# Artificial Intelligence

## Opportunities for investors

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### IN A NUTSHELL

- Artificial intelligence ("AI") continues to bridge the separation between machine and human intelligence, led by substantial advancements in generative AI such as Large Language Models.
- Artificial intelligence has the potential to add trillions to global economic growth, with broad influence across all sectors of the economy. Productivity gains are likely to be driven by gains in labour productivity, although labour displacement is also likely.
- The Artificial Intelligence value chain for investment can be broadly grouped into three main categories: 1. Data collection, 2. Computing power, and 3. Use cases.
- Geographic and regulatory landscapes for artificial intelligence are rapidly evolving, in some cases hindering AI growth in particular areas or geographies but in many cases helping to drive forward innovation through competition.
- Aligning investments to capture AI growth can help investors participate in the transformative potential of Artificial Intelligence.

*"AI is one of the most strategic technologies of the 21st century."*

-European Commission Press Release (April 2018)

As Artificial Intelligence ("AI") capabilities continue to evolve, the separation between machines and human intelligence is becoming less clear, paving the way for AI to fulfil functions traditionally limited to humans or requiring human input and oversight. Currently, advancements in generative AI are reshaping how AI can replicate human behaviour through the origination of text, image, and audio content that are increasing indiscernible from human-generated content. For instance, OpenAI's GPT model can effectively converse in human-like text, making general connections across vast knowledge domains and almost instantaneously answering queries or prompts across a broader scope than previously thought possible.

Experts believe AI growth has the potential to dramatically increase capital efficiency, with the potential to add trillions to economic growth and to shift human labour away from mundane, repetitive tasks. The collection, analysis, and even creation of data has sweeping application across economic and social landscapes. Sceptics, however, caution against the potential unintended consequences of AI, ranging from mass unemployment and increased wealth inequality to infringement on privacy and other personal liberties. What is inarguable is the increasing importance of AI in our daily lives.

In this paper, we will explore and define the broad categories of AI, illustrating real-life examples of AI application across industries. For investors, considering the effects of AI development on the investment landscape is an important consideration to investing strategically. Thus, we outline the pillars of AI within the public equity universe and how business profitability might be shaped by AI going forward. We then discuss the investment landscape across the AI value chain, which we view in three broad categories: 1. Data collection, 2. Computer power and 3. Use cases. Finally, given the important economic, moral, and ethical questions that AI growth brings about, we highlight the current geographical and regulatory landscape for AI integration.

# 1 / Introduction

## 1.1 Defining Artificial Intelligence

### What is Artificial Intelligence?

Artificial Intelligence ("AI") at its simplest definition refers to the simulation of human intelligence by machines. Human intelligence relies on our ability to not only retain information but to adapt to changing circumstances and apply knowledge to new environments. These functions roughly divide into thought processes/reasoning and behaviours. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig1 differentiates these functions across two axes, 1. Thinking and acting and 2. Human and ideal approaches.

**Figure 1: Definitions of AI across two dimensions**

| | |
|---|---|
| Think Humanly<br>"The exciting new effort to make computers think… *machines with minds*, in the full and literal sense." (Haugeland, 1985)<br>"[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning…" (Bellman, 1978) | Think Rationally<br>"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985)<br>"The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992) |
| Act Humanly<br>"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990)<br>"The study of how to make computers do things at which, at the moment, people are doing better." (Rich and Knight, 1991) | Act Rationally<br>"Computational Intelligence is the study of the design of intelligence agents." (Poole *et al.*, 1998)<br>"AI… is concerned with intelligent behavior in artifacts." (Nilsson, 1998) |

Source: Russell, Stuart, and Peter Norvig (2010). *Artificial Intelligence: A Modern Approach (Third Edition).*

### The Turing test

Introduced by Alan Turing, the father of artificial intelligence, in 1950, the Turing test, originally called the imitation game, tests a machine's ability to exhibit intelligent behavior that is equivalent to, or indistinguishable from, that of a human. In practice, this test is conducted by a human evaluator who would blindly interact with both a machine and another human through conversation. The evaluator would judge the responses from both the machine and the human and try to differentiate the machine from the human. If the evaluator could not reliability identify the machine from the human, the machine is said to have passed the test.

While a machine can, in many cases, produce highly accurate or objectively correct responses in a natural language context, it has proven more complex for a machine to mimic or resemble how a human would answer a question. The release of OpenAI's ChatGPT chatbot signifies a tremendous leap forward, as a machine can refine its answers to be more human-like and, in some cases, also indistinguishable from human responses. Ex. ChatGPT relies on techniques from Natural Language Processing ("NLP"), which encompasses spoken and written language, and allows computers to understand language. According to IBM, "NLP combines computational linguistics—rule-based modeling of human language—with statistical, machine learning, and deep learning models. Together, these technologies enable computers to process human language in the form of text or voice data and to 'understand' its full meaning, complete with the speaker or writer's intent and sentiment".

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While machine's capacity to "think" or "act with intention" is a quite abstract question, we view AI capabilities as falling into three general categories that mimic or "behave" like humans:

(i) **Sense**: Collect numerical, textual, visual, audial data.

(ii) **Comprehend**: Analyze the data to draw conclusions and establish models. (

(iii) **Act**: Use the trained models to take action.

**Sense:** Sensory AI enables the machine to observe and collect data, typically through textual, visual and audial processing. As with human intelligence, collecting and processing information is at the foundation of decision-making processes. Consuming and textualizing large pools of information enables more precise and scalable analytical processing.

**Comprehend**: Computers identify and analyze digital images, videos, or other numerical inputs. Combined with significant processing power, a well-trained computer can analyze thousands of products or images within seconds, identifying inconsistencies or patterns beyond the scope of human capabilities. AI comprehension, requires significant amounts of data to learn to identify these patterns and draw conclusions.

Ex. Machine learning refers to the field of study that gives computers the ability to learn without explicitly being programmed[2]. Whereas traditional methods of programming computers require precise "ingredients" and detailed instructions, as with a baking recipe, machine learning simply requires supplying the machine with data and letting the computer model train itself to find patterns or make predictions. For instance, computer vision, which enables computers to identify and understand objects and people in images and videos, must learn from huge datasets to be able to make correct predictions, so that when applied to real-world applications, it will suggest the correct products or services to customers.

**Act**: AI systems act upon the collected information, i.e., take action in the real world, performing physical tasks or supporting users with analytics.

Ex. Inference engines incorporate decision-making logic into a dataset or knowledge base to draw conclusions and provide expert recommendations.

### Generative AI vs Discriminative AI

The main difference lies in their approach to learning. Generative AI learns the underlying distribution of the data, while discriminative AI focuses on learning the decision boundary that separates different classes and categories in the data. Generative models can generate new data that is similar to the input data, even if the generated data does not exist in the original dataset.[3] Discriminative models aim to learn a mapping between the input data and the output label or class.

Generative AI produces content using deep learning algorithms, rather than analyzing or acting upon existing data. Generative AI can create a wide range of content, from written text to images and now even video. This process generally requires less data as compared to discriminative models but also generates more model bias. Gaps in data as well can be "filled" by generative models, as generative AI can be used to generate synthetic data.

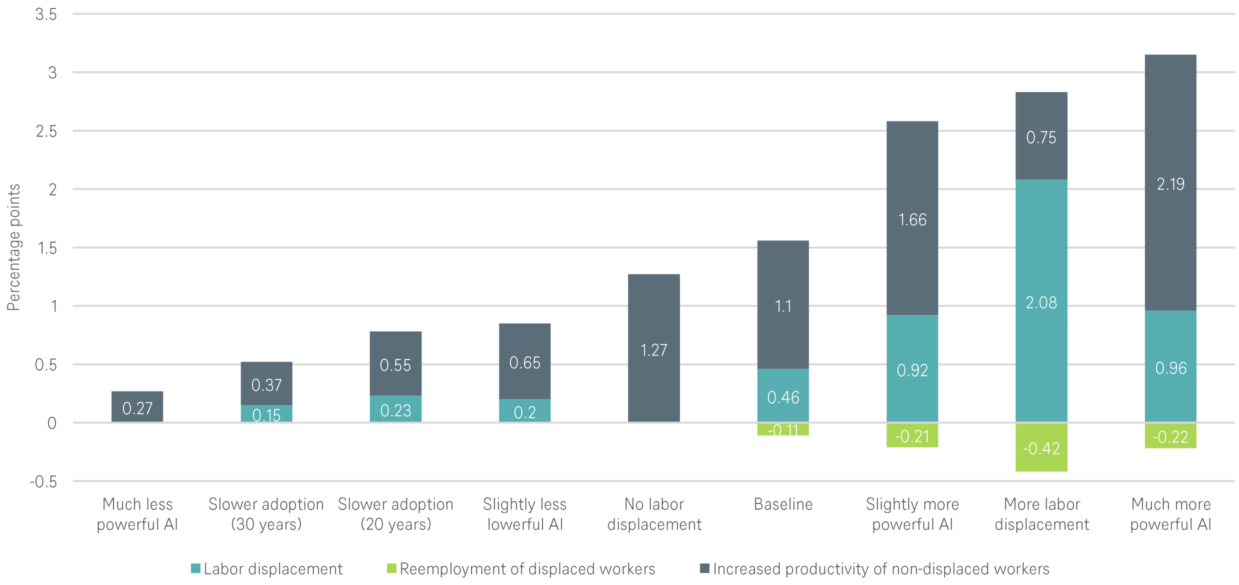
## 1.2 The scope of AI across businesses and the economy

### Potential impact on productivity and consumption

McKinsey predicts that AI could add roughly $13 trillion to the global economy by 2030[4], and PwC puts this figure at nearly $16 trillion–or roughly 14% higher global GDP–over the same time frame[5]. Goldman Sachs Research predicts that generative AI alone could drive a 7%, or nearly $7 trillion increase in global GDP and lift productivity growth by 1.5 percentage points over a 10-year period[6]. The impact of generative AI on labor productivity, however, blends labor displacement with improved worker productivity, with estimates of the potential impact shown in **Figure 2**.

[2] MIT Management Sloan School (2021). Machine learning, explained .
[3] Turing (2023). Generative Models vs Discriminative Models: Which One to Choose?
[4] PwC (2017). Sizing the prize: What's the real value of AI for your business and how can you capitalize?
[5] McKinsey Global Institute (2018). Notes from the AI Frontier: Modeling the Impact of AI on the World Economy.
[6] Goldman Sachs Research (2023). Generative AI could raise global GDP by 7%.

Figure 2: Effect of AI adoption on annual labor productivity growth, 10-year adoption period



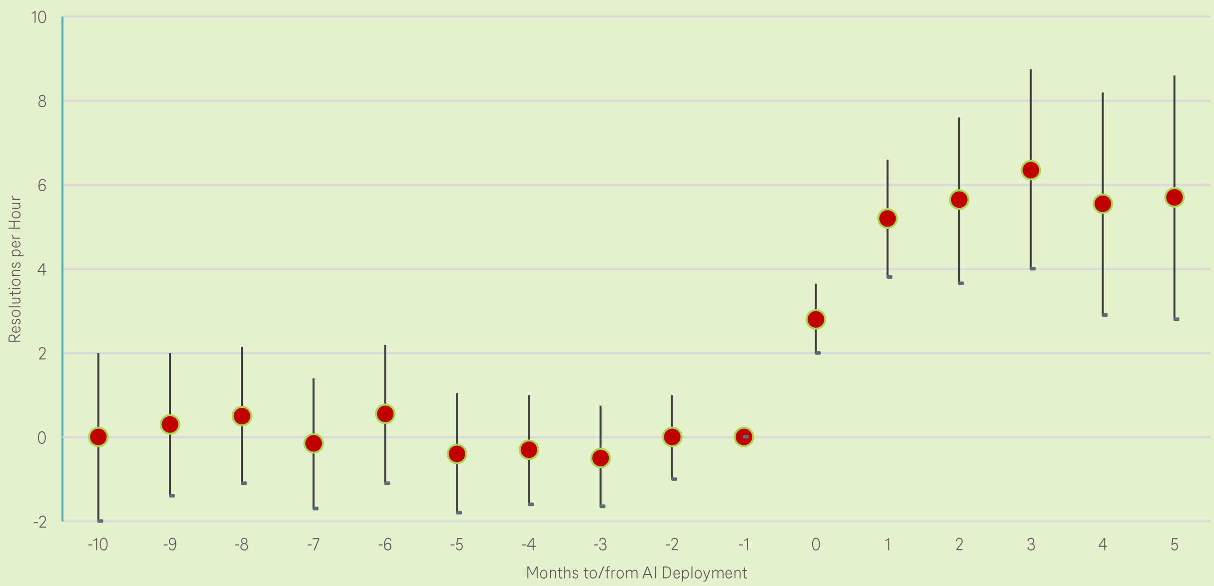

Source: Goldman Sachs Research (2023). Generative AI could raise global GDP by 7%.

Labour productivity gains are likely to be concentrated in capital-intensive industries such as manufacturing and transportation given the operational and logistical opportunities for AI-led efficiency improvements, while produce enhancements and greater product and service customization should help to drive increasing consumer demand for higher quality goods and services.

## Generative AI improves productivity

A study conducted by Stanford and MIT found that generative AI-based conversational assistant increased average productivity (measured by issues resolved per hour) by 14 percent on average, with the largest productivity improvement for novice and low-skilled workers. Further, the study found evidence that the AI model helps disseminate knowledge from more skilled to less skilled, newer workers, thus accelerating their move down the experience curve.

Figure 3: AI assistance and customer complaint resolutions




Source: Erik Brynjolfsson, Danielle Li, & Lindsey R. Raymond (2023). Generative AI at Work.

The potential to increase economic growth will be realized across a number of industries. According to a McKinsey forecast from September 2019, 72% of business experts believe that AI will be the most valuable business advantage of the future. AI techniques are likely to be the most disruptive force for the technology market in the coming decades. However, traditional technology firms are not the only sectors or industries that face potential transformation with the proliferation of AI. Areas of AI expansion include but are not limited to healthcare, self-driving, virtual inventory, virtual reality, and robotics.

Within healthcare, remote patient monitoring capabilities are greatly enhanced with AI's ability to collect, analyze, and interpret thousands or patient data points a day, providing personalized healthcare management and freeing medical professions up to focus on more complex tasks. Wearables and sensors containing AI software can improve patient outcomes, predicting issues in some cases well in advance of traditional medical monitoring and providing active monitoring that can even prevent medical issues from arising. Beyond patient monitoring and diagnostics, AI also has practical applications in drug development, with the Food and Drug Administration reporting 100 drug and biologic application on submissions using AI/ML opponents in 2021 alone[7].

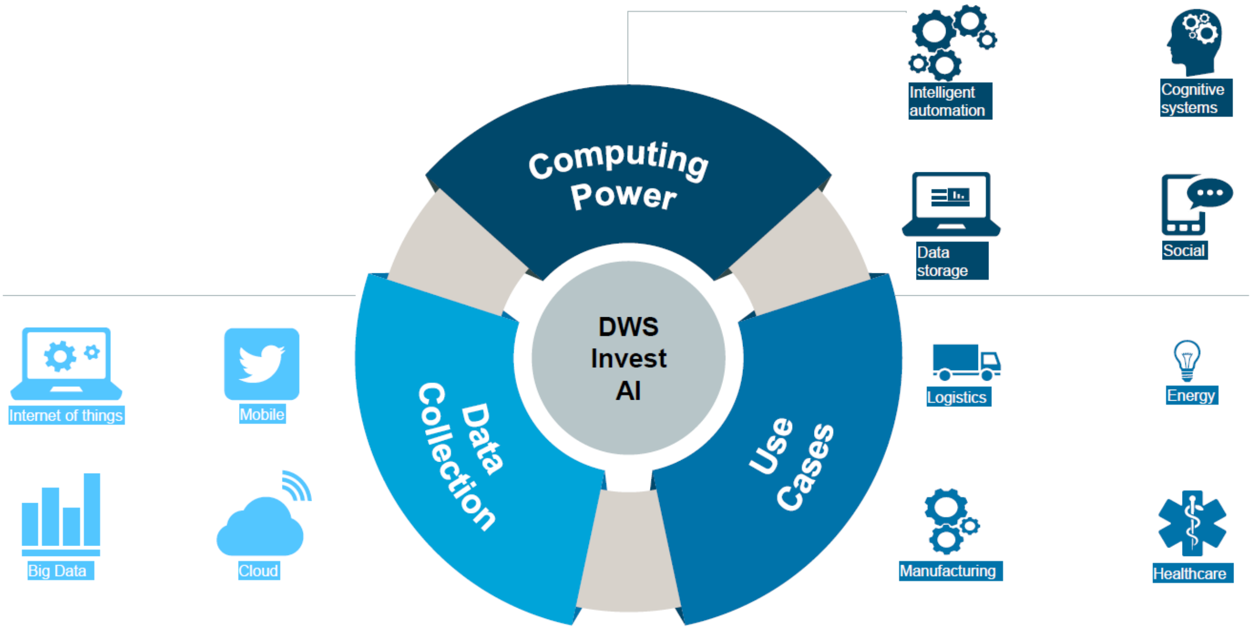
Across the manufacturing supply chain, collaborative robots allow for greater capital efficiency in producing the goods we consume. Inventory management helps to reduce the transactional costs of overstocking and understocking, and warehouse and employee monitoring can help with labour efficiency and even identify factors that help with employee training and retention. IBM finds that supply chain resiliency, accelerated time-to-value, smarter workflows, and intelligent automation will be import drivers of improvement across manufacturing supply chains in the future[8] According to Maersk chief technology and information officer Navneet Kapoor, generative AI has progressed into more "real" projects. Kapoor states "We are using AI to build what we call a predictive cargo arrival model to improve scheduled reliability for our customers... Reliability is a big deal, even post pandemic, so they can plan their supply chain, their inventories better, and bring their costs down"[9].

[7] U.S. Food & Drug Administration (2023). Artificial Intelligence and Machine Learning (AI/ML) for Drug Development.
[8] IBM (2023). IBM Supply Chain Intelligence Suite.
[9] CNBC (2023). A.I. could 'remove all human touchpoints' in supply chains. Here's what that means.

# 2 / How to invest across the AI value chain

The growth potential across the AI landscape provides meaningful opportunities for investment across the value chain. While specific areas of AI application are likely to emerge and demerge over time, we can generally categorize artificial intelligence investment into three broad categories: (i). Data collection (ii). Computing power and (iii) Use cases. Figure **4** shows examples of each of these three categories of AI development.

**Figure 4: Investible categories of AI development**




Source: DWS

## 2.1 Data collection

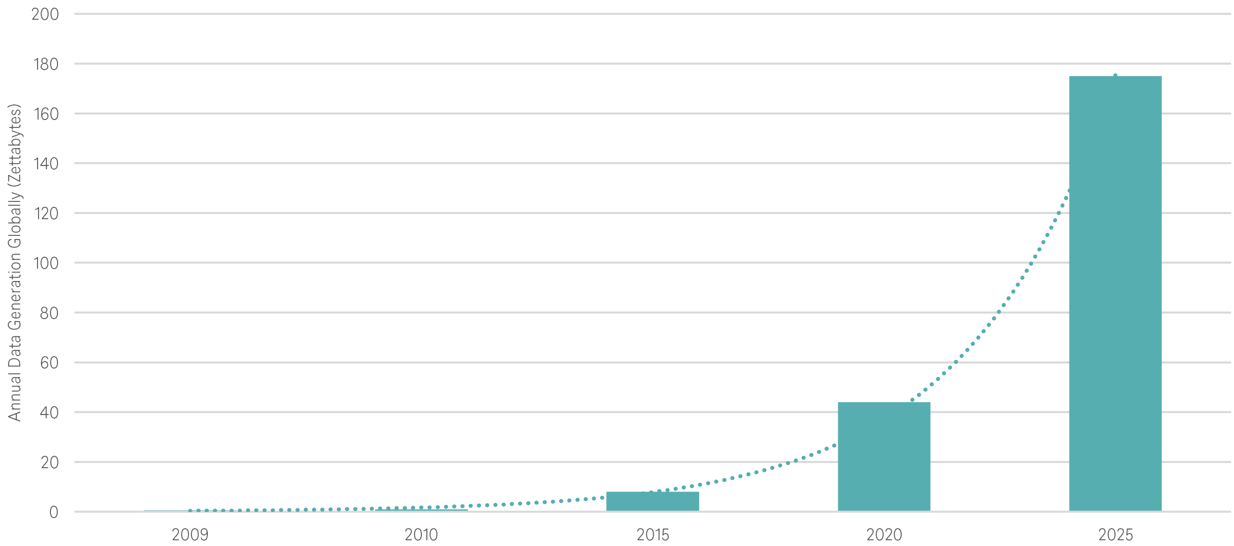
*Data is to AI what food is to humans*

- Barry Smyth, University College Dublin.

Data collection is an essential part of the research and business processes. As digital data gathering makes up an increasing proportion of data collection, there are a few essential industries that should benefit from the exponential growth of generated data. "Big data", as it's often called, refers to data sets that are too large or too complex for traditional data-processing applications, thus necessitating developments in data capture, storage, and validation. As AI models become increasingly complex and able to solve substantially more difficult problems, effective collection and quantifying of large pools of data becomes increasingly essential. According to the International Data Corporation (IDC), global data generation is doubling every 2-3 years, with a forecasted level of 163 zettabyte (or a trillion gigabytes) by 2025[10] shown in Figure 5.

[10] International Data Corporates (IDC) (2017). Data Age 2025: The Evolution of Data to Life-Critical. Don't Focus on Big Data; Focus on the Data That's Big.

**Figure 5: Computing growth drivers over time (1960-2030E)**




Source: EMC, IDC. Data as of April 2023.

While the collection of data is the main area of focus for many investors, secure and accurate data aggregation requires ongoing development of essential hardware and software as well as cybersecurity and data protection. These other areas of data collection are critical to the collection, validation, and security of the "food" that AI "consumes" and translates into practical use cases that mimic and approve upon human intelligence.

One of the biggest challenges to deploying and scaling AI is ensuring the data being used to train AI algorithms is of high quality. Using inaccurate or not timely data hampers AI models' ability to predict future trends and make meaningful business decisions. A PwC survey[11]. found that while 76% of companies plan to extract value from the data they already have, only 15% said they currently have the right kind of data needed to achieve that goal. Non-tech companies are especially lagging, but new tools can get them in the race. A growing range of hard- and software for data collection (e.g., computer vision, sensors, natural language understanding or NLU) can help them catch up.

At the same time, companies need to build in privacy safeguards. The utility of data versus the right to personal privacy is one of the biggest balancing acts faced by the companies. For example, there is tremendous value in using personal data such as health indicators or geolocation tracking for understanding trends. But people have a legitimate desire and right to not be tracked. Companies that work with data typically promise that it is anonymized and aggregated, but not all of them have the same data protection standards and cybersecurity.

There are two types of data that are important for AI development and application: human-generated data and machine-generated data. Human-generated data is data that is created by people through human action and can include anything from text data to social media posts to pictures and videos. Human-generated data remains one of the fastest growing and most valuable sources of information for businesses and tech developers.

Human-generated data in the form of images and video is unstructured data and remain challenging for organizations to utilize due to the complexity of building and maintaining cutting-edge algorithms. There are companies that work on unlocking the ability to extract insights from images and video. There are also companies that are specializing exclusively on a particular set of data, for example, geospatial data.

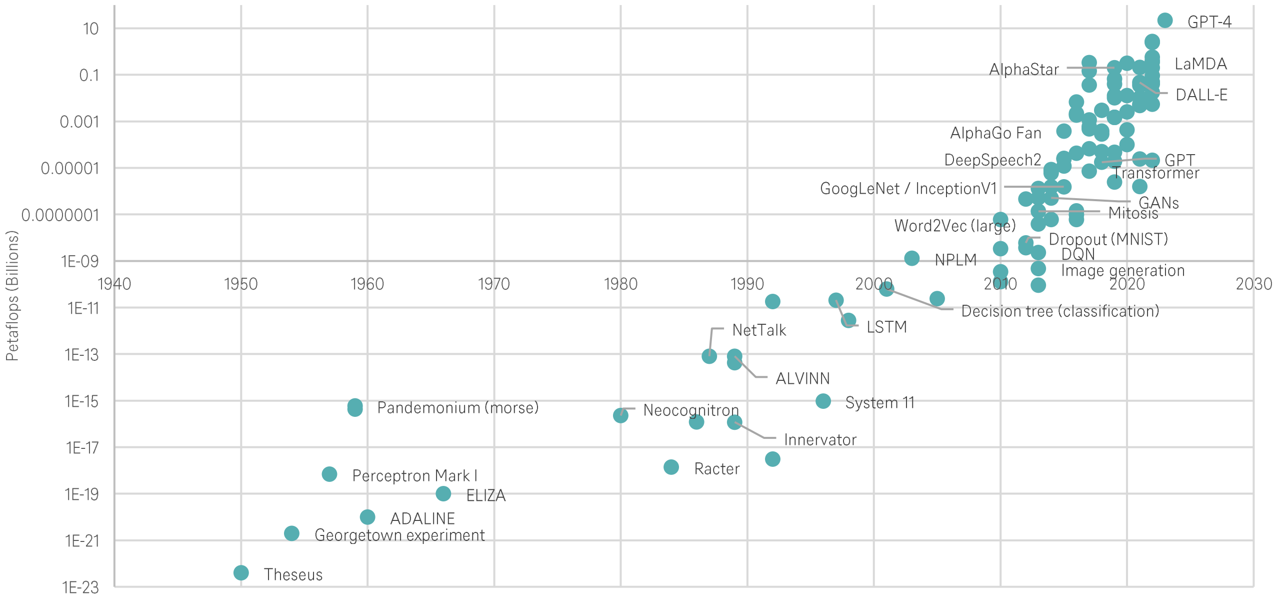
[11] PWC (2019). Trusted data optimization pulse survey.

Machine-generated data is data generated by all the systems running in data centers, the Internet of things (IoT) and by connected devices. It consists of all data generated by the applications, servers, network devices, security devices and remote infrastructure as well as through sensors in warehouses, manufacturing devices, and robotics

## 2.2 Computing power

The rapid development of AI capabilities in collecting, producing, and analyzing data has required ongoing advancement in processor architecture. Central processing units ("CPUs") are the central component of a computer, consisting of electric circuity that executes instructions of a computer program. CPUs can be thought of as the "brain" of almost any device, facilitating or "processing" the calculations necessary to accomplish tasks. Graphics processing units ("GPUs"), as the name indicates, are used primarily for the rendering of graphics and videos on a computer device. While CPUs have always been the most essential component of computer processing, growth in generative AI, allowing for the creation of original images and videos, has accelerated the demand for GPU technology. When used together, CPUs and GPUs act as the foundational components of computer processing, providing fast and large-scale processing for an immense array of AI functionality.

**Figure 6: 275x more computing power needed every two years**




Source: Outworldindata, BofA, DWS International GmbH. Data as of April 2023.

AI systems need to process massive amounts of data quickly. While the performance of general-purpose chips has improved enough to kick-start a new generation of AI technology, they cannot keep up with the exponential increase in the volume of data that AI systems process. As a result, chip design emphasis has shifted from a race to place more transistors onto a square millimetre of silicon to focus on building microprocessors as systems, made up of multiple components, each of which is designed to perform a specialised task.

Semiconductor memory growth in the next decade will outpace overall semiconductor growth. All the trends around AI and autonomous vehicles need memory, and this will ultimately contribute to economic growth. Today about 85% of semiconductors are manufactured in Asia. 98% of memory silicon is made in Asia. The major Asian countries that provide the supply chain and semiconductor manufacturing are concentrated in South Korea, China, Japan, and Taiwan. There is demand for a balanced supply chain, hence, the interest of various national governments to promote local growth in semiconductor manufacturing. The intentions can be seen behind the CHIPS act and other such funding, as it is an attempt to diversify the global supply chain.

Cloud infrastructure growth also empowers the next generation of AI by reducing network latency and improving hardware utilization. Datacenters ("DCs") in many cases are connected with optical cables, creating AI clusters in DCs that ultimately impact cloud customers in how efficiently they are able to run their end applications. Faster, more reliable connectivity afforded from reliable cloud infrastructure is a critical component for AI to function optimally.

### 2.3 Use cases

One of the biggest challenges to deploying and scaling AI is ensuring the data being used to train AI algorithms is of high quality. Using inaccurate or not timely data hampers AI models' ability to predict future trends and make meaningful business decisions. A PwC survey[12]. found that while 76% of companies plan to extract value from the data they already have, only 15% said they currently have the right kind of data needed to achieve that goal. Non-tech companies are especially lagging, but new tools can get them in the race. A growing range of hard- and software for data collection (e.g., computer vision, sensors, natural language understanding or NLU) can help them catch up.

#### Strategic investment cases

Use Case #1: AI for the consumer

AI helps companies provide personal recommendations and consumer marketing based on purchase history, ratings, and other customers' behavior. Already, many companies generate a significant share of their sales from recommendation engines. As AI capabilities grow, AI can create augmented reality services that allow for personalized product creation and interaction. To support ongoing customer service, AI can help to handle customer inquiries, helping to boost productivity and supporting agents with real-time suggestions. Emotion detection technology can also help inform higher level decision-making on customer strategy. The ongoing shift toward more individualized products and marketing works in tandem with voice-controlled smart speakers such as Amazon's Alexa. Voice-controlled smart speakers have expanded their number of skills to now >25,000, allowing customers to make purchases and track packages more easily..

Use Case #2: AI logistics and supply chain management

To improve on logistics and supply chain, AI can help improve inventory management, more accurately predicting demand for products in advance and helping reduce the cost of over and understocking. Sensor technologies can help to track the movement of goods as well, helping to improve on logistics discipline. Warehouse automation is also providing robotic solutions to improve productivity and safety in warehouses through automated conveyors, image scanners, and driverless forklifts. Beyond the warehouse, AI can optimize delivery routes to drive meaningful cost savings. AI-powered drone delivery technology and unmanned delivery vehicles are on the horizon as well, helping to alleviate the labor burden of product delivery.

Use Case #3: AI in scientific innovation

Better knowledge systems have the potential to meaningfully increase our level of scientific understanding. In recent years, AI-based solutions have discovered new patterns in math, physics, and chemistry. Google's DeepMind has developed the ability to predict how proteins fold, and challenges such as nuclear fusion and room temperature conductors are now more in reach than ever before. While the landscape for scientific innovation is rapidly changing, the opportunity set for AI contribution to knowledge development across math and science is likely to widen considerably.

Use Case #4: Search engines

A key milestone in Generative AI is Microsoft's demonstration of Bing with ChatGPT, a more conversational and potentially much more useful way to search the world's information. While there is very valid debate as to whether Bing could see market share gains vs the very dominant Google, perhaps the even bigger implication is the possibility to improve conversion. Less than 3% of current internet searches monetize. If a more useful and conversational interface can improve that by just 100bps, that could be a 1/3 uplift in monetization

[12] PWC (2019). Trusted data optimization pulse survey

# 3 / Geographical and regulatory dynamics

With the rapid development of artificial intelligence, major questions arise around the social, regulatory, and geopolitical implications of AI proliferation. AI importance has driven an arms race between countries and regions, with heavy private and public investment into research and development. Parameters around AI regulation have been defined in the US, China, and Europe, although the regulatory environment will evolve alongside technology advancements across the AI spectrum.

## 3.1 Geographical dynamics

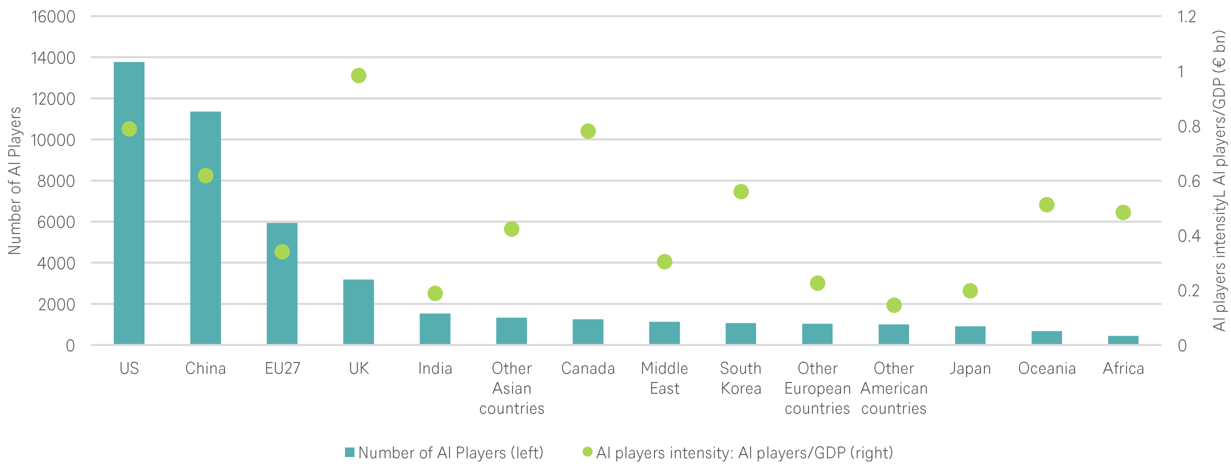
Given the broad landscape for AI applicability, there is a significant degree of differentiation of AI growth across regions and across company size. The United States has indisputably become the primary hub for artificial intelligence development, with tech giants like Google, Facebook, and Microsoft at the forefront of AI-driven research. As the race to dominate AI grows ever more competitive around the world, companies within the U.S. are exploring new opportunities to strengthen their foothold in the industry through acquisitions, sharing deals and internal advances. Their goal: to become a major player in an industry that is expected to reach upwards of $118 billion by 2025. While competitors in China and other parts of the world are set on challenging US dominance, U.S.-based firms continue to push forward with cutting-edge initiatives that position them as AI leaders for years to come.

While the USA is currently leading the AI Arms race, China is quickly becoming a close second. The government of China has been investing heavily in AI research and development, thus taking steps to try and overtake the USA in this new technological race. Major corporations including Alibaba, Baidu and Tencent are all actively involved in pushing China's AI capabilities to new heights, with many of their efforts creating groundbreaking results that have pushed the boundaries of AI like never before. This competitive rivalry will push AI development further, leading to rapid advancements in technology.

The European Union continues to develop coordinated national and European strategies around AI, demonstrating strength in research, industrial applications such as automotive and robotics, and promoting a strong legal and regulatory framework. The development of networks and centralized facilities will support AI growth, and open access to data and interactivity should provide a robust ecosystem for public administrations, firms, and civil society is paramount to AI applications.[13]

Beyond the US, China, and Europe, AI research and development has important implications for several key countries. Canada announced its AI strategy in the 2017 budget, which allocations CAD$125mm over five years, India has focused on three key areas for AI: opportunity for economic impacts, AI for greater good, and AI garage, Japan has been a long-standing leader in robotics. **Figure** 7 shows the number of AI players by country or region and AI intensity from 2009-2020.

**Figure 7: AI economic players and AI players intensity. Worldwide , 2009-2020**




Source: European Commission AI Watch (2020). Global View on the AI Landscape.

[13] European Commission JRC Publications Repository (2018). Artificial Intelligence: A European Perspective.

## 3.2 Small versus large companies

Among private sector leadership, large tech companies are at the forefront of AI development, with significant advantage in terms of access to vast amounts of data, financial resources, and more potential users where AI algorithms rely heavily on high quality data to train and improve their performance. Research and development funding, attracting top talent, and investing in software and infrastructure also provide leverage to the development of AI.

Smaller companies tend to be more flexible in their approaches to AI development, more quickly adjusting to customer needs, experimenting with new ideas, and focusing on more niche AI applications. Smaller firms can drive more specialized innovations in particular industries, tailoring solutions to more specific needs relative to their larger peers. In a sense, big tech/AI companies provide any of the resources (computing power, data, etc.) where small companies can utilize big tech's APIs to train (fine-tune) their own models to solve for more unique problems and datasets.

## 3.3 Regulatory implications and potential for investment risks

The immense potential AI possesses to change the global business and social landscape brings about several known and unknown risks. As such, AI-leading countries have undergone efforts to define regulatory landscapes in hopes of avoiding adverse AI-related outcomes.

To this point, the European Commission ("EC") has drafted AI ethics guidelines, which will "[...] inform a comprehensive framing of ethical and societal challenges, based not only on fundamental values and rights, but also on wider discussions on who benefits from AI development, to what end, and under what conditions." The EC highlighted several key individual and societal challenges that AI evolution might pose, ranging from autonomy and identity protection to surveillance and democratic trust.

In the US, The National Artificial Intelligence Initiative Act of 2020 "(NAIIA")[14] became law on January 1, 2021 and seeks to further establish US leadership in AI through research & development but to also prepare and support future US workforce for the integration of AI across sectors of the economy and society. This coordinated program across the Federal government focuses on developing trustworthy AI in the public and private sectors to facilitate sustainable growth.

In January of this year, the National Institute of Standards and Technology ("NIST") of the US Department of Commerce, released the Artificial Intelligence Risk Management Framework 1.0 ("RMF") along with other resources to provide guidance to companies building and using AI systems. The "[NIST's AI RMF] is intended for voluntary use and to improve the ability to incorporate trustworthiness considerations into the design, development, use, and evaluation of AI products, services, and systems."[15] The RMF defines trustworthiness by seven distinct characteristics: 1. Safe 2. Secure and resilient 3. Explainable and interpretable 4. Privacy-enhanced 5. Fair 6. Accountable and transparent and 7. Valid and reliable.

China has also drafted the Measures for the Management of Generative Artificial Intelligence Services which "would make companies providing generative AI services to the public responsible for the outputs of their systems and would require that data used to train their algorithms meet strict requirements"[16]. In coordination with Stanford's DigiChina department, Helen Toner of Georgetown University's Center for Security and Emerging Technology pointed out two distinct new elements in China's regulatory framework: 1. A clause requiring providers to "ensure the data's veracity, accuracy, objectivity, and diversity" and 2. Assigning responsibility to companies that provide access to generative AI for all content produced. These two points create a clear line of liability and accountability between companies and AI outputs that is perhaps lacking across other regional or country AI frameworks.

AI regulation is not, up to this point, uniform across geographies, with Europe's AI regulatory framework far more advanced versus the US and China. However, the regulatory landscape is rapidly evolving and will remain critical to the orderly evolution and adoption of AI technologies across the economy. We expect that regulation may be a driven for AI development in some countries but may hinder certain areas of AI development across more stringent regions such as the EU.

[14] National Artificial Intelligence Initiative Act of 2020 (NAIIA) (2020). Legislation and Executive Orders.
[15] National Institute of Standards and Technology, U.S. Department of Commerce (2023). AI Risk Management Framework.
[16] Stanford University DigiChina (2023). How will China's Generative AI Regulations Shape the Future? A DigiChina Forum.

# 4 / Conclusion and outlook

*The development of AI is as fundamental as the creation of the microprocessor, the personal computer, the Internet, and the mobile phone. It will change the way people work, learn, travel, get health care, and communicate with each other. Entire industries will reorient around it. Businesses will distinguish themselves by how well they use it.*

-Bill Gates

Artificial intelligence is perhaps the most important technological trend of this century, with the potential to add trillions to global economic growth and to transform the way companies conduct business. The capabilities of AI to sense, comprehend, and act are transformative to operations across all sectors of the economy, and most experts already agree that AI will be the most valuable business advantage of the future.

AI growth naturally raises questions around regulation and governance, with important implications for labour and capital share across the real economy. As such, we are seeing governments propose and codify guidelines around AI growth particularly in the private sector, although the long-run implications of AI growth in some cases pose more questions than answers in this regard.

What we can be certain of is the unavoidable impact that artificial intelligence will bear in transforming industries over the coming decades. AI will play an integral role in reshaping the way that we operate day-to-day, with significant implications for corporate profitability. By aligning investments to capture the changing landscape for the AI megatrend, investors can participate in this tremendous growth and ensure they do not miss out on the transformative potential of AI, which is likely to reshape entire industries, drive innovation and shape the future of our interconnected world.

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