data sovereignty (based on transparent rules and general clarity about what

happens to personal data and how it is processed) rather than treading the path of data minimalism (restricting the processing of data to the greatest extent possible). The General Data Protection Regulation (GDPR) ratified by the EU in 2016 harmonizes data protection across Europe. It also strengthens the rights of consumers. The GDPR lays a good foundation. Europe's people should be best enabled to make their own informed decisions about which AI services and functions they wish to use and the kinds of data processing to which they thus give their consent. Contrary to the GDPR, however, the EU's planned ePrivacy Regulation points in the wrong direction. Focusing on data minimalism, the regulation in its current form raises further barriers to the processing of data, thereby hindering the development of European companies and having negative consequences for the European economy as a whole. In the medium term, data privacy might just be easier to ensure in an AI-driven context. Our fourth thesis paints a picture of the world of portable AI. In this world, every user has control over their data as this is stored in their private cloud and processed on their own, private device. Such portable AI would be fully GDPR compliant.



Conclusion

We have seen how important AI is to companies. Without question, future business will be unthinkable without AI, and the global race for AI demonstrates that economies and companies expect to gain competitive advantages from implementing AI on a large scale. We have also seen that AI presents both opportunities and challenges. For the first time, it will be possible to replace company silos with powerful value networks. Portable AI will disrupt the current business models operated by platforms and, in so doing, will re-empower consumers. AI will raise innovation processes to new levels. The challenges lie in new uncertainties for financial markets, the possibility that AI algorithms could "collude", algorithms' lack of transparency and the need to protect personal data. Regulators too must answer new questions. Exploiting AI's opportunities and mastering its challenges will only work on the basis of human judgment, coordination and responsibility. In other words, as our first two theses clearly stated: In the age of AI, human leadership and a good corporate strategy are more important than ever.

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