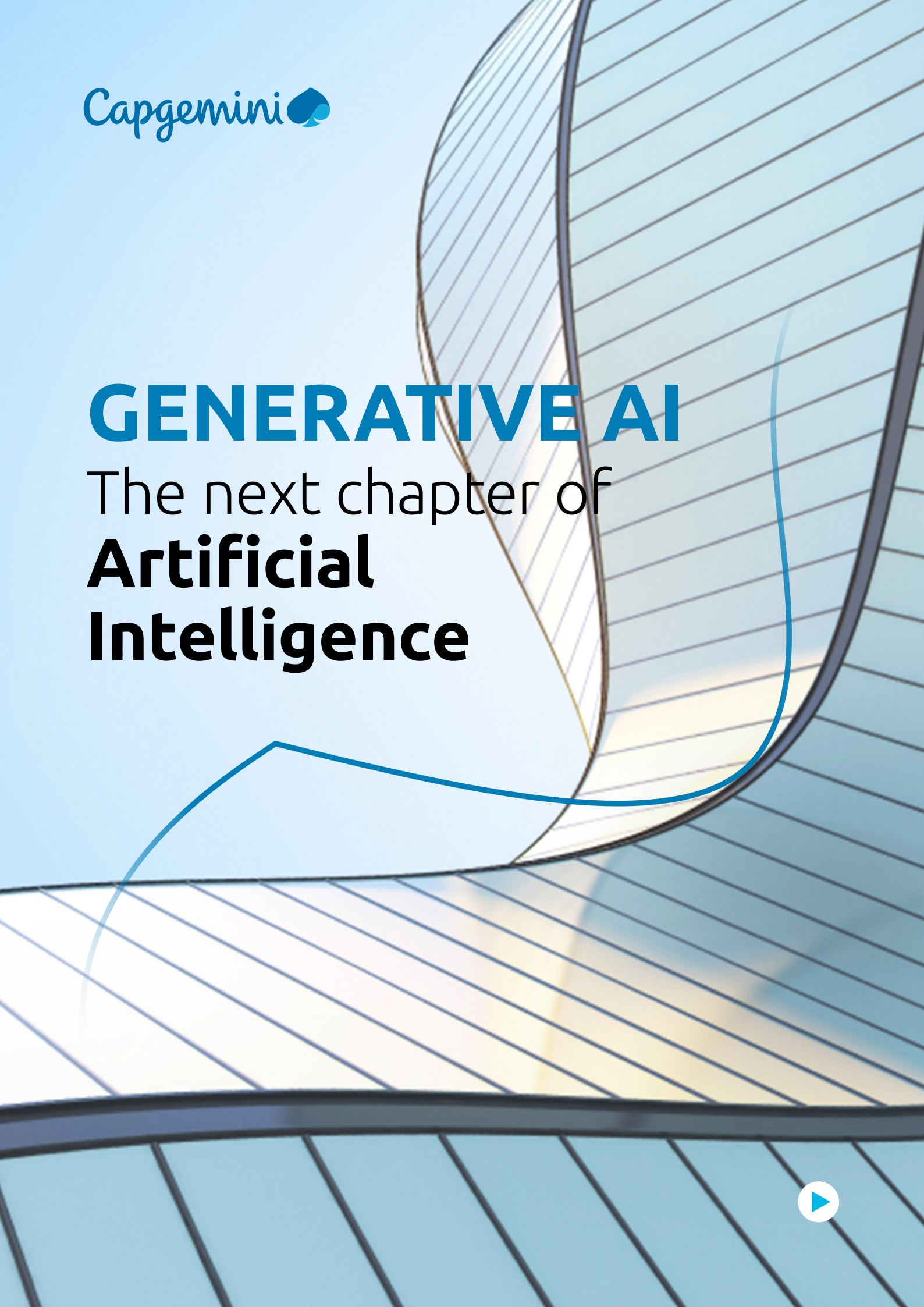
Capgemini
GENERATIVE AI
The next chapter of
Artificial
Intelligence

FOREWARD

While we observe a huge adoption of Generative AI across organizations and industries - nearly all (96%) executives cite Generative AI as a hot topic of discussion in their respective boardrooms[1] – the topic is not new.

The rise of Generative AI is part of an overall evolution of AI - from ML and DL explosion to Large Models maturity - leading to an AI becoming now more powerful, scalable, and accessible.

The Next-generation AI is here, driving radical business transformation. From content production, workflow to product innovation, it is revolutionizing the way we create, interact and collaborate, completely shifting at the same time the way we look at AI as a whole.

As we observe an unprecedent enthusiasm around it - 74% of executives believe the benefits of Generative AI outweigh the associated risks[2] - Ethics is more then ever critical for organizations to successfully and responsibly implement Generative AI across their data value chain, and therefore should absolutely not be seen as the fifth wheel on the wagon.

The expected benefits are huge and as a business leader, understand how Generative AI is transforming the way your organization operate is a must. This Everest Group report explores where does the true value of Generative AI lie, considering the potential pitfalls and sharing the key areas to prioritize. In definitive, as for any Data & AI topic, the way organizations should approach Generative AI starts by building the right foundations including a strong testing & trust layer. No doubt the derived outcomes will outweight the risks if tailored to organizations specificities and built with secure, privacy protecting and reliable high-scale Generative solutions.

If you would like to continue the discussion and know more about how can help customizing Generative AI for your own purpose, please reach out

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[1, 2] Source: Capgemini Research Institute, Harnessing the value of Generative AI: Top use cases across industries

Everest Group®

Generative AI: the Next Chapter of Artificial Intelligence

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Introduction

Since its conceptualization in 1956, AI has been a remarkable technology, revolutionizing industries, and redefining human-machine interaction. The technology has pushed boundaries and uncovered new frontiers in the digital space. One such remarkable breakthrough that has captured the imagination of researchers, innovators, businesses, and individuals alike is gen AI. Using complex neural networks, gen AI models develop new content in various forms and modalities, such as text, images, audios, videos, codes, and more.

In this report, we examine the advent of AI, tracing its origins and fascinating innovations, up until the emergence of gen AI. We then explore the technology's capabilities, challenges, and the transformative opportunities it presents. As the applications of gen AI continue to expand across industries and with its ability to generate human-like content and mimic human creativity, it becomes crucial to explore the profound impact it can have on our society, economy, and everyday lives.

The report recognizes that while this technology holds great promise, it also possesses inherent risks such as rising concerns about data privacy, identity theft, and misinformation. Moreover, accountability for its consequences becomes a pressing concern as AI-generated content becomes increasingly indistinguishable from human-generated content. By addressing the risks and challenges head-on and adopting industry best practices, enterprises can unlock the true potential of gen AI while ethically and responsibly integrating this groundbreaking technology.

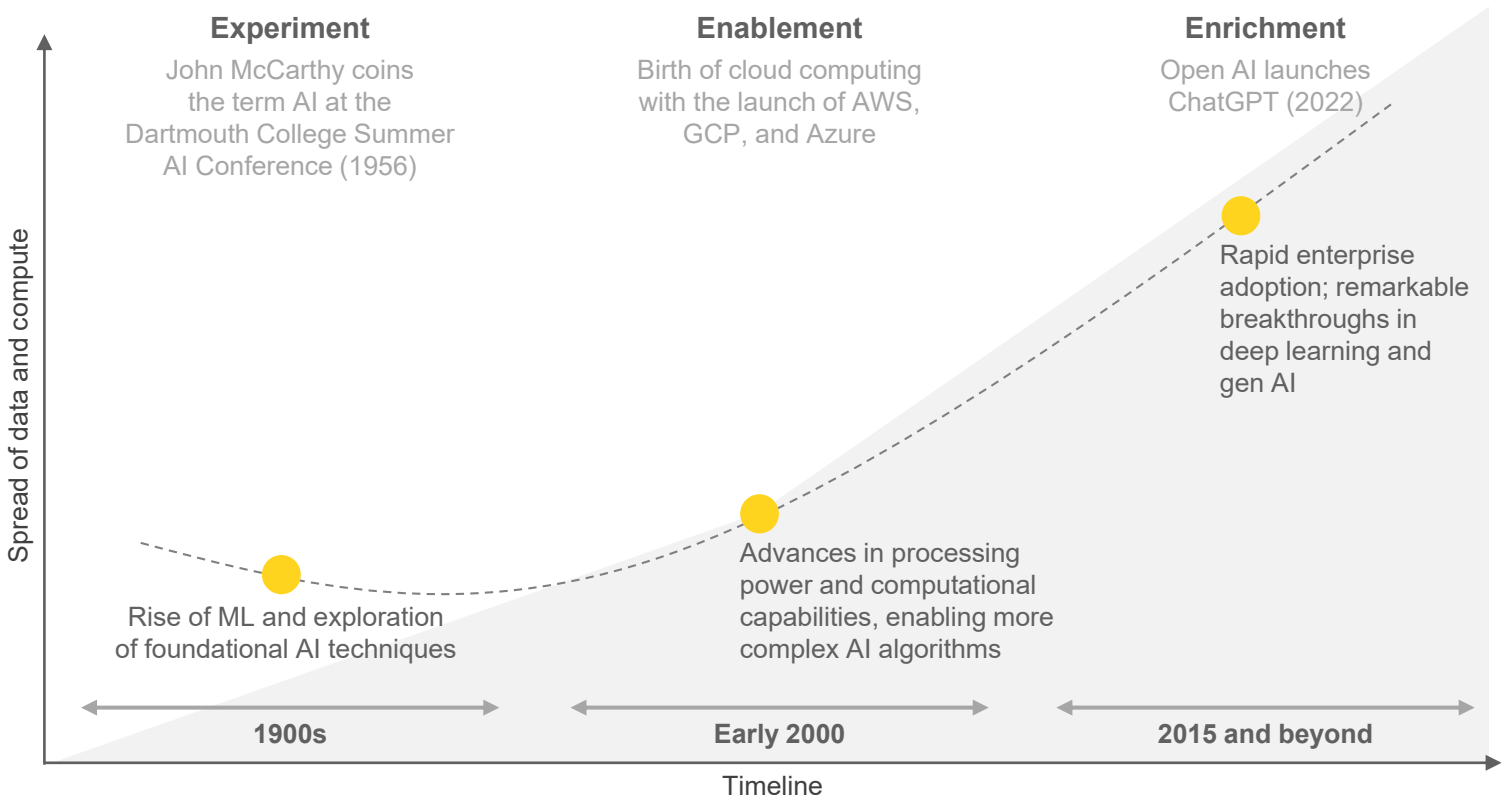
AI: the journey so far

John McCarthy first used the term artificial intelligence in 1956, but AI made its first appearance much earlier in a 1927 film titled Metropolis, featuring a human's robot double. This initial fictional idea sparked a series of advances that have led to the most advanced development in the history of AI today, gen AI, which can create fictional characters and stories of its own. Notably, a technology intended to enhance human capabilities can now potentially take over a multitude of tasks that humans performed traditionally. But AI did not reach this stage in a sprint; it has been a long and challenging journey involving significant investments, numerous unsuccessful trials, and breakthrough advances. Exhibit 1 provides an overview of the various stages of AI development, innovation, and adoption over time.

EXHIBIT 1

Milestones in the journey

Source: Everest Group (2023)



The term artificial intelligence became the buzzword of the time after its first appearance. However, the development of AI did not really begin until the late 1960s, as the necessary computing power and data were not yet available, and, hence, most of the work was around the mathematics of AI. During the 1960s and 1970s, AI techniques such as ML, NLP, and computer vision were established, which laid a solid foundation for AI to make inroads into our daily lives, paving the way for its widespread adoption.

The early 2000s was a period of significant progress for AI. A thriving ecosystem emerged that supported AI infrastructure. Advances in computing power, storage, and networking technologies facilitated the processing of vast amounts of data for training AI models. The birth of cloud computing in 2006 was a catalyst for increasing AI development. Significant improvements in hardware, such as the development of powerful processors, GPUs, and specialized chips, were made for AI workloads. The period also marked the appearance of a thriving ecosystem of AI start-ups.

AI development and adoption fast-tracked from 2015. Notable improvements in algorithms and software tools, such as the launch of open source AI software TensorFlow and PyTorch, made it easier for developers to build and scale AI applications. These developments, coupled with access to dynamic computing power thanks to the cloud, enabled enterprises to accelerate AI adoption.

Both enterprises and consumers became increasingly comfortable with AI in the past decade. In fact, AI is so deeply embedded in our daily lives that it is almost impossible to imagine a world without it today. The use of AI has also significantly scaled across enterprises. According to Everest Group's 2023 AI survey, 96% of enterprises have successfully implemented AI in one or more of their operations.

For the longest time, AI could perform repetitive tasks, such as recognizing patterns or identifying objects. That changed with Open AI's launch of ChatGPT on November 30, 2022. ChatGPT is an AI-powered chatbot trained on large datasets of unlabeled text to generate human-like output. We examine its capabilities next.

Gen AI – what's with the hype?

The world's largest and most valuable enterprises are either talking about gen AI or have begun to lay the foundations for its implementation. Open AI researcher Ian Goodfellow is credited for coining the term generative AI in 2014. **Everest Group defines gen AI is a field of AI that can create, manipulate, and synthesize new content that did not exist before in various forms and modalities.**

Thanks to ChatGPT, which has democratized the use of AI and fundamentally changed the way consumers search content, the category is trending more than the overall gen AI market. The chatbot has put AI – which was earlier privy to technology creators – into consumers' hands.

However, one must be careful about the synonymous use of the terms ChatGPT and gen AI. While gen AI is a field of AI with generative capabilities, ChatGPT is a gen AI application. Before we probe the commercial and application facets of gen AI, it is vital to understand the differences between AI as we know it today (also known as decision AI) and the disrupter next-generation gen AI.

Exhibit 2 shows how gen AI models differ from traditional ML models and lists their input/output features:

EXHIBIT 2

Decision AI vs. gen AI: a comparative view

Source: Everest Group (2023)

Parameter	Decision AI	Gen AI
Training parameters	Can be trained on smaller datasets with fewer parameters	Need large datasets with an exponentially high number of training parameters
Training time and cost	• Relatively cheap to train and deploy • Relatively quick to train	• High training and deployment costs • High cost of acquiring large quality datasets • Significantly longer training time
Compute and infrastructure	Can be trained and run on standard computing infrastructure	Need specialized hardware such as GPUs and TPUs
Capability	• Provide predictions or classifications based on existing data • Perform specific AI applications on which they are trained	• Generative capability – image and video synthesis, text generation, speech synthesis, code generation, etc. • General-purpose models capable of performing multiple AI tasks

The fundamental difference between traditional ML models and gen AI models is the number of parameters they are trained on. Such training has become possible due to increased availability of quality training data and hardware capacity, which were the two biggest constraints in this field. For example, training a large image model requires a dataset of millions of high-quality labeled images, while training an ML classifier to recognize specific objects in images may require a dataset of thousands of labeled examples.

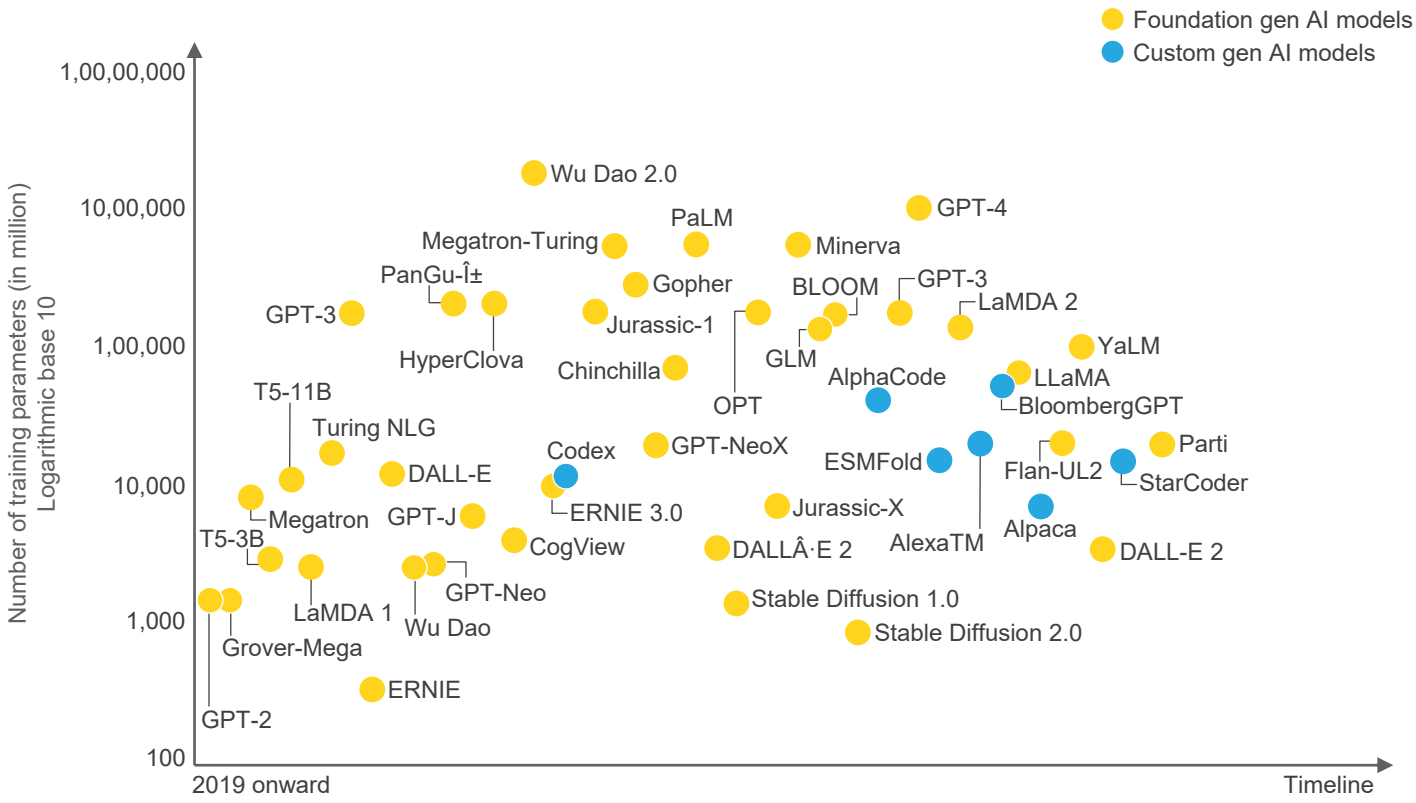
The rising number of training parameters is an indicator of increasing model complexity and the model's ability to perform more generalized tasks. However, foundation gen AI models, which are trained for no purpose-defined tasks are trained on an extremely high number of training parameters and require specialized resources. To date, only large tech giants have been developing foundation gen AI models due to their complexity and resource requirements. However, in this race of developing better gen AI models, quality is proving to be more important than quantity. Custom gen AI models, which are designed for specific tasks and are trained on smaller but targeted data sets, are gaining high traction in the market.

Exhibit 3 shows the prominent large models launched over time and their training parameter sizes.

EXHIBIT 3

Evolution of ML models

Source: The AI Index 2023 Annual Report by Stanford University[1] and Everest Group analysis



Note: The representation is not exhaustive and covers large models that have a publicly disclosed number of training parameters

Interestingly, it took Meta[2] US$4.05 million to develop its 65B-parameter Large Language Model (LLM), LLaMA, which was trained using 2048 NVIDIA[3] A100 GPUs. The cost exemplifies the significant resources required to develop gen AI models, particularly in terms of extensive computation. While advances in technology and the availability of superior datasets may help bring down development costs, the cost of developing generative models is expected to remain considerably higher than that for traditional ML models. Considering OpenAI's GPT model, which was trained on 10,000 such GPUs, one can only imagine the scale and associated costs involved. As the benefits and potential of this technology continue to unravel, the investment itself holds great promise for transforming industries and unlocking new possibilities in the AI realm.

1 The AI Index 2023 Annual Report by Stanford University
2 Meta Research
3 NVIDIA GPU pricing

The true value of gen AI

The success and adoption of gen AI depends on several crucial factors. While we believe the technology will make its impact on every industry in the future, some industries are positioned to adopt this technology faster than others. Everest Group sought to understand the readiness of these industries for gen AI adoption by analyzing four parameters – current data availability, technical readiness, regulatory and compliance requirements, and criticality of content across industries.

Our analysis shows that Media and Entertainment (M&E), professional services, Retail and Consumer Goods (RCG), Banking, Financial Services, and Insurance (BFSI), and travel and transport are well positioned to adopt the technology before others. For example, RCG companies have been data banks for consumer- and product-centric data for years and have been at the forefront of technology adoption with robust data and infrastructure foundations to build upon. Additionally, while every industry has a certain level of sensitivity for regulations and compliance, RCG has fewer regulations than other industries.

Several enterprises across other verticals have also started experimenting with gen AI. For example, the travel booking company eDreams Odigeo has partnered with Google to implement its gen AI capabilities to personalize customer interactions, while Siemens has partnered with Microsoft to use gen AI for automatic inspection notes creation on the factory floor.

Exhibit 4 provides insights into the readiness for adopting gen AI by industry.

EXHIBIT 4

Industry adoption of gen AI

Source: Everest Group analysis

Low ○○○●● High

	Availability of quality data	Technology readiness	Regulation and compliance	Need for content generation*	Time to adoption	Current market movements**
M&E	●	●	●	●	Within 1 year	●
Professional services	●	●	●	●	Within 1 year	●
RCG	●	●	●	●	Within 1 year	●
BFSI	●	●	●	●	Within 1 year	●
Travel and transport	●	●	●	●	Within 1 year	●
Pharmaceuticals and life sciences	●	●	●	●	1-2 years	●
Education	●	●	●	●	1-2 years	●
Manufacturing	●	●	●	●	1-2 years	●
Healthcare	●	●	●	●	1-2 years	●
Telecommunications	●	●	●	●	>2 years	●
Public sector	●	●	●	●	>2 years	●
Energy and utilities	●	●	●	●	>2 years	●

*We believe content as a vector will be a key decision-maker for industries to adopt gen AI in the short term; however, in the longer term, the impact of this parameter will neutralize across all sectors

**Market movements are tracked based on enterprises' public announcements of adoption of gen AI use cases across industries. However, these implementations are in PoC stages and do not indicate production deployment of the technology at this point in time

While most industries are in the experimentation phase, innovative use cases are emerging every day.

Exhibit 5 highlights prominent gen AI use cases that are generating interest among enterprises:

EXHIBIT 5

Key industry use cases leveraging gen AI

Source: Everest Group (2023)

ILLUSTRATIVE

Industries	M&E	Professional services	RCG	BFSI	Travel and transport
Key industry use cases	• Writing assistant • Article summary • Synthetic voice • Text-to-music • Image/Video creation and enhancement • Game development • AI avatars • AI-generated media posts	• Contract assistant • Report summarization • Research assistant	• Generating product descriptions • Customer interaction bots • Order processing • Personalization • Sentiment analysis • Product personalization • New product designing • Sketch-to-design	• Report summarization • Unstructured data summarization • Financial bots • Insurance bots • Synthetic data for risk simulation • Contract assistant • Underwriting • Claims processing	• Travel itinerary designing • Travel bots

	IT	Customer experience	Employee experience	Human resources	Finance and accounting	Sales & marketing
Horizontal use cases	• Code generation • Text-to-SQL • Synthetic datasets for model training • Test cases generation • IT document creation • Website development	• Customer service bots • Call notes creation/ • Summarization • Automatic email responses for customer queries	• Enterprise search • Employee assistance bots • CRM bots • Automatic emails • Automatic slide generator	• Policy draft creation • Contract creation • AI-generated job descriptions • L&D content creation	• Financial statements preparation • Contract assistant	• Campaign and advertisement creation • Content personalization • Media posts and promotional content

Potential pitfalls – gen AI is not a bed of roses

Until now, the application of AI systems was not readily apparent to end users. While it did have a transformational impact on how companies operate, most of it was transferred to end customers in the form of benefits and user experience. ChatGPT is gen AI's iPhone moment, which turned a technology into the zeitgeist. It provides its users a fascinating experience of engaging with AI systems first-hand, along with the ability to have meaningful conversations like never before.

However, these broad conversational abilities don't move the gen AI needle forward in ways that are meaningful for broader industry adoption. The underlying issues with the technology hinder its adoption among enterprises looking out for impactful gen AI use cases.

Data preparedness – is your data gen AI-ready?

The output of a generative model is a true reflection of the data that is fed into it during its training. Most large models are trained on unfiltered data from the internet (social media feeds, publications, e-journals, etc.) and are, therefore, subject to inherent biases and errors.

> It's a mistake to be relying on ChatGPT for anything important right now.
> – Sam Altman, Chief Executive Officer, OpenAI

The current large models are trained to present their users with an output for their query or prompt – no matter how right or wrong. However, in contrast to what a few might claim, these models have not achieved the ability to reason yet. Many a times, in situations where a large model has limited or no actual information, it fills up any gaps based on information that is most likely to be correct. This opacity regarding the source data can catastrophically affect the output quality and the decisions taken thereafter.

Safety first – how do you safeguard your enterprise data?

Earlier this year, Amazon warned its employees about the risks of sharing confidential information through ChatGPT. Soon after, Samsung's employees accidentally leaked company secrets via ChatGPT and made headlines for several press releases in early April. Consequently, the company banned the use of gen AI internally. JP Morgan has also banned the use of ChatGPT.

Models that are pre-trained on external data can present the risk of exposing sensitive or confidential data to third parties. While employees may use gen AI as a productivity tool, at the backend, the platform continuously learns from the data that is shared with it. This can have disastrous consequences for enterprises, which stand at the verge of leaking their private data to the outside world, including their competitors.

Actions based on pre-trained foundation gen AI models also lack clear responsibility and accountability for the output generated. As enterprises begin to integrate generative capabilities of AI into their core operations, they must address the elephant in the room – who is responsible for the quality and legality of the output generated by these "intelligent" systems? If things go wrong, is it the model owner to be blamed or the user?

Cost considerations – is gen AI affordable?

Despite their exceptional performance, the pre-trained foundation models today are not enterprise ready. They do not accurately capture the language used within an enterprise's specific industry or domain, and thus can lead to suboptimal performance. Notably, the customization of these models on enterprise data is the biggest enterprise concern today. To truly uncover the power of gen AI, enterprises need to fine-tune these models with local enterprise knowledge using techniques such as transfer learning. In the realm of gen AI, open source models are emerging as a cost-light alternative to proprietary foundation models. However, fine-tuning any foundation model, be it open source or proprietary, is a time-consuming and resource-intensive process that requires significant financial investment. Hence, it is important for enterprises to carefully assess the RoI before they push the gen AI boat out.

The conundrum of sustainability – can gen AI lower your sustainability score?

Sustainability has been on everyone's minds lately and, consequently, many enterprises have laid down ambitious sustainability goals to achieve in the coming years. Meanwhile, the excitement created by gen AI is unimaginable. The generative models are getting bigger, but so are their carbon footprints. Training these models requires a massive amount of computing power, which boils down to increased energy consumption, further aggravating the ongoing climate crisis. Another sustainability issue with these models is their potential to perpetuate bias and inequity. These models learn from large datasets, and, if those datasets are biased, the model may produce biased outputs. Gen AI models also pose a larger societal risk of taking over certain jobs.

At a broader level, AI systems carry huge potential to overcome some of the most pressing sustainability issues. So, the question is, how can we use these systems to build a better society? How can enterprises and providers solve this paradox of a bitter-sweet relationship between AI and sustainability? Will the current green AI systems be enough to manage the scale of these gigantic systems? While the technology is promising, evaluating the RoI of gen AI implementations and carefully weighing them against the cost of sustainability will be critical for businesses.

To truly uncover the power of gen AI, enterprises need to fine-tune these models with local enterprise knowledge using techniques such as transfer learning.

Requisites to build a sturdy gen AI stack

While we weigh in on the challenges hindering scaled gen AI adoption, one thing is becoming evidently clear: once contextualized, the technology has tremendous potential for enterprises. Unlike other technologies, gen AI is here to stay for a long time because current AI systems have already set the right stage with a robust foundational infrastructure and complementary technologies. Everest Group believes that enterprises should consider six factors to move beyond experimentation with gen AI to commercial advantage.

The need for customization – how do you make gen AI models talk your organization's language?

To truly unlock gen AI's power, enterprises need to make these models compatible with their organizations' language, security and privacy requirements, and existing systems and infrastructure. One thing that is evidently becoming clear is that no one can win this race alone and that knowledge will be a key differentiator in this ecosystem. Notably, Reddit and Stack Overflow have set forth plans to start charging for access to their APIs for those crawling their websites to gather training data. Partnerships have always been critical for the development of any breakthrough technology, and this need is further driven with gen AI pushing enterprises to re-think their collaboration strategies with the extended ecosystem.

The Chinese AI giant Alibaba recently announced a new partner program to find partners that can help build custom gen AI models. Many foundation model providers are either looking for partners or have already fashioned a partnership with the broader data and AI ecosystem to help enterprises build their versions of large AI models that can serve their specific needs. On the other end, there is a frenzy among foundation model developers to come up with purpose-defined gen AI models. This need is evident from the recently forged partnership between Google and Gitlab to further the adoption of gen AI across enterprises and stand strong among the existing code-generating tools, namely GitHub's Codex and Amazon's CodeWhisperer.

Infrastructure – how do you optimize the cost of developing gen AI models?

Building a gen AI model from scratch requires massive investments in AI infrastructure. This is why the development of these foundation models has been restricted to deep-pocketed AI providers until now. However, cost is not the only concern. Fine-tuning and further running these models in production require significant computing power and powerful hardware to achieve optimal performance. This is especially true for large and complex models that are based on foundation pre-trained models and further require fine-tuning based on complex datasets.

While everyone has at one point or another experimented with ChatGPT, or other such conversational tools, meaningful applications of this technology are yet to come. Technology providers have started working in this direction, with AWS collaborating with NVIDIA to develop a scalable AI infrastructure optimized for training complex LLMs and further developing its applications.

As enterprises take their gen AI projects from proof of concept to production, they will require these models to run on local AI infrastructure to minimize latency and derive real-time inferences.

Human augmentation – how do you facilitate co-working with AI systems?

There has been much discussion about how gen AI could potentially replace human workers and completely take over certain jobs. While it is true that this technology has the potential to automate many manual tasks, especially those that require large-scale content generation and data synthesis, it is also true that AI models are as perfect as their training data, which is far from perfect in its current form. Gen AI is suitable for tasks such as generating synthetic data, enhancing image resolution, summarizing large texts, or optimizing designs. However, there are many tasks that require human skills such as creativity, empathy, critical thinking, and decision-making, which AI cannot easily replicate.

We believe that gen AI needs to be developed, trained, and supervised by humans who should be accountable for the output created by these models. This is especially true for critical applications where accuracy is table-stakes and there is absolutely no room for mistakes, including drug discovery, financial decision-making, legal content creation, and more. For example, in drug discovery, a mistake could result in a drug being ineffective or even harmful to patients. To avoid such potential risks and unintended consequences, enterprises must ensure that they keep human oversight and expertise in their gen AI architectures at every stage of the development and training process – from designing the algorithms to monitoring their performance and adjusting them, as needed.

Security, responsibility, and governance – how do you avoid gen AI risks?

Gen AI systems can be vulnerable to many kinds of attacks, including attackers ingesting malicious data to trick the system into producing inaccurate or harmful outputs such as phishing emails. Thus, enterprises must implement security measures such as data encryption, access controls, and network security to prevent unauthorized access to systems and data.

To scale gen AI, enterprises must establish the right governance and security guidelines, starting with data collection and ingestion. To safeguard enterprise data, foundation model providers are putting their best foot forward to stand out in relief against their competitors. For example, Microsoft has announced plans to sell private GPT to customers and also launched Security Copilot to identify breaches.

Enterprises must also develop a robust, end-to-end, centralized governance system for policies, procedures, and guidelines to ensure that these gen AI systems operate ethically and responsibly. They should ensure that the systems are transparent, accountable, and fair and that they comply with legal and regulatory requirements. Notably, global organizations are stepping up their efforts as the risks associated with gen AI begin to compound on top of existing AI issues. For example, UNESCO recently published a policy paper on AI foundation models with procedural frameworks to address and mitigate potential AI risks.

We believe that gen AI needs to be developed, trained, and supervised by humans who should be accountable for the output created by these models.

Responsible data sourcing and continuous data observability – how do you build a healthy data foundation?

If the cloud was the catalyst of traditional AI models, then data is the same for gen AI. While data quality has always been of essence for enterprises, the importance of high-quality data has acquired existential importance in the context of gen AI. This has driven the concept of data observability, which involves monitoring the health of data across all stages of the data life cycle in real-time.

Currently, we are dealing with massive volumes of data that are expected to increase further as this technology becomes more widely adopted. Consequently, data observability will become a critical driving force to address the unique challenges and complexities of these advanced AI systems.

While it is vital to monitor the health of data, it is even more critical to ensure ethical and responsible sourcing of the data that is used to train and run the gen AI models to avoid accountability risks. Having clarity on where the data is sourced from and under what conditions will help enterprises understand its limitations and further provide an opportunity to improve the quality of their gen AI models.

AI literacy – how do you bridge the gen AI talent gap?

Gen AI has democratized access to advanced AI technology, allowing business users to experiment with it directly. However, business domains are invariably less aware of technical nuances of what they are engaging with and need to be equipped with the right knowledge of the technology, its implications, and applications:

- **Technology:** Business users must equip themselves with a solid understanding of the technology itself. This includes understanding the underlying algorithms, architectures, and frameworks that power gen AI systems
- **Implications:** They need to be aware of gen AI's potential implications, including the technology's potential risks and limitations, as well as its ethical and legal implications
- **Applications:** Finally, business users must be trained on prudent applications of gen AI that can generate long-term sustainable value for themselves and their organizations

While it is important to spread AI literacy among business domains, it has been difficult to do so due to the lack of technical experts. The pace of innovation in this technology has outpaced the learning curve of existing talent, and, hence, it is important for enterprises to train their in-house experts on this breakthrough technology and develop an arsenal of skilled experts to accelerate and scale gen AI initiatives when the industry is ready.

Conclusion and the way forward

Increasingly, implementing gen AI is less of a choice and more of a requisite for enterprises to remain relevant today. The technology offers an opportunity to reimagine the way we work and unlock new levels of creativity and productivity. Hence, it is important for enterprises to explore its potential benefits and consider ways to integrate it into their workflows in a responsible and sustainable manner starting now. As gen AI continues to evolve and mature, we expect even greater innovation and disruption across industries. Enterprises that are able to leverage these technologies effectively will be well positioned to stay ahead of the curve and meet the ever-changing demands of their customers and markets.

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