Assessing the New AI Paradigm

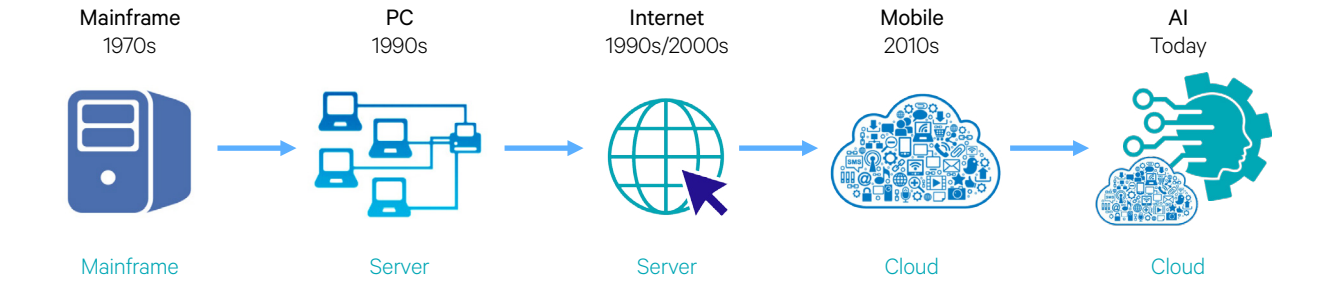
As investors, we have lived through multiple technology paradigm shifts and hype cycles. The advent of cloud computing and mobile phone technology represented true paradigm shifts that fundamentally changed the prevailing compute architectures. Others, such as the rise of cryptocurrency were mostly hype. We believe generative artificial intelligence (AI) is a true paradigm shift—the first major one since the changes set in motion by the adoption of software-as-a-service, cloud computing, and smartphones. Earlier shifts sparked mega trends that lasted more than 10 years and created tremendous value. They expanded markets, boosted productivity, increased information technology (IT) spending, and attracted some of the best talent. Apple's market capitalization has risen about 30 times since the first iPhone was sold in 2007.[1] Amazon's Web Services (AWS) business has a revenue run rate over $80 billion.

AI isn't new. We've been following its evolution and introduction into products for years. However, it didn't stoke the public imagination until ChatGPT launched in November 2022 and became the fastest service in history to reach 100 million users.[2] People were wowed by the technology that enabled a computer to understand their intent when they simply talked to it. ChatGPT can answer questions, write poems, and emulate the prose of famous authors. But on a much wider level, generative AI can generate images, write code, and execute requests by interacting with other systems. We expect the capabilities of generative AI—similar to those of most new technologies—will dramatically increase while the cost of the technology falls exponentially over the coming years. Many use cases that sound like a dream will become feasible as this occurs.

EXHIBIT 1

AI IS A PARADIGM SHIFT

The last 50 years have seen multiple paradigm shifts.



We have a framework to invest through paradigm shifts.

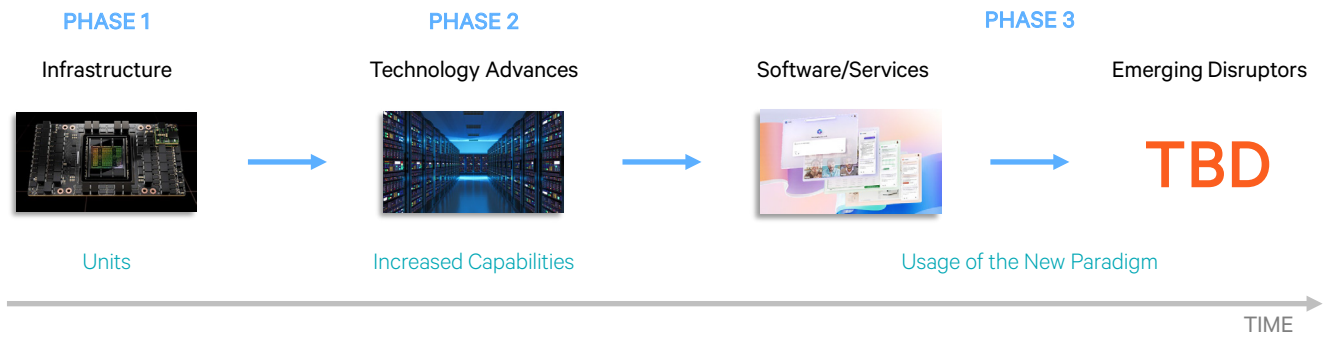


Exhibit 1 graphic is for illustrative purposes only.

[1] Market caps as of June 29, 2007, and July 17, 2023, respectively.
[2] Emily A. Vogels, "A majority of Americans have heard of ChatGPT, but few have tried it themselves," Pew Research Center, May 24, 2023, https://www.pewresearch.org/short-reads/2023/05/24/a-majority-of-americans-have-heard-of-chatgpt-but-few-have-tried-it-themselves/

We expect yet-to-be-imagined new use cases of generative AI will have far-reaching effects across industries. Just as migrating from DOS prompts to Windows made computing more accessible to the general population, the shift from interacting with computers through programing code or graphical interface to natural language commands, will make many tasks easier and lower the cost of creating code, content, music, and images. We anticipate generative AI will have a significant impact in many areas, some of which include customer service and support, infrastructure and logistics, personalized medicine, financial services, and media and entertainment, etc.

As fundamental research analysts, we have invested through and studied paradigm shifts. As we turn to analyzing the impact of generative AI, we are redeploying the framework that we have used through past transitions. We believe this has positioned us well at the outset of the paradigm change, sets us up for its evolution, and clues us into finding second-order effects that will create emergent disruptors that are currently only a twinkle in an entrepreneur's eye.

A Framework for Change

Throughout our more than 30-year history, we have invested through several paradigm shifts, including the move from mainframes to personal computers (PCs), the widespread adoption of mobile devices, and the migration to cloud computing. In doing so, we developed a general framework (Exhibit 1) to guide us. When a shift begins, we have found that phase one of value creation tends to be in hardware and infrastructure. Without this foundational layer, nothing else can be built. We followed this framework in the shift to PCs when we invested in computer maker Dell Technologies and chipmaker Intel, and then again with the advent of smartphones, when we bought Qualcomm, an intellectual property holder and chipmaker for mobile phones, and what became tech giant Apple.

As time progresses, phase two begins and value creation transitions from unit growth in hardware and infrastructure to companies that deliver technology advances that enable additional capabilities. For example, even as smartphone unit sales began to ebb, British chip designer ARM Holdings was able to ride a second wave of growth by increasing the complexity of its chip designs to handle the needs of the phone-makers' advanced applications. Some of the early hardware winners will adapt to this phase, just as we saw Intel do in the PC era. Similarly, Microsoft's Windows operating system consistently advanced the capabilities of PCs throughout the 1990s with advances, such as moving from DOS to Windows.

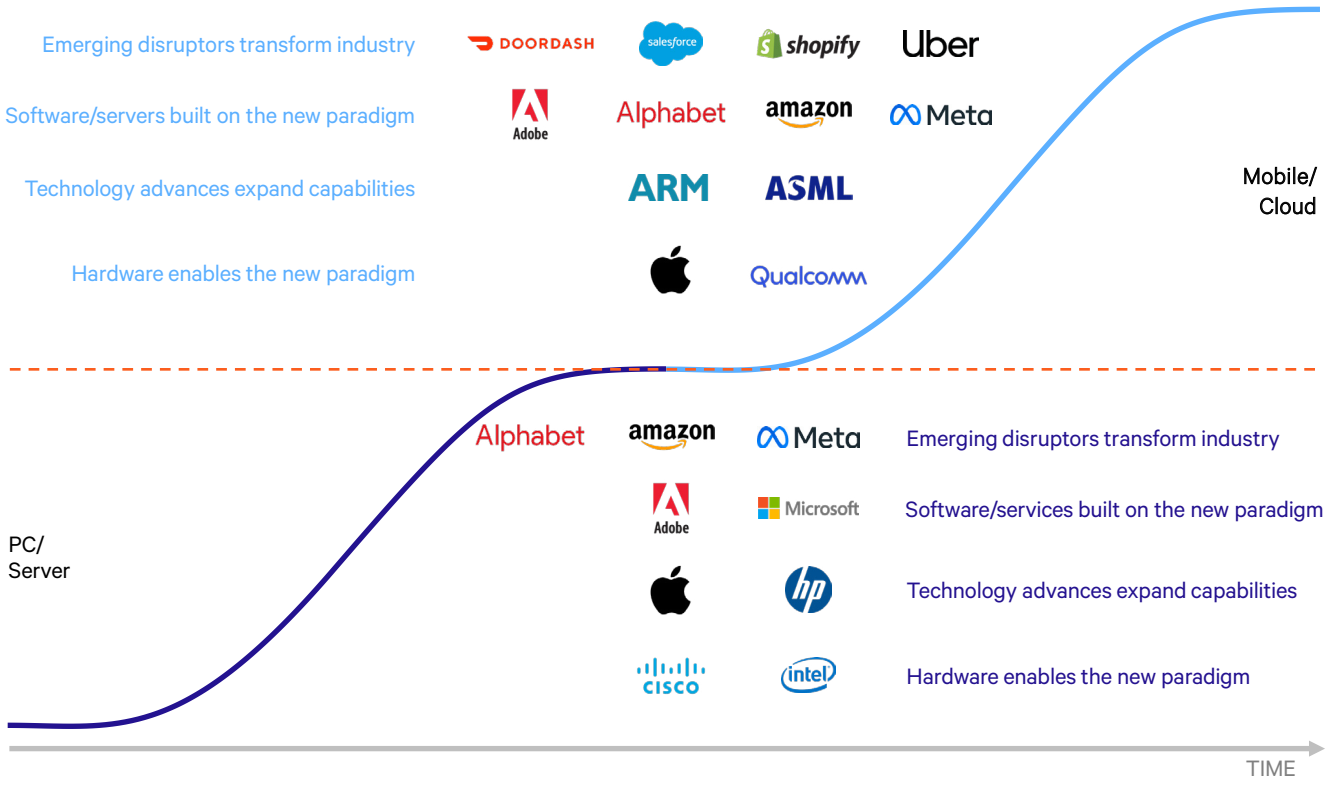
Ultimately, we expect the greatest and likely most enduring opportunities will be in the third phase, when AI technology is used to create new software and services. In this phase, software and services built on the new technology will create new markets and transform existing capabilities. In other words, this is where we see usage of the technology change how the world functions. The first examples of this should come from incumbents that incorporate the new technology. This can be a volatile phase as businesses and investors anticipate possible outcomes and companies adjust to the new technology paradigm.

Facebook and Google, as they were then known, underperformed early in the transition to mobile computing. Facebook came under pressure because of fears that a shift to mobile would reduce revenue because advertising prices on mobile were lower. Instead, both engagement and advertising efficacy rose. Google, on the other hand, faced a competitive threat that lasted several years from Apple's App Store and vertical search. Today, both are market-share leaders in mobile. Similarly, Adobe stagnated as the PC era matured and upfront license payments were traded for smaller annual subscriptions. Over time it became clearer that the cloud transition would improve its growth prospects, reduce piracy, and expand its market opportunity. In contrast, other incumbents will not be able to survive the transition because their products or service cannot adapt to new realities.

The second part of the usage phase is defined by the rise of emerging disruptors that spring to life in the new paradigm. These companies are driven by second-order effects and do not even exist at the outset of the shift. DoorDash, for instance, didn't come onto the scene for five years after the launch of the iPhone. Similarly, many modern cloud companies didn't go public until 10-plus years after AWS launched. Other second-order effects are not as apparent but still create tremendous value. For example, the efficacy of Facebook mobile advertising enabled ecommerce startups to find their audiences and spawned a direct-to-consumer revolution. Shopify became a significant beneficiary by enabling these startups. All through this phase, we have to keep in mind

EXHIBIT 2

HOW WE APPLIED THE FRAMEWORK DURING THE LAST TWO PARADIGM SHIFTS



As of 6/30/23. For illustrative purposes only. The specific securities identified and described do not represent all of the securities purchased, sold, or recommended for advisory clients. There is no assurance that any securities discussed will remain in the portfolio or that securities sold have not been repurchased. You should not assume that any investment is or will be profitable. The securities identified were selected on an objective basis to illustrate examples of businesses held in Sands Capital portfolios at one point in time that provided hardware, software/content, or solved for the increasing complexity in the past two technology paradigm shifts (PC/Server and Mobile/Cloud). The businesses reflect the largest weights of companies that provide hardware, solve for increasing complexity, or provide software / content that we believe enables or is likely to benefit from AI.

that the first companies to emerge will not necessarily remain the market leaders. For instance, Google was not first in search; Apple was not first in smartphones; and Facebook was not first in social media.

It is important to note that the various phases may not be completely linear, and they typically overlap. Exhibit 2 outlines how we applied the framework to the two most recent shifts. In earlier shifts, we had concurrent investments across multiple phases.

Investing in Infrastructure Providers Powering the AI Shift

We already have investments across multiple phases, despite being less than a year into generative AI. Naturally, we have a heavy emphasis on the infrastructure in phase one, given how early we are in the shift. We believe the semiconductor and infrastructure companies we own are positioned to benefit as they help build the foundation supporting the paradigm shift. We are optimistic that many of these phase-one companies will advance AI technology after the initial adoption and will continue to benefit in phase two.

Generative AI requires significant compute power, which drives demand for AI chips, such as the graphic processing units (GPUs) designed by NVIDIA needed to unleash the capabilities to enable a more natural human interaction. Therefore, we are investors in companies in the semiconductor value chain, such as Entegris, Lam Research, ASML, and Taiwan Semiconductor—which have enabled the creation of the most complex microprocessors through the creation of key components for wafer production, precision etch techniques, lithography, and advanced manufacturing, respectively. Many companies in the semiconductor manufacturing value chain adapted well to phase two by delivering more capable technology, and we expect that to happen with AI.

In drawing parallels from the past, we view NVIDIA as the architectural leader in AI. The company has been able to adapt its high-resolution graphics that were first used in computer gaming into GPUs optimized for AI. Nearly every company, such as OpenAI, relies on NVIDIA's GPUs to train their AI models. We see it as a pure play on the evolution of generative AI, providing the hardware and software ecosystem necessary to support more AI adoption. We expect NVIDIA—similar to earlier architectural winners, such as Intel in PCs and ARM in mobile, will drive technology advances and benefit from phase two, because it enables an ecosystem built on software that expands far beyond its hardware.

In addition, we are invested in the largest hyperscale cloud providers, such as Amazon's AWS, Microsoft's Azure, and Alphabet's Google Cloud Platform. We expect the vast majority of the AI work to be done in the public clouds due to the tremendous amounts of storage and compute required to house and crunch the data. We further expect market-share leaders (in terms of revenue) AWS and Azure to benefit from an accelerated migration to cloud as businesses understand that it will be much harder to reap the benefits of AI until data and applications are moved to a cloud-based ecosystem. Cloud also provides much of the needed security, IT management, and governance around AI that is needed to help customers sustainably adopt AI.

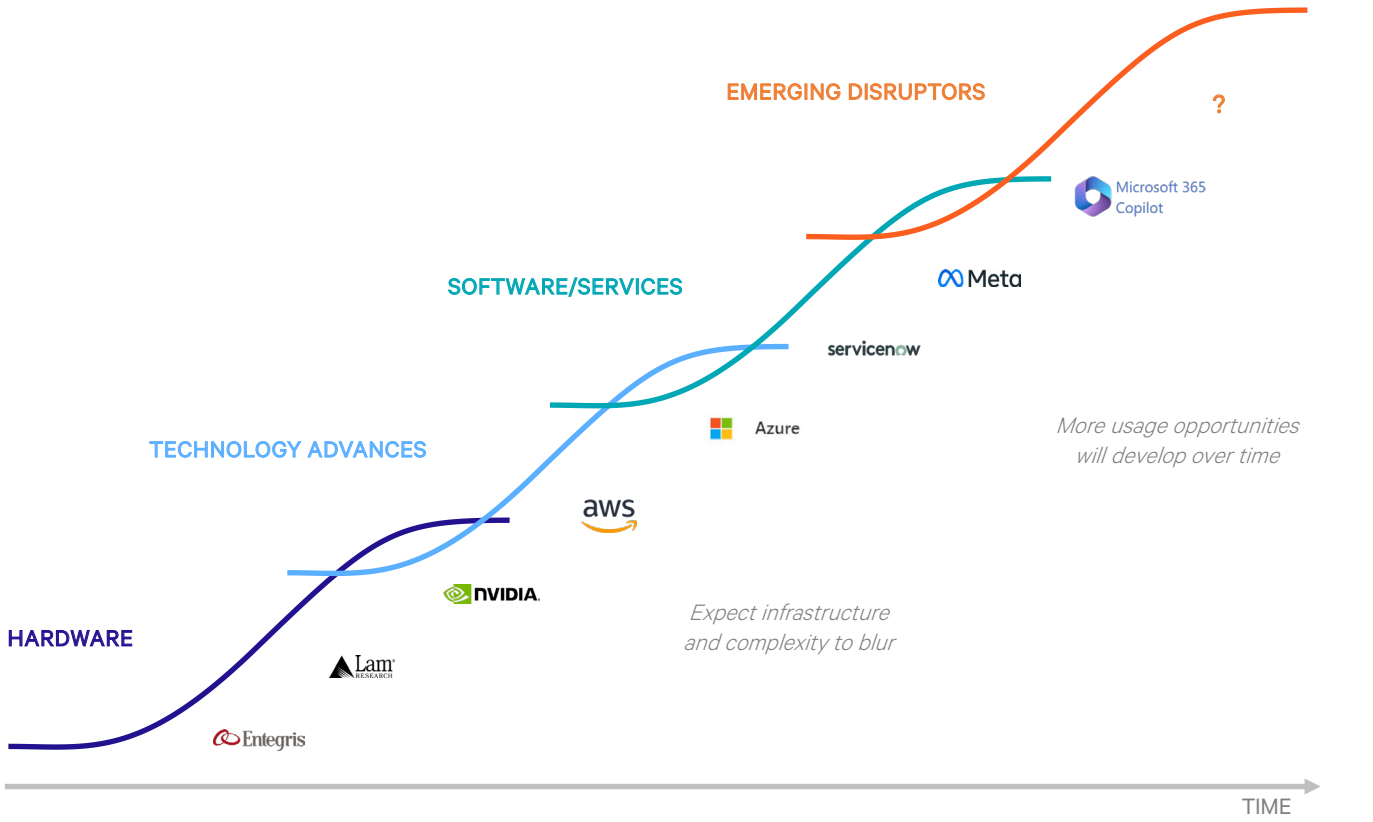
It's Early for Usage Opportunities

Less than a year ago, the public began to grasp the enormous changes that could be made possible through the use of generative AI. In this short period, emerging disruptors and second-order effects haven't had time to fully materialize, but significant and growing venture capital investments are a strong leading indicator of the potential wave of emerging disruptors that could be built on AI.

Currently, we are focusing on the existing software and services providers that are rapidly adopting generative

EXHIBIT 3

APPLYING THE FRAMEWORK TO AI



For illustrative purposes only. The companies illustrated represent a subset of holdings in the Select Growth Tax Exempt Institutional Equity Composite. There is no assurance that any security listed will remain in the portfolio. These examples were selected based on businesses held in Sands Capital portfolios that we view as the providers of hardware, software/content, or as solving for the increasing complexity as it relates to artificial intelligence. The businesses reflect the largest weights of companies that provide hardware, solve for increasing complexity, or provide software/content that we believe enables or is likely to benefit from AI. The views expressed are the opinion of Sands Capital and are not intended as a forecast, a guarantee of future results, investment recommendations, or an offer to buy or sell any securities. The views expressed were current as of the date indicated and are subject to change.

AI to augment existing applications and product offerings. While there was some concern earlier in the year that AI would disrupt the business models of many software providers because AI accelerates the shift to cloud computing, we believe many incumbents are well positioned to benefit from the capabilities that AI can offer. These companies are acutely aware of the potential disruption posed by AI and are thus acting to integrate AI into their products and services. Often, they also have access to proprietary data, scarce engineering talent, and the capacity to fund the large infrastructure investments required to capture the benefits of AI.

In our view, Microsoft, thanks partly to its end-to-end ecosystem, is among the best positioned of the incumbents. Aside from its Azure business, which is a beneficiary in the infrastructure phase, Microsoft has been an early adopter of generative AI for its apps. It developed a "copilot" model in which it uses AI to increase the productivity of coders and office workers. It has embedded these copilots in six major solutions including, Windows, Office, Teams, Dynamics applications, security, and search. In addition to the opportunities in Azure and copilots, Microsoft also benefits from the breadth of its ecosystem. If enterprises adopt the full spectrum of Microsoft products, AI will have a greater ability to look across them, which should further increase its value.

In the media world, generative AI tools are making video, image, and text generation less expensive and even easier. Content production has grown exponentially over the last 15 years with the proliferation of YouTube and Facebook. However, we expect this growth will pale in comparison to the coming explosion in content driven by AI tools. We expect Meta Platforms could benefit as AI makes it easier to create better advertising copy and potentially increase the volume of targeted content across its family of applications, which should improve advertising return on investment and increase engagement, respectively. We expect other content business, such as YouTube, to experience similar tailwinds.

Emerging Disruptors and Second-order Effects

Moving forward, we will focus on companies that are finding new AI use cases and trying to understand the second-order effects. Over the next 10 to 15 years, we expect these will become some of our largest and most durable investments.

As we have learned from the emergence of past use cases, these opportunities take time—often years—to develop. Much will depend on how fast the capabilities of generative AI expand and how quickly costs fall. We will be looking for the AI equivalents of mobile emerging disruptors, such as Uber and DoorDash, and second-order opportunities, such as Shopify. We are spending our time learning and following the fundamental progression of the technology and emerging possibilities. In collaboration with our venture capital business, we are closely following the private markets, which is where disruptors are likely to emerge.

One second-order effect that has great potential is the opportunity for generative AI to drive a dramatic decline in the cost of software development, which until now has been a constraint on software creation. If the cost goes down, we expect a lot more software to be created. We anticipate all the additional software will create opportunities in which it augments human capabilities to increase productivity and make the world more efficient and capable.

Responsible Adoption Is Key

Similar to other paradigm shifts and the advent of new technologies, AI poses risks that we are closely monitoring. The power of AI may create challenges for cybersecurity, privacy, disinformation, bias and fairness, copyright, and energy consumption, to highlight several. Companies are actively developing "responsible AI" commitments and integrating them into their products and services. Governments around the world are also looking to ensure AI safety, trust, and fairness. We think these are natural and appropriate developments to ensure that society captures the benefits of AI and mitigates the risks. We believe these safeguards will also make AI adoption more sustainable for investors.

An Opportunity for Active Investors

AI has the potential to be one of the most transformational technologies of the modern age. In less than a year, we have seen how it has upended business models and captured the public imagination. Having invested through past paradigm shifts, we have seen the opportunities disruption can create for active investors who are able to differentiate between tangible value creation and hype.

Acknowledging the uncertainties, we believe that select businesses in semiconductors and cloud infrastructure represent the best near-term investment opportunity for our clients. Over time, we anticipate the emergence of many more opportunities in the later phases of our framework.

As long-term growth investors, we will continue to look toward the future to imagine how AI could alter industries, workspaces, and society as a whole.