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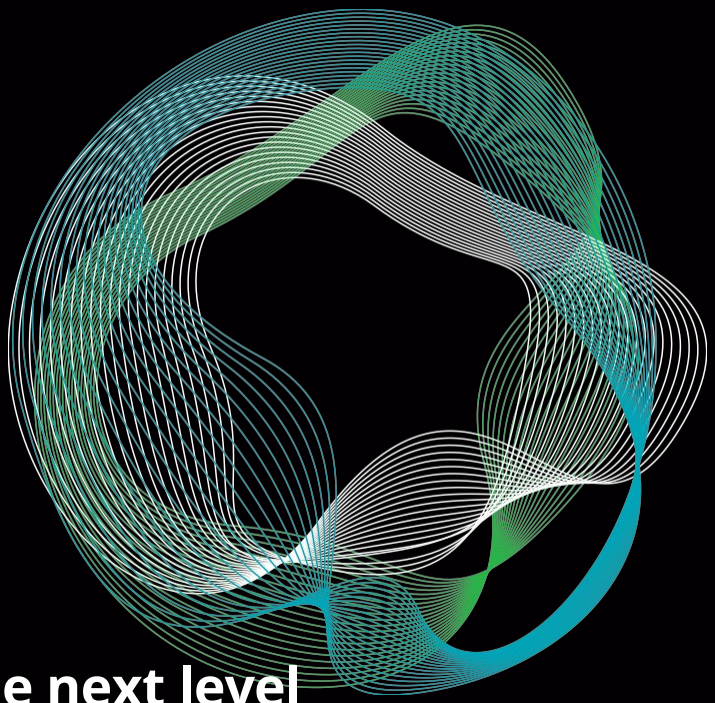


Taking AI to the next level

Harnessing the full potential and value of AI while managing its unique risks

Artificial intelligence (AI) has become a clear and undeniable force for business disruption and transformation. It is delivering significant business benefits today—and its potential to shape the future is even greater. In fact, the main challenge now is how to scale up AI-led innovations to deliver the greatest impact as efficiently and effectively as possible while at the same time managing AI's unique risks.

Although AI value and AI risk management are often viewed as separate and distinct, these four key questions can help you address both factors simultaneously:

1. ***Value:*** How do you predict, prioritize and capture the value of AI for your business?
2. ***Architecture:*** What architectural capabilities are needed to scale AI?
3. ***Workforce:*** How will AI affect your workforce?
4. ***Governance:*** How do you tackle the challenges of AI responsibility, ethics and governance to harness AI's full potential and value?

The answers to these questions will be different for every company; however, the questions themselves are universally applicable. Also, there are no perfect answers. What matters most is being intentional and considering each as you navigate your AI journey and avoid falling too far behind.

The AI systems market is expected to reach $79 billion in 2022.[1] Yet a recent Deloitte survey found that while 79 percent of companies are already experimenting with AI, less than one percent are using AI widely across the enterprise.[2]

In this report, we explore getting beyond experimentation through a detailed look at each of the four key questions raised above. But before going into the details, let's briefly cover the basics. What is AI? How is it different? And why should you care?

Artificial intelligence demystified

Theorists have been arguing for decades about what constitutes true "intelligence"—both in machines and in people—and that debate might never end. However, in practical terms, a good working definition of AI is: *Computer systems able to perform tasks normally requiring human intelligence.*

Key things to know about AI

AI systems learn

Unlike traditional computer systems that are explicitly programmed to follow sets of rules and produce deterministic outcomes, AI systems get smarter over time, sometimes on their own. This ability to learn gives AI the potential to deliver superior outcomes—and to solve problems that previously were unsolvable or poorly solved (e.g., using computer vision to analyze medical scans, or using voice recognition to enable virtual assistants such as Siri, Alexa, Cortana, and Google Home). However, AI's learning ability also produces outcomes that can be challenging to explain and are at times probabilistic (i.e., subject to chance and variation), which contributes to concerns regarding AI trustworthiness.

AI's "intelligence" is based on underlying capabilities similar to those of human intelligence

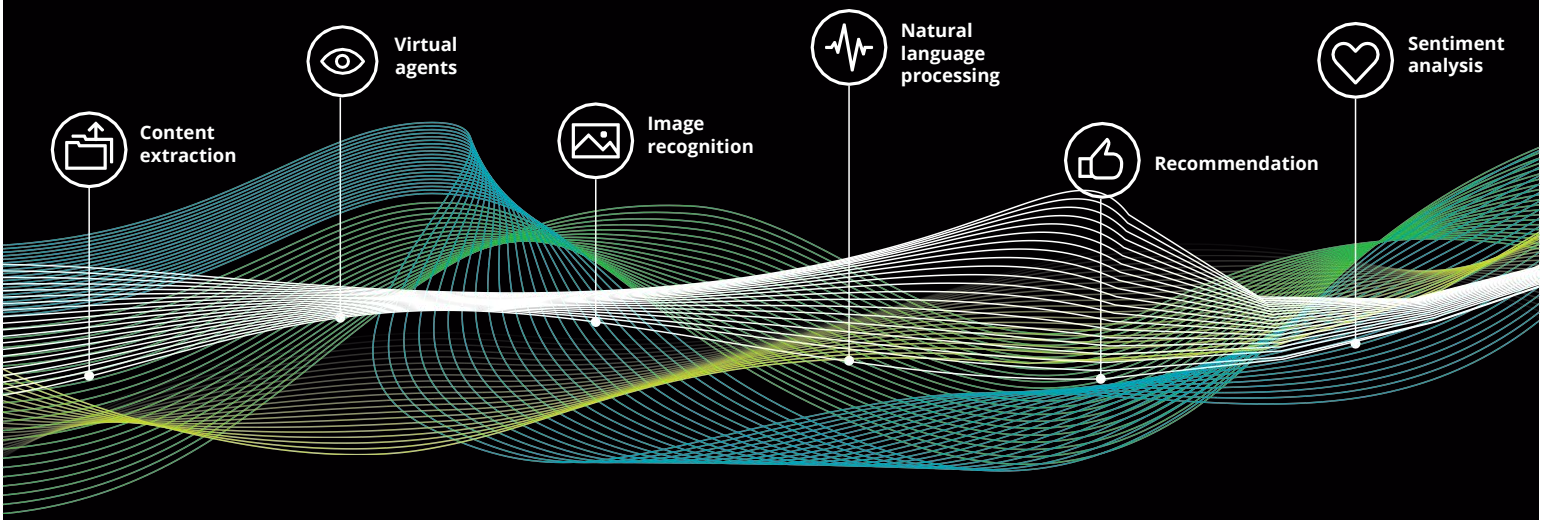
The core capabilities of AI are similar to those of human intelligence, such as clustering (pattern recognition), categorization, anomaly detection and regression and prediction. However, AI can effectively apply these capabilities to data sets and challenges that are far richer and more complex than humans can readily handle.

There are many ways to achieve AI

AI systems use a variety of methods and algorithms, including symbolic reasoning, Bayesian inference, connectionist AI (neural networks), genetic algorithms that emulate evolution, and learning by analogy. They also use a variety of learning approaches, including supervised, unsupervised and reinforcement. As such, AI is not just a single technology; it's a rich set of development techniques and problem-solving approaches. The better you understand AI, the more impactful your company's AI-driven innovations can be.

In today's marketplace, AI-based capabilities are emerging that are proving to be valuable (Figure 1).

Figure 1. A sampling of AI capabilities



AI-related innovations like these are reshaping the business landscape and propelling forward-thinking companies into the future—enabling them to do different things and do things differently (even rethinking their business and operating models).

For example, Ant Financial uses AI and data from its mobile-payments platform (AliPay) to serve 10 times as many customers as the largest US banks (more than a billion customers) with one-tenth as many employees. The company is built around a data-centric business model and digital core, generating unique and valuable innovations and insights without the operating constraints that burden traditional firms.[3]

How do you predict, prioritize and capture the value of AI?

Although AI's overall ability to create business value is now widely accepted, the specific impacts AI is likely to have are not as well understood and vary by company and industry.

At the industry level, how is your industry likely to be affected given AI's continued maturity? Will the impact be disruptive or evolutionary? Will your industry be destroyed (the way digital technology destroyed travel agencies and film photography) or simply transformed (the way the music industry has shifted from records and CDs to paid downloads and streaming services)? Will industry boundaries blur through convergence with other new or existing industries?

At the company level, how can AI enable your business to create and capture shifting value pools, create sustained competitive advantage, and achieve profitable growth? How will AI affect your business strategy? How can AI help you achieve your strategic goals? How will it affect various business functions and how they work in the future? What problems do you want/need to solve with AI? What quantifiable value will you get from investing in AI? How should you prioritize your AI initiatives and develop a plan to execute?

Here's a structured model for thinking about existing and future ways that AI can create business value. It's made up of five fundamental levers (Figure 2):

- *Intelligent automation.* Automate the "last mile" of automation by freeing humans from low-value and often repetitive activities (which, ironically, are in many cases conducted to gather and prepare data for machines).
- *Cognitive insights.* Improve understanding and decision-making through analytics that are more proactive, predictive, and able to uncover patterns in increasingly complex sources.
- *Transformed engagement.* Change the way people interact with technology—allowing machines to engage on human terms rather than forcing humans to engage on machine terms.
- *Fueled innovation.* Redefine "where to play?" and "how to win?" by enabling creation of new products, markets and business models.
- *Fortified trust.* Secure the franchise from risks such as fraud and cyber, improve quality and consistency, and enable greater transparency to enhance brand trust.

Unconventional Wisdom – Part 1

Don't judge AI by its past, or even its present. Judge AI by its future (which is right around the corner).

In the earliest stage of the AI S-curve, most companies focused on using intelligent automation to reduce costs associated with repetitive, labor-intensive processes. However, AI technology is maturing rapidly and we are now at the stage where opportunities for disruption and revenue generation are coming to the fore. When thinking about how to apply AI to your business going forward, be sure to consider all five value levers—not just cost reduction through automation.

Figure 2. The five levers for AI value

Intelligent automation

Before AI
People engage in repetitive low-value activities, often at the service of machines (for example, cleansing, preparing, and keying in data; handling system exceptions).

After AI
AI systems "read" unstructured data, optimize and repair themselves, and are overseen by people.

Cognitive insights

Before AI
Insights are limited by static and reactive analytic structures that struggle to deal with increasingly complex, distributed, real-time information.

After AI
AI can identify patterns through proactive and predictive analysis of vast amounts of highly complex information (that is often in motion).

Transformed engagement

Before AI
People engage with systems and organizations on machine terms (for example, filling in forms).

After AI
Machines engage with people on human terms (for example, natural language, gestures) and customers, employees, and other key stakeholders receive a hyper-personalized and efficient multichannel experience.

Fueled innovation

Before AI
Innovation is limited by current technology paradigms, as well as the growing complexity of rules and data.

After AI
New market, product, and service opportunities emerge as human capabilities scale up massively with the help of AI systems that learn.

Fortified trust

Before AI
Reactive and rule-oriented security prevention and detection; transparency in decline as organizations and information increase in complexity.

After AI
Dynamic and proactive security measures are a priority, as well as increased transparency into decision-making (with less human bias).

What architectural capabilities are needed to scale AI?

AI requires the right supporting architecture and infrastructure. Without that solid foundation, your AI solutions will be severely limited, prohibitively expensive, or just won't work.

Digital native firms are at the forefront in this area. Microsoft, for example, is transforming itself into an AI-driven firm by reorganizing its internal IT and data assets and migrating all legacy processes onto a consistent software base and data architecture in the Microsoft Azure cloud. The company's new centralized operating platform helps integrate the organization using a shared software component library, algorithm repository and data catalog—enabling the company to scale and deploy digital processes across different segments of the organization.[4]

Given the rising importance of AI—and digital technology in general—every business leader needs both a practical and theoretical understanding of the latest technology innovations. AI is no longer just the domain of the CIO and CTO. Because in an increasingly digital world, technology is having an impact on every aspect of business, which means that in many ways every company is now a technology company, and every business leader is a technology leader.

Fundamental elements of an AI-enabling technology architecture

Cloud

Public cloud has become the essential enabler for business innovation and disruptive technologies (including AI). It provides flexible and scalable access to a level of computing resources that would be physically or economically impossible to achieve using traditional in-house IT service models. It also provides fast and easy access to valuable data that historically was buried deep inside organizational silos. Just as important, cloud provides instant access to the latest AI innovations—and to pre-built, pre-configured building blocks that can help your company jumpstart its AI innovation efforts. Cloud is no longer just a means to reduce operating costs; it is the platform for digital business and is where innovation happens.

Data

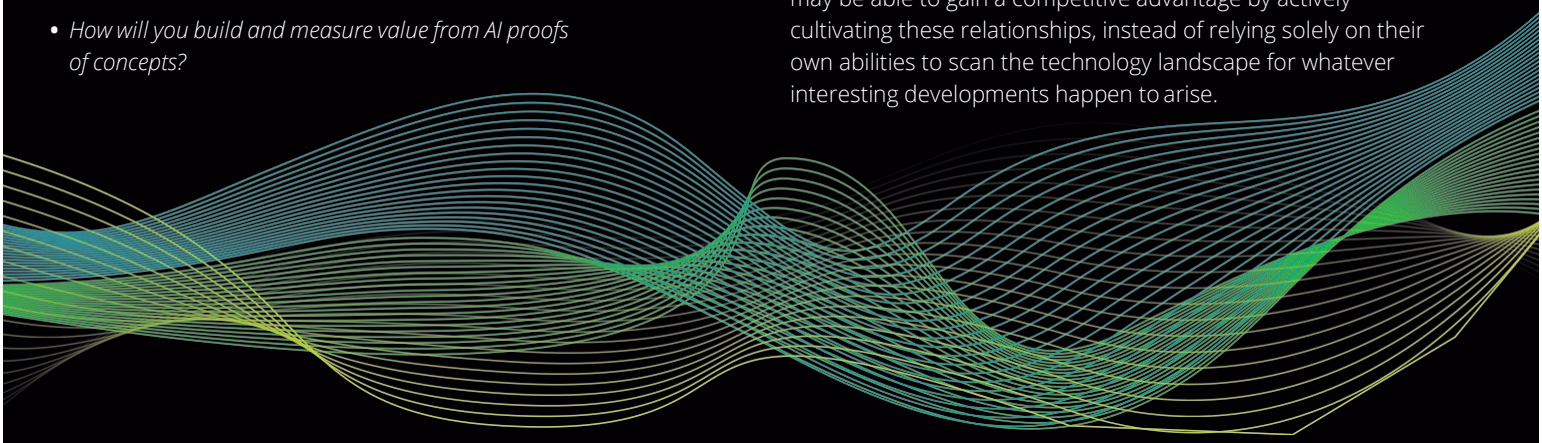
The data that AI learns from is just as important as the algorithms that allow it to learn. In fact, 60 percent of companies surveyed by Forrester cited managing data quality as a key challenge in delivering AI capabilities.[5] Data that is static, narrow and disjointed severely limits the AI solutions that can be built, their learning potential and—consequently—their impact. Modern data architectures that provide holistic and secure access to quality first-, second- and third- party data (in motion and at rest) are foundational to innovative AI development and the operating models of the future.

AI is no longer just the domain of the CIO and CTO. In many ways every company is now a technology company, and every business leader is a technology leader.

Other considerations to keep in mind

- *What do the capabilities and components of an AI-enabled architecture look like?*
- *What technology capabilities, data, and systems are required to enable your AI priorities?*
- *How does AI impact your existing technical architecture? How do you need to change this to enable AI scaling?*
- *What will you build vs. acquire from hyperscale cloud providers vs. niche third parties? Why? How will your AI services interrelate and build upon each other?*
- *What vendors and ecosystems will you leverage to enable your AI priorities?*
- *How will you build and measure value from AI proofs of concepts?*
- *How do you leverage enterprise architecture to support the scaled development of proofs of concepts across the organization? What is your data strategy (data sources and signals, data collection, data preparation, acceptance for AI, models)?*
- *How will you access and control first-, second- and third-party data sources?*

Companies should consider taking a more active role in AI innovation. Future AI breakthroughs are likely to stem from close collaboration with and among AI start-ups, technology and professional services firms, and academia. Businesses may be able to gain a competitive advantage by actively cultivating these relationships, instead of relying solely on their own abilities to scan the technology landscape for whatever interesting developments happen to arise.



Unconventional Wisdom – Part 2

Don't let past technology investments limit your future.

A company that has invested heavily in technologies that are not AI-enabling will naturally be reluctant to move away from them. But in order to stay competitive in a future where AI is a fundamental operating requirement, there may be no choice. For example, companies that have been pouring money into legacy systems and other in-house IT capabilities for decades will likely need to phase those out quickly in favor of public cloud. Letting past decisions limit your ability to fully harness AI in the future is self-defeating.

Ultimately, it's not about investing in AI; it's about investing in the future of your business. AI just happens to be a key to that future.

How will AI affect your workforce?

AI has tremendous implications for a company's workforce. However, those implications are different than what most people think. In particular, there is a common misconception that AI equates to replacing people with machines. Sometimes this does happen, especially for the low-skill, labor-intensive activities that have been a primary focus for early AI efforts, which revolved around automation. However, many of AI's most compelling use cases involve machines and people working together as a team, with AI augmenting humans—not replacing them—and making their jobs more enjoyable and rewarding.

AI workforce implications can be divided into three broad categories. The first focuses on creating a general workforce that can work effectively with intelligent machines. The second focuses on acquiring and cultivating the business and technical talent necessary to design, build and deploy top-notch AI solutions. The third focuses on accelerating AI development and deployment through centers of excellence and other mechanisms that provide expertise and support exactly when needed.

General workforce

AI will create new business roles and enable and transform existing roles, such as customer service and sales. Even in an ideal case where AI perfectly replicates human behavior, workers will still need to get comfortable with the idea of collaborating with machines (versus just using them). And in more realistic scenarios, people will also need to learn how to work around AI's unique quirks and limitations.

When developing an AI strategy, key workforce questions to consider include:

- *What will the business look like when the workforce is a mix of humans with machines?*
- *Which processes will be the top priority targets for human/machine collaboration? What are the challenges?*
- *How will the organizational culture need to change?*
- *What training will be needed to teach people to collaborate with machines?*
- *How will performance measurement and compensation be affected?*

AI development

AI technology requires a broad range of specialized roles and skill sets that go beyond traditional IT capabilities; roles such as algorithm developers, machine learning engineers and data scientists. Gaining access to high-quality talent with those unique skills can have a major impact on AI project outcomes. Key questions to consider include:

- *What AI-specific skills are needed?*
- *Which skills are best maintained in-house?*
- *Which skills are already available in the existing workforce, and which need to be shored up?*
- *What are the options for acquiring scarce AI talent (third-party vendors and ecosystem partnerships; training/upskilling; external contractors and experts)?*

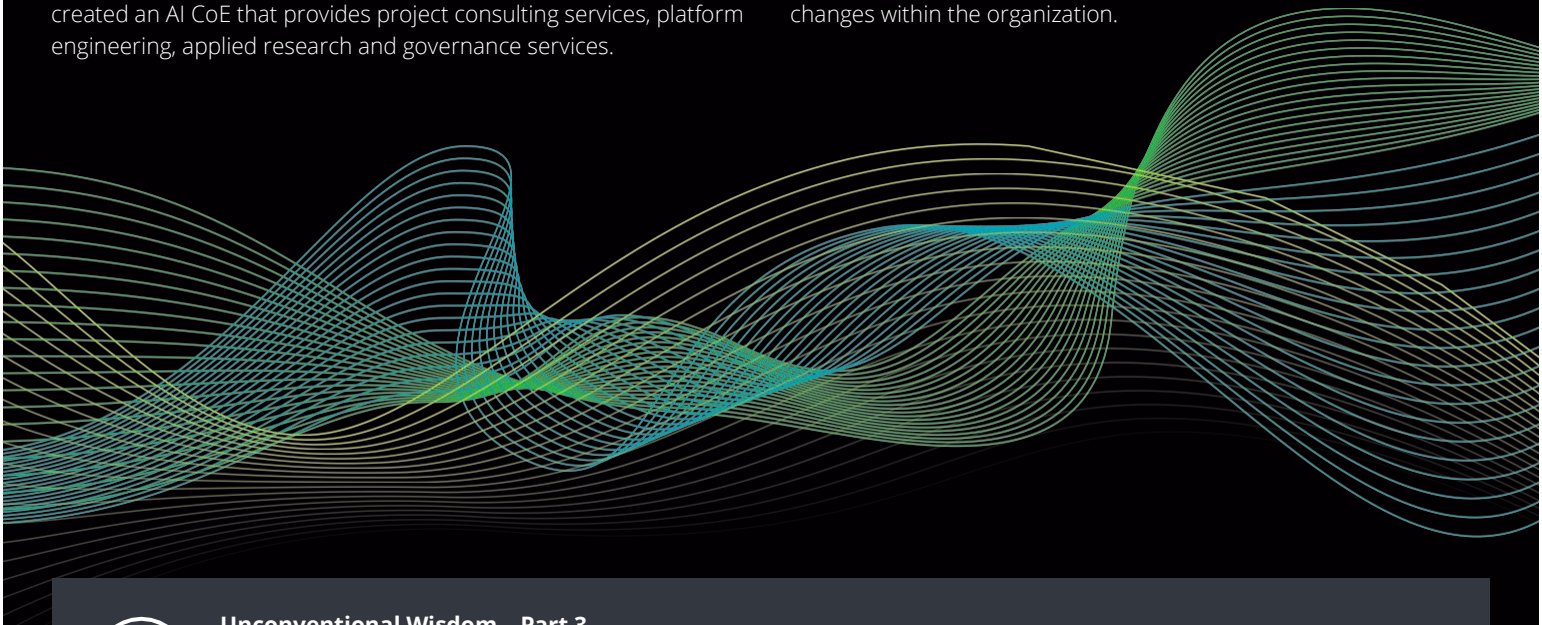
As noted in the architecture section, expanded relationships with academia and other external partners can be valuable sources of talent, expertise, and innovation.

Many of AI's most compelling use cases involve machines and people working together as a team, with AI augmenting humans—not replacing them.

Acceleration

Transforming large segments of the workforce by developing new skills is time-consuming and can inhibit the pace of innovation. That's why many organizations are turning to temporary operating constructs such as centers of excellence (CoE). These centers typically focus on education, advice, research and knowledge sharing that accelerate near-term value creation while building a bridge to the future workforce. For example, a large investment bank recently created an AI CoE that provides project consulting services, platform engineering, applied research and governance services.

This has improved the quality and pace of service delivery. It has also improved technology standardization; enabled the firm to test AI on its most differentiating opportunities; provided sandbox environments for learning and experimentation; and helped the firm get a head start on addressing issues such as bias and explainability. Perhaps most important, it has created a sense of progress and helped build enthusiasm and momentum for skills changes within the organization.



Unconventional Wisdom – Part 3

AI is less about machines replacing people and more about machines collaborating with people.

One of the most common fears about AI is that it will steal jobs and make humans obsolete. However, in reality, many of AI's most valuable and compelling use cases revolve around people and machines working together to perform challenging tasks and jointly evolve their capabilities.

In many situations, AI isn't taking over people's jobs—it is helping people be more effective and making their jobs more satisfying and enjoyable by boosting their performance and reducing tedium. Also, it can free people up to spend more time and energy on activities that are more valuable and strategic to the business.

How do you tackle the challenges of AI responsibility, ethics and governance?

Because AI often learns and behaves like humans, it presents many of the same kinds of risks that a company faces in its human workforce. As such, without effective safeguards, AI might act in ways that are unpredictable or have unintended consequences. (See Unconventional Wisdom – Part 4.)

Achieving AI that is trustworthy requires effective governance in every phase of the AI life cycle. Waiting until after problems arise can have significant legal, regulatory and financial repercussions. It can also cause significant reputation damage and embarrassment for a company and its leaders.

Businesses can and should innovate at a rapid pace; however, they also need to establish guardrails for responsibility and ethics that allow AI innovation to proceed rapidly while reducing risk. Even in industries such as banking that are closely regulated and therefore have strong governance in place, enhanced governance will likely be needed to address AI's unique challenges and risks. Also, AI can affect the controls a business has already established, as well as its process and life cycle for implementing future controls.

Six key attributes of trustworthy AI:

1. ***Fair/unbiased.*** AI systems need to include internal/external checks to ensure equitable treatment for all participants.
2. ***Robust/reliable***. AI systems that learn from humans (and from other systems) need to produce outputs that are reliable and consistent with human norms of behavior.
3. ***Privacy.*** AI systems need to comply with current privacy standards, including the right to safety, to be informed, to choose, to be heard and to be forgotten.[6]
4. ***Safe/secure.*** AI systems need to be adequately protected from cyber threats.
5. ***Responsible/accountable.*** Clear policies must be in place to determine who is responsible/accountable for AI outputs and actions.
6. ***Transparent/explainable.*** Companies must be willing and able to explain how data is being used and how AI systems make decisions.

BMO Financial Group is working towards accelerated business outcomes using AI while preserving trust with their customers and internal stakeholders with their Trustworthy AI initiative. It is achieving these outcomes by designing for fairness, transparency and explainability as initial priorities; rapidly identifying and mitigating issues posed by the incremental risks of AI; and enhancing its development, enterprise risk, privacy, legal and ethics practices to embrace AI at scale.

Unconventional Wisdom – Part 4

The good news is AI acts human and thinks for itself. The bad news is AI acts human and thinks for itself.

Like the humans it seeks to emulate, AI can make mistakes. It can exercise poor judgment and exhibit biases that might seem perfectly logical based on objective data but that violate social norms. And it can learn bad habits. (The most famous example being a chatbot that started using offensive language it had learned from human users.)

From a risk perspective, AI's biggest problems stem from its biggest advantages—reach, scale and speed. Machines and humans are both imperfect. However, problems created by humans tend to be limited to a relatively small part of the business that is directly within their reach, whereas problems created by AI can propagate at digital speed across the entire enterprise.

The AI journey: How do we get from here to there?

In the future, AI mastery will likely be essential for businesses in every industry. As with the rise of digital, AI will progress from something companies need to do toward something they need to be. Today, many organizations are at least somewhat satisfied with their current AI efforts because they are doing a lot of different things that can be considered AI. However, they have a sense that more can and should be done. In particular, they need to bridge the gap from experimenting and doing to being an organization with AI as a core capability. As with most disruptions, the AI journey involves three major stages: establishing a foundation, where a company begins to gain confidence in AI's potential and its ability to harness it; scaling, where the company can create AI at a rapid pace through mechanisms that are well governed and not limited by function or category; and mastery, where the company's brand, business and operating model are shaped by AI. Every company's journey through the three stages will be unique, but all will require maturation across the four dimensions of value, architecture, workforce, and governance.

Establishing a foundation

Organizations at this stage of maturity are typically agreeing on a definition of AI, why it's different and why it matters. They are clearly articulating the sources of value the organization will pursue over time, as well as establishing near-term priorities. Most will be embracing public cloud for targeted use cases and beginning to industrialize the data pipeline. Establishing a CoE to broker learnings and highlight skill availability is common at this stage, as is identifying and agreeing to guiding principles and an overarching governance framework for AI (centralized, distributed or hybrid).

Scaling

Scaling is often characterized by moving beyond narrow classes of use cases and subsets of business functions to a broad portfolio of valuable AI efforts; fully embracing public cloud for AI services; experimenting with, developing and executing a metadata management framework for first-, second- and third-party data; and institutionalizing the AI development life cycle. Additionally, organizations in the scaling stage are often formalizing efforts to raise awareness of AI's impact; upskilling and reskilling their workforce; embracing non-traditional partnerships; and establishing policy frameworks, accountability, playbooks and monitoring for AI governance.

Mastery

Organizations that have achieved mastery are typically moving beyond a use-case and function-based portfolio to transforming the enterprise and driving widespread innovation of products, services, and markets. They are adopting a data-first, cloud-powered, hypothesis generating and testing business and technology architecture. Most are having success retaining and attracting the best next-generation talent. Creating AI that benefits communities and society is common. And integrating AI governance into corporate and technology governance, establishing trust as a competitive differentiator, is the norm. Aside from some of the world's leading digital companies, most businesses are still in the early stages of the AI journey. Now is the time for decisive action. Companies today need to start or accelerate their journey in an intentional and structured way that anticipates their competitors feverishly racing to achieve AI mastery.

Unconventional Wisdom – Part 5

AI isn't something companies need to *do*. It's something they need to be.

At the moment, most companies still think of AI in terms of isolated use cases and pilot programs. However, in order to harness the full potential and value of AI, it must be deeply ingrained in every part of the enterprise, from strategy and technology to workforce and governance. Any part of a business that currently requires any level of intelligence can benefit from AI. Which means that *every* part of the business needs to be AI-enabled.

Taking the next step.

Individual use cases for artificial intelligence are interesting and exciting to think about and implement. However, as AI matures and becomes increasingly integral to the future of business, companies need to consider AI's challenges and opportunities more comprehensively and strategically. In particular, companies and their leaders need a clear understanding of AI along four key dimensions:

- Value
- Architecture
- Workforce
- Governance

Whether you are starting with a clean slate and approaching AI from the top down or starting with your existing AI initiatives and building up from there, all four dimensions must be addressed. Crafting and executing an AI strategy that considers these four dimensions will help your company scale up quickly to capture the full benefits of AI without getting bitten by AI's unique risks.

Before you know it, you might find your company has become a next gen AI company.

Let's talk

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Glossary

Deterministic
Deterministic AI environments are those on which the outcome can be determined based on a specific state. In other words, deterministic environments ignore uncertainty.

Probabilistic
Probabilistic AI environments are those where the outcome is determined based on leveraging probability-based reasoning and controlling for uncertainties to predict outcomes.

Clustering
Clustering is a machine learning technique that involves the grouping of data points. Clustering is a method of unsupervised learning and is a common technique for statistical data analysis used in many fields. Clustering is used with applications including customer segmentation, fast search and visualization.

Categorization
Categorization is a supervised learning algorithm technique that allows machines to assign categories to data points (categorize data into a given number of classes).

Anomaly detection
Anomaly detection (also outlier detection) is the identification of rare items, events or observations which raise suspicions by differing significantly from the majority of the data.

Regression
Regression is a statistical approach that estimates the relationships among variables and predicts future outcomes or items in a continuous data set by solving for the pattern of past inputs, such as linear regression in statistics.

Symbolic AI
Symbolic AI is the term for the collection of all methods in artificial intelligence research that are based on high-level "symbolic" (human-readable) representations of problems, logic and search.

Bayesian inference
Bayesian networks are graphical models for representing multivariate probability distributions. They aim to model conditional dependence, and therefore causation, by representing conditional dependence by edges in a directed graph.

Connectionist AI
Connectionist AI systems are large networks of extremely simple numerical processors, massively interconnected and running in parallel. *Note: Connectionism is an approach to AI that developed out of attempts to understand how the human brain works at the neural level and how people learn and remember.*

Genetic algorithms
Genetic algorithms are those algorithms based on principles of genetics that are used to efficiently and quickly find solutions to difficult problems.

Virtual agents
A virtual agent is a software program that uses scripted rules and, increasingly, AI applications to provide automated service or guidance to humans.

Image recognition
Image recognition is the ability of a system or software to identify objects, people, places and actions in images. It uses machine vision technologies with artificial intelligence and trained algorithms to recognize images through a camera system.

Natural language processing
Natural language processing, or NLP for short, is a field of study focused on the interactions between human language and computers. NLP helps machines "read" text by simulating the human ability to understand language. It sits at the intersection of computer science, artificial intelligence and computational linguistics.

Recommendation algorithms
Recommendation algorithms are those algorithms that help machines suggest a choice based on its commonality with historical data.

Knowledge representation
Knowledge representation and reasoning is the field of AI dedicated to representing information about the world in a form that a computer system can utilize to solve complex tasks, such as diagnosing a medical condition or having a dialog in a natural language.

Sentiment analysis
Sentiment analysis refers to the use of natural language processing, text analysis, computational linguistics and biometrics to systematically identify, extract, quantify and study affective states and subjective information.

Hyperscale cloud providers
Hyperscale cloud providers are those that offer robust, scalable applications and storage portfolio of services to individuals or businesses to enable their architecture to scale appropriately as increased demand is added to the system.

Endnotes

1. "Worldwide Semiannual Artificial Intelligence Systems Spending Guide," IDC, 1H 2019.
2. Jeff Loucks, Tom Davenport, and David Schatsky, *State of AI in the enterprise*, 2nd edition (survey and Deloitte analysis), Deloitte Insights, 2019.
3. Marco Iansiti and Karim R. Lakhani, *Competing in the age of AI," Harvard Business Review*, January/February 2020.
4. bid.
5. Gil Press, *AI And Automation 2019 Predictions From Forrester*, Forbes, November 6, 2018.
6. European Union General Data Protection Regulation

Deloitte.