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**Xuesong Zhao, CFA**  
Lead Fund Manager

Xuesong has worked on the Fund since launch, he joined Polar Capital in 2012 and has 16 years of industry experience.

### Setting the stage for the next technology leap

The Polar Capital Global Technology team has long recognised the potential of artificial intelligence (AI), launching a fund dedicated to the theme six years ago. The belief then was that AI would always become mainstream; the question was when and it would appear the answer is 'now'.

The technology being developed within AI has the potential to transform not just technology itself but the wider world. There have been plenty of examples in the past of technologies' overhype/underdeliver moments along with other more recent near-misses – the metaverse has been overhyped but might still deliver, while blockchain underdelivered but is still the foundation for bitcoin and other cryptocurrencies. AI today feels very different.

To put it into context, we think this feels a bit like the development of writing systems or the translations of key ancient texts and, more recently, the internet. Our view is that generative AI offers similar, if not greater, promise. The key here is history tells us that, while technology is the driver of that change, in time change moves beyond the technology and is many times greater than the original driver.

### AI's 'iPhone moment'

Nobody in 1855 could have predicted steel would change the way we construct buildings or make cars or home appliances and tinned food. Campbell's Soup is one business that owes a lot to Henry Bessemer<sup>1</sup>. We are now seeing something similar with smartphones.

The smartphone opportunity in the 2000s was about handsets in a market worth around \$100bn in 2007 when Apple launched the iPhone, and which has become a much larger industry today. Now the app economy alone is said to be worth more than \$6trn and none of that opportunity set was available before the smartphone. That is what AI feels like to us.

Whenever a technology comes to market, the most important thing is the pace of its adoption and that is the reason why we think OpenAI's ChatGPT created a so-called 'iPhone moment'. The service garnered one million users within five days of its launch, setting the record for the fastest-growing user base for a consumer application in history. While it has since been eclipsed by Meta's Threads, it still received 1.7 billion monthly users in June, just off a high of 1.9 billion the previous month.

ChatGPT reached around 100 million users within two months, at the time the fastest adoption of technology in history – and with zero marketing spend. With this rapid uptake, we think the technology can penetrate faster from here and we will see a meaningful gain when penetration hits 50%.

1. Henry Bessemer developed the first process for manufacturing steel inexpensively.

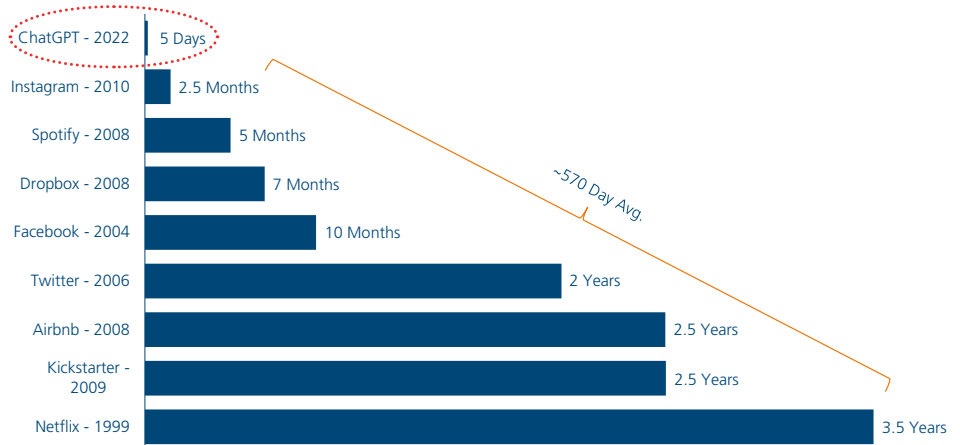
2. SimilarWeb, 23 July 2023.

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Its sustained popularity (versus Threads' traffic which has already fallen by over 50%?) is an early sign of outright utility over novelty, a key nuance which tends to underpin the viability of the most successful long-term technology applications.

If we look at what happened previously, for example, the PC existed but when Windows was introduced it became a very user-friendly interface that significantly expanded the addressable market or, more importantly, the number of users.

### Time it took for selected online services to reach one million users



Source: Morgan Stanley, 2 March 2023.

**“This is the iPhone moment of artificial intelligence. This is the time when all of the big ideas about mobile computing and all that, it all came together in a product that everyone kind of [says] I see it.”**

Jensen Huang, NVIDIA CEO, Feb 2023

The internet existed when the web browser was introduced but we needed web browsers to effectively expand the user base and accelerate the adoption of this new technology. The mobile internet existed, but the iPhone user interface was so easy to use it significantly expanded the number of devices in circulation. In the end, it created an economy.

We think the most interesting innovation OpenAI introduced was to use natural language to drive large language models (LLM). These are computer programs which use vast amounts of text data to learn how human language works, using it to produce content based on its bank of linguistic patterns. Previously only engineers could work with these language models, given their complexity. Their newfound accessibility and uptake are the reasons why we agree with NVIDIA CEO Jensen Huang that this is the ‘iPhone moment’ for AI.

### AI adoption and progress are still accelerating

When Apple introduced the iPhone, the company did not expect the app economy to be this big. It is a reminder that the opportunity set is uncertain at the outset and hard to quantify. This time around, we think AI could be the next general purpose technology – that is to say it is an innovation with the ability to fundamentally change the ways businesses operate and society functions. The opportunity set could be much bigger than the last one, the internet.

The upgrade to ChatGPT-4 from GPT-3.5 is extreme, showing the pace of innovation has accelerated significantly. Just four months after ChatGPT-3.5 was launched, GPT-4 made a significant step change in terms of performance.

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### Non-linear step change in performance

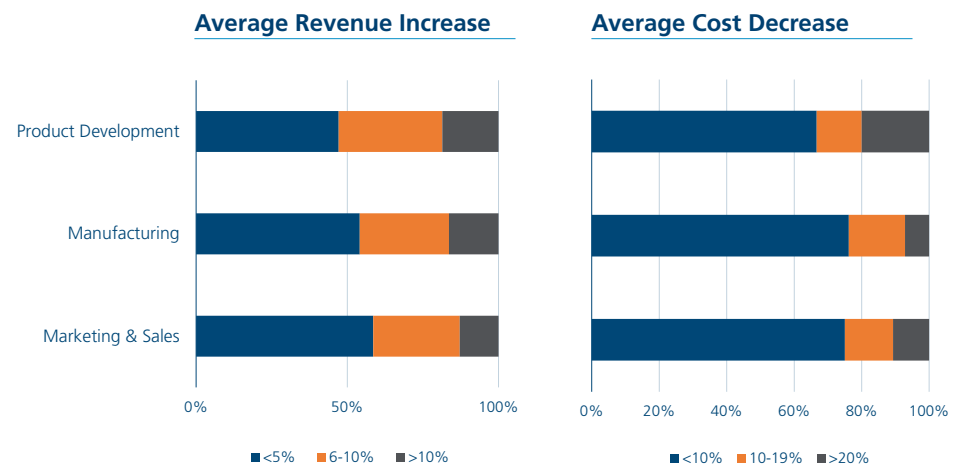
	GPT-3.5	GPT-4-8K	GPT-4.32K
Maximum context length for requests	4,096	8,192	32,768
Number of English words	-3,000	-6000	-24,000
Number of single-spaced pages of English text	6	12	50
Input types	Text	Text and images	Text and images

**Sub: GPT-4 estimated to be trained on 100 trillion parameters (571x times larger than GPT-3), which is roughly equal to the human brain.**

Source: Tooltester, [www.tooltester.com/en/blog/chatgpt-statistics](http://www.tooltester.com/en/blog/chatgpt-statistics), 6 April 2023.

**“There is a famous Amazon coding test, considered the gold standard in its industry. ChatGPT scored 100% within four minutes. A human needs two hours to finish it so this is a significant improvement.”**

We are seizing the opportunity as we think generative AI could add 1.5% to annual productivity growth, around 7% of GDP, with the most significant gain coming from productivity. This means some jobs will be impacted by this new technology, but in the end the number of jobs will continue to grow, just as different roles. AI can accelerate revenue growth but more importantly we can see it provides an average cost decrease and productivity uplift, probably the biggest benefit so far in terms of AI application.



Source: McKinsey, State of AI 2022.

### Data set, go

AI is the first technology humans invented that can perform analytics on unstructured data, which is 80% of all the data we create. Before that, we had to convert unstructured data into structured data to do the analytics. That is the reason why it is so important. This is a new way for enterprises to harness the power of the data.

There is a famous Amazon coding test, considered the gold standard in its industry. ChatGPT scored 100% within four minutes. A human needs two hours to finish it so this is a significant improvement.

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**“...by 2025, we expect more than 30% - up from zero today - of new drugs and materials to be systematically discovered using generative AI techniques”**

Gartner, *Generative AI Use Cases for Industries and Enterprises* (gartner.com), January 2023

However, if everyone has the same access to the same large language model, where is the differentiation? If you have a unique data set, you finetune the models that are readily available and apply this finetuned version giving a completely different result. The classic example is TikTok which did not have the LLM, just a very smart algorithm. What TikTok (a private company, owned by ByteDance, therefore outside our investment universe) had was significantly more data points than any other internet company and that helped them train their algorithm very effectively. Google and Meta (Facebook) are trying to catch up, but so far the conversion rate is not at the same level. It shows the power of the unique data set, which is one area we are trying to invest in to capture the opportunities.

### Are yesterday's disrupters about to be disrupted?

We know when change happens, disruption also happens within technology. A case in point is we know the cloud had negative impacts on traditional ways of computing.

The same is true of Nokia. In 2007, they had 34% market share and thought they had the mobile market sewn up. Then smartphones happened and Apple and Samsung are now the largest players in the mobile phone economy.

We do not have any exposure to IT services where we think that could happen. Right now, their products are in demand because people need help with the route to monetise AI, but in the longer term they will be challenged. In this sense it is still early for AI, but consulting companies, with a hierarchy where you bill people out to do sort of the sort of work that ChatGPT can do in seconds, might be impacted.

### Where are the risks?

The supply chain, manufacturing and reliance on Taiwan as a centre of leading-edge manufacturing likely represents the largest risk.

AI technology is based on leading-edge semiconductors. If there is any disruption to their manufacturing facility, that could present a significant barrier for the whole industry. That is the reason we have seen Western countries trying to move some of the supply chain out of Asia, particularly Taiwan.

The US and China have also been engaged in low level economic warfare for quite a while now and it has been very well contained. While the Taiwan risk is real, we are hopeful it will stay low level and contained because it is in neither side's interest to see a full-blown falling out.

### Capturing the investment opportunities

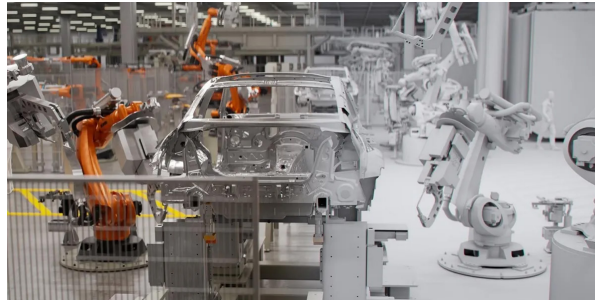
LLMs work best in areas where their application is to a very rich sequential dataset and **healthcare**, particularly drug discovery, is one such area.

**Automation** is another interesting area with significant potential, principally through robotics, as robots become more intelligent. This is why Google and NVIDIA specifically developed LLMs. At the moment, if you want to use a robot, you have to train or programme it and the robots cannot perform unseen tasks.

Now they can, with the help of the LLM. Hardware aside, the exponential growth in the AI engines behind any automation improvements is key to our thinking. It will significantly expand the addressable market and that is why we are so excited about it. Tesla talks about humanoid, or human-shaped, robots. In fact OpenAI, after receiving Microsoft investment, bought 1X, a Norwegian company working specifically on humanoid robots. It shows what the industry leaders are thinking and we believe the robotic industry could provide strong investment opportunities.

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Last is the so-called **digital twin**, using real-world data to simulate a virtual version of a physical object. Simulation has been done at a component level but with the introduction of AI, we can run the simulation at the system level, which will give significantly more insight. This explains why some in the industrial or manufacturing industry have been aggressively embracing AI technology, to significantly improve the efficiency of their digital twin technology.



*BMW are building a complete digital factory, two years before starting operations, to prototype the factory and model performance.*

Source: NVIDIA, BMW Group Starts Global Rollout of NVIDIA Omniverse | NVIDIA Blog

### Technology enablers complement technology providers

According to Morgan Stanley, Microsoft expects to generate c\$40bn-90bn in incremental revenue opportunities related to AI in the next two years, the majority coming from the infrastructure and monetisation of the software in terms of productivity gains. In that sense, Microsoft is in pole position to benefit from AI.

Post-pandemic, we have seen Microsoft do well in areas like collaboration and communication, and the AI wrapper around all the products they offer on their platform and their ability to enrich their product platform with AI is going to be very hard for any point solution company to come anywhere near.

On the non-technology side, a stock we have liked from day one is Walmart. It is one of the very few supermarkets that systematically implements AI to change how they operate and has featured in every GPU (graphics processing unit) technology conference over the past three years. Walmart lets its algorithm drive the purchase decisions, so each store has dynamic inventory management. We estimate this can deliver a 1% cost saving, preventing those stores from incurring losses.

Also, Walmart's e-commerce business has been muted. With the help of AI, their search engine improved significantly, and they can better match the products to the consumer. In the end, we estimate the e-commerce-related business to grow 20-30% which should contribute significantly to incremental revenue growth.

### Investing beyond the headline AI names

Ultimately, what we are trying to build is a global equity portfolio that not only captures the AI-enabling companies but also the early adopters and, more importantly, beneficiaries of this technology. This sets our approach apart from others, who concentrate more on competition within companies aiming to produce the AI functionality itself. While this certainly holds merit, we see those capabilities as tools other firms may use to further enhance their own value. We think we can add value by talking to the technology company supply chain, to help us understand the disruption and thereby identify the winners (adopters) of AI in non-technology sectors that much earlier. If we are successful, not only could we enjoy the earnings revisions but also multiple re-ratings as well.

### Xuesong Zhao

Lead Fund Manager, Polar Capital Artificial Intelligence Fund

14 August 2023

**“The development of AI is as fundamental as the creation of the microprocessor, the personal computer, the Internet, and the mobile phone. Entire industries will reorient around it. Businesses will distinguish themselves by how well they use it.”**

Bill Gates, GatesNotes, The Age of AI has begun (gatesnotes.com), 21 March 2023

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