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AI TREND CARDS

Book 1

April, 2020

INTRODUCTION TO AI TREND CARDS

We are in the Age of With, where humans are collaborating with machines in ways previously unimaginable. AI is in the news every day, sometimes highlighting how the technology is transforming an industry, yet too often pointing to an invasion of privacy or other organizational misstep. Leaders everywhere are struggling to grasp the implications of this wide-ranging and transformative technology, and government is no different. At Deloitte, we support government clients throughout the entire lifecycle of becoming an AI-fueled agency. Some trailblazing agencies are already developing full-scale centers of excellence to help prioritize and develop AI use cases across the enterprise. Agencies who once struggled to generate meaningful insights, are now developing an enterprise-wide AI strategy or testing initial pilots to predict what is going to happen. Regardless of current level of adoption, AI can be perplexing.

This collection of AI trend cards aims to demystify AI concepts that are often top of mind for government leaders. We start with explorations into several fundamental technologies of AI, including robotic process automation and machine learning. In addition to these root technologies, we examine tactical considerations for the enterprise, including AI strategy and the role of cybersecurity.

Given that ethics of AI is top of mind for everyone, we believe in helping agencies harness the power of AI responsibly. To that end, we discuss our Trustworthy AI™ framework, which provides a comprehensive approach across the spectrum of AI ethics, governance, risk, and controls. Lastly, we explore AI enablers that are often prerequisites toward realizing the full potential of AI in an enterprise, including cloud platforms and data quality.

AI is a vast topic, and it often becomes highly technical. We have crafted these cards so anyone can understand, regardless of their technical proficiency. We plan to continue to create more trend cards on supplementary topics over the next few months. Until then, enjoy these brief explorations into the future of anticipatory government and the power of the Age of With.

CONTRIBUTORS

Nitin Mittal

Deloitte Consulting LLP

Carl Engle

Deloitte Consulting LLP

Deborah Golden

Deloitte & Touche LLP

Beth Mueller

Deloitte Tax LLP

Ashish Verma

Data and Analytics
Modernization Leader
Deloitte Consulting LLP
asverma@deloitte.com

Irfan Saif

Deloitte & Touche LLP

Juan Tello

Deloitte Consulting LLP

Michael Greene

Deloitte Consulting LLP

Amy Park

Deloitte & Touche LLP

Mark White

GPS Analytics & Cognitive
Assets Partner
Deloitte Consulting LLP
mawhite@deloitte.com

Ranjit Bawa

US Cloud Leader
Deloitte Consulting LLP
rbawa@deloitte.com

Ryan Brotman

Analytics & Cognitive
Deloitte Consulting LLP
rbrotman@deloitte.com

Jim Guszczka

Deloitte Insights & Research
Deloitte Services LP
jguszczka@deloitte.com

Scott Pobiner

Analytics & Cognitive
Deloitte Consulting LLP
spobiner@deloitte.com

Will Bible

Deloitte & Touche LLP

Jennifer Burns

Deloitte & Touche LLP

Tom Kramer

Deloitte Consulting LLP

Gina Schaefer

Managing Director

gschaefer@deloitte.com

Amit Desai

Strategy Principal
Deloitte Consulting LLP
amitdesai@deloitte.com

SK Chaudhary

GPS Analytics & Cognitive
Deloitte Consulting LLP
skchaudhary@deloitte.com

Dave Kuder

AI Insights Leader
Deloitte Consulting LLP
usai@deloitte.com

Priyanka Saxena

Analytics & Cognitive
Deloitte Consulting LLP
prsaxena@deloitte.com

Ayan Bhattacharya

AI & Cognitive Leader
Deloitte Consulting LLP
aybhattacharya@deloitte.com

Charley Chen

AI Strategy
Deloitte Consulting LLP
charleychen@deloitte.com

Timothy Li

Advisory Principal
Deloitte & Touche LLP
timothy@deloitte.com

Melissa Smith

GPS Analytics & Cognitive
Deloitte Consulting LLP
melissasmith@deloitte.com

Beena Ammanath

AI & Cognitive Leader
Deloitte Consulting LLP
bammanath@deloitte.com

Sherry Comes

Analytics & Cognitive
Deloitte Consulting LLP
scomes@deloitte.com

Ryan Luckay

GPS Analytics & Cognitive
Deloitte Consulting LLP
rluckay@deloitte.com

Rohit Sreedhar

Innovation
Senior Manager
rsreedhar@deloitte.com

Jeff Brashear

Strategy Managing Director
Deloitte Consulting LLP
jbrashear@deloitte.com

Bill Eggers

Government Insights Director
Deloitte Consulting LLP
weggers@deloitte.com

Abhijeet Panse

GPS Analytics & Cognitive
Deloitte Consulting LLP
apanse@deloitte.com

Mark Urbanczyk

Analytics & Cognitive Partner
Deloitte Consulting LLP
murbanczyk@deloitte.com

ACKNOWLEDGEMENTS

Sumeer Bhagat

Leigh Bechet

Sudi Bhattacharya

Ben Booher

Sabthagiri Chandramohan

Kevin Coltin

Joanna Cullinan

Deborah Cynn

Cathleen Domes

John Fogarty

Rachel Forstater

Tushar Halgali

Alex Halper

Emma Harvey

Alison Hu

Satish Iyengar

Manish Jain

Sid Kant

Cory Liepold

Erica Macheriotou

Habib Maya

Hallie Miller

Aline Mnayan

Leah Morrison

Meredith Parker

Ashwin Patil

Alex Payne

Nathan Petersen

Clark Rudd

Jason Sawyer

Taylor Schmidt

John Stone

Arthi Subramanian

Stella Tewksbury

Theresa Tsuei

Faith Umoh

David Yaros

Zack Zweig

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EXAMPLES OF PROMINENT AI TECHNOLOGIES

Deep Learning, Machine Learning, Natural Language Processing, Computer Vision, Neural Networks and many more are examples of AI technologies. **Deloitte is well-versed with all types of AI technologies**, and brings these tools to clients to help them solve their most pressing challenges. Whether it is helping clients drive towards their mission, or improve efficiency in the workplace, Deloitte brings a deep understanding of when and how to apply these tools.

This first chapter introduces some of the high-level building blocks of AI.



AI, DATA SCIENCE, AND MACHINE LEARNING

The pervasiveness of computer driven solutions in our society has made terms such as AI, Data Science, and Machine Learning commonplace. What do these terms mean and how might they apply to a specific challenge or problem?

WHAT IS THE DIFFERENCE?

AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence.¹

Machine learning is a subset of AI, which uses a set of statistical techniques that identify and adapt to patterns in data to achieve a goal.

Data science is a scientific method for transforming data into actionable insights. Data scientists form and test hypotheses through data extraction, analysis (sometimes using machine learning), and visualization.

AI encompasses many technologies that work together to build innovative solutions that transform society, government and business...

Machine Learning

Virtual Assistants

Intelligent Automation

Robotics Process
Automation

Natural Language
Processing

Deep
Learning

Unsupervised
Learning

Neural
Networks

Predictive Analytics

Speech
Recognition

Computer Vision

POTENTIAL BENEFITS

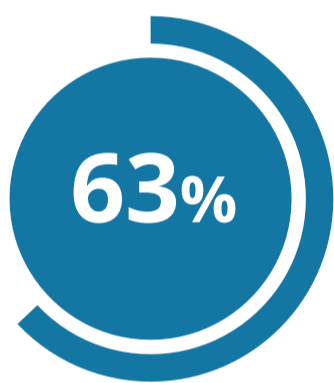
- Can be applied to a diverse range of use cases, such as enhancing products and services, driving growth, cutting cost, and improving internal organizational operations
- Can deliver insights not possible before
- Can deliver increased productivity and better insights through humans *with* machines working together

CONSIDERATION POINTS

- Good insights require access to good data
- Even the best models are only useful if they inform action
- AI ethics such as transparency and biases need to be carefully managed
- AI systems may be vulnerable to unanticipated attacks
- AI is a combination of technologies that work together to enable use cases that transform the way we work and operate

DATA SIGNALS

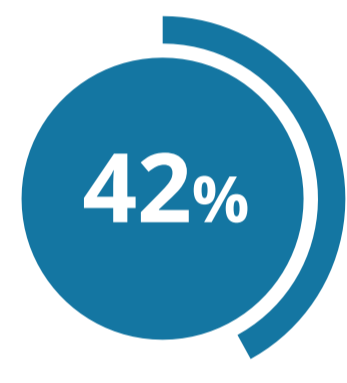
According to Deloitte's State of AI in the Enterprise, 2nd Edition:



63% of early AI adopters use machine learning²



82% of surveyed executives report positive ROI from AI efforts²



42% of surveyed executives believe AI will be critical to stay competitive two years from now²

CASE STUDIES

Augmenting Systematic Reviews at a Federal Agency: Systematic reviews are used at a federal agency to identify consensus among scientific findings, but are manual and time consuming. Deloitte developed an NLP model to automatically classify scientific research by language in its abstract, augmenting the review process and reducing the required time by 65%.

Identifying Overpayments of Indirect Taxes for Retailer: A large, global retailer paid billions in indirect taxes to suppliers. Deloitte used its machine learning capabilities to classify \$100B+ of complex spend, including \$5B of indirect taxes, and generate insights to identify cash leakages. The insights delivered \$100M of indirect tax refunds, and potential \$300M of additional cost-savings through a tax efficient structuring opportunity.

1. Oxford Dictionary 2: State of AI in the Enterprise, 2nd Edition, Deloitte 2018

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ROBOTICS & INTELLIGENT AUTOMATION (R&IA)

Robotics & Intelligent Automation (R&IA) is the use of AI technologies such as Natural Language Processing and Machine Learning to augment Robotics Process Automation (RPA), enabling processing of unstructured data, predictive and prescriptive analytics, and automation of tasks that involve judgement. While RPA can deliver efficiency gains to rules-based processes, combining RPA with AI solutions can deliver significantly greater returns on end-to-end organizational processes that are much more complex.


STATE OF PLAY

R&IA can quickly add capacity to a labor force with new capabilities and options to achieve impact on the most common organizational performance measures. Some outcomes include:


 **\$79M in benefits** over five years by automating **25 processes** for a telecom

 **70%+ correct diagnoses** and **6,000 referrals annually**, by automating cancer diagnostic triage


 **25% productivity increase** and a **300+ FTE benefit** by automating a bank's complaints resolution


 **30% cost reduction** by reimagining **50+ processes** and automating at scale for a manufacturer

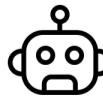
These are the R&IA technologies most commonly used by organizations to automate processes:

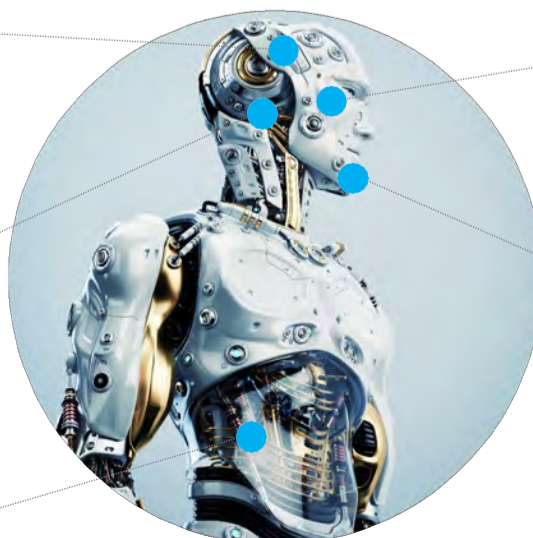
 **Machine Learning (ML)** gives bots a **brain** so they can mimic human judgement in making decisions

 **Intelligent Text Extraction (ICR)** gives bots **eyes** so they can process a greater range of unstructured inputs

 **Natural Language Processing (NLP or Chatbot)** gives bots **ears** to listen and understand stand human inputs

 **Natural Language Generation (NLG)** gives bots a **voice** to communicate vastly complex information in personalized way

 **RPA** is the **body** that converts IA inputs into action



POTENTIAL BENEFITS

- Eliminate manual intervention and reduce time needed to execute tasks
- Reduce time to action based on accuracy and confidence in data available
- Increase processing volume significantly with overnight/weekend processing
- Ensure consistency/accuracy of data in reporting by eliminating manual errors
- Shift employee focus to value-added tasks
- Reduce average time to execute transactional processes

CONSIDERATION POINTS

- Intelligent automations are not out-of-the-box solutions and require functional expertise, focus on value, and operational change
- IT and business functions must partner to combine native technical knowledge and operating experience
- Internal campaigns are needed to champion the benefits of automation and redesign roles to collaborate with digital workers
- Automations may reimagine and redesign end-to-end processes in order to maximize ROI and enable human-machine collaboration
- Automations must be designed to produce the data required for analytics and cognitive technologies
- An initial investment in a Center of Excellence (CoE) and automation architecture is required to build a sustainable automation transformation program

DATA SIGNALS



According to Forrester, the size of the RPA services market by 2023 is expected to be \$12B, up from \$5B in 2019¹



While 90% of respondents in a Deloitte survey believe Robotic & Intelligent Automation has met or exceeded productivity improvement expectations²...



... only 8% have successfully automated at scale with 50+ automations³

Scaling is possible and requires leadership coordination and commitment to value to be successful

CASE STUDIES

National Aeronautics and Space Association: Applied RPA to business processes in the Shared Services Center and was the first government agency to implement RPA. When one example – the Funds Distribution Bot – achieves full scale, NASA will realize 25,000 hours of manual work saved, 85% reduction in cycle time, and \$1M in annual savings.

US Energy Company: Implemented 70+ automations across 9 business functions, established an automation CoE, and instituted a multi-geography foundry model to execute and sustain. Client is now introducing cognitive capabilities throughout the automation ecosystem to enhance the ongoing benefits of automation. Automations will deliver 60,000 hours back to the functions annually.

Global Manufacturing Company: Automated 30 processes across 3 global regions. The automated processes were migrated to the R&IA managed services operations and integrated with an automation CoE. Client drove 80% improved efficiency and achieved >30% reduction in operating costs. Through smart analytics, client is able to detect key patterns and relationships within automation data to derive deep and actionable cognitive insight.

U.S. Department of Agriculture: The first government entity to deploy an unattended bot at the server level, which allowed USDA to quickly scale RPA throughout the 29 USDA agencies and staff offices nationwide.

1. Forrester, The RPA Services Market Will Grow To Reach \$12 Billion By 2023
2. Deloitte, "The Robots are Waiting"

3. Deloitte, "Automation with Intelligence"

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EXAMPLES OF DELOITTE AI CAPABILITIES

Deloitte has end-to-end capabilities across the AI spectrum, from helping organizations develop their AI strategy, design and implement specific use cases, and maintain and operate after deployment. In addition, **Deloitte is investing in new AI scope of services including Data in Motion, Cloud ML, Cyber AI, and more.**

This chapter introduces a small sample of our capabilities.

AI STRATEGY

AI is a suite of breakthrough technologies that are on a trajectory to reshape how business gets done. However, for AI to have a real and meaningful impact across the enterprise, leaders must take a broad and holistic perspective that views AI strategically as a source of transformation and competitive advantage. This involves a set of choices that articulate where and how AI will be used to create value, and the data and technology architecture, workforce, and governance needed to do so.

STATE OF PLAY

Despite widespread experimentation with AI, many large organizations are struggling to embrace AI strategically and grapple with questions like “how do we scale AI?” and “how do we address AI with responsibility and ethics?” Tackling these questions in silos often leads to failed or stalled efforts. To achieve real transformation across the organization, effective AI implementation requires a carefully considered strategy with an enterprise-wide perspective. An integrated AI Strategy incorporates both technical and managerial perspectives, across a set of strategic choices, as shown below.

Focus

Where should we concentrate our AI investments?

- Management: Which applications, processes or problems should we consider?
- Technology: Which AI technologies and what level of human involvement are needed?

Success

How will AI deployment create value?

- Management: How will value be defined/measured? Should certain capabilities be created?
- Technology: How mature/complex are solutions? How will they be piloted and scaled?

Capabilities

What do we need to execute our AI Strategy?

- Management: What people, partners, skill, and organization changes are needed?
- Technology: What platform, data, and other technical changes are needed?

Management Systems

What systems changes will be required to govern AI?

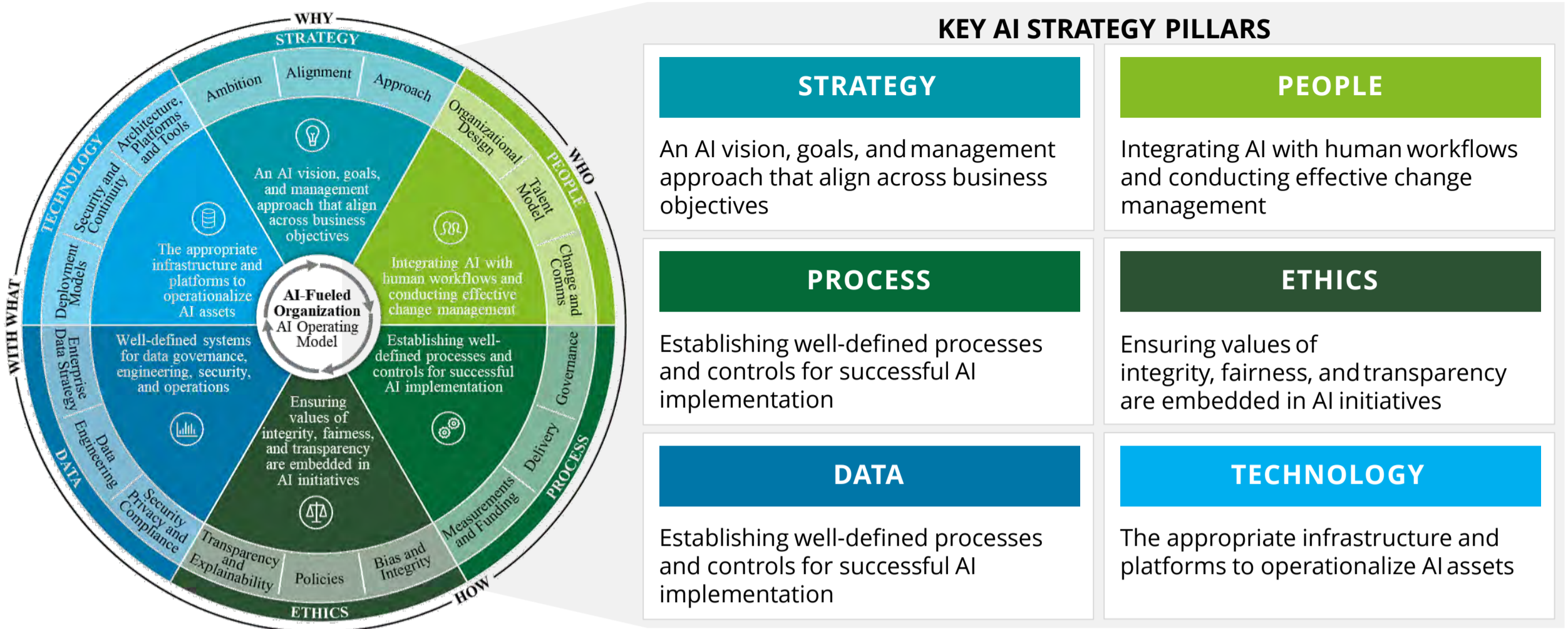
- Management: What should operating, governance, and change management approaches be?
- Technology: How should the tech stack, data, and scale-up be managed?

Vision:
What is our level of AI ambition?

[To learn more, visit the AI Strategy Nerve Center site on KX](#)

STATE OF PLAY (CONTINUED)

In defining their AI Strategy, organizations need to consider broad enterprise implications across the following six key pillars:



CONSIDERATION POINTS

- AI Strategies should balance both aspirational and incremental change
- Strategies need to be agile to keep up with the pace of technological advances
- Sunk costs in prior tech investments shouldn't become obstacles to embracing AI

DATA SIGNALS

According to a recent IDC survey:

50% of responding businesses believed AI was a priority¹

25% of respondents had a broad AI strategy in place¹

25% of respondents reported that up to half their AI projects failed to meet their targets¹

CASE STUDIES

Top 5 North American Bank: Deloitte helped company establish an enterprise AI strategy to accelerate their corporate vision of being the modern relationship bank of the future. Included prioritizing 42 of 100 AI use cases using AI opportunity framework, and developing proof of concepts or pilots for 15.

¹ IDC Artificial Intelligence Global Adoption Trends and Strategies, June 2019

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CONVERSATIONAL AI

Conversational AI is the only interface everyone already knows how to use. Because we do not have to teach users how to use this interface, they are instantly able to use any service, system, or application. That's why every ERP and cloud provider are building conversational capabilities into their core platforms. Deloitte designs and builds conversational systems that help clients achieve specific business goals – faster information acquisition, improved customer satisfaction, and more.

STATE OF PLAY

Deloitte is helping enable **better human experiences** through conversational AI with:



Virtual Agents

Digital agents that deliver a better customer experience on multiple channels at once



Human Assistance

AI driven conversational bots that help humans make data driven decisions to negotiate, advise, recommend



Conversational Bots

Access complex AI, analytics, and data derived via a conversational interface



IOT Process Automation

Using speech to trigger a process, interact with a device, or lookup data from a system

What can Conversational AI do?

- Customer Support: 24/7 support & customer engagement, mass personalization, data collection for analytics
- Servicing Centers: Handling customer interactions 24/7
- Collections – 24/7 virtual agents that negotiate and accept payment for past due bills
- Supercharge Humans – Virtual agents that listen to human conversations and suggest actions
- Compliance Monitoring – Active listening to real-time conversations to monitor for compliance and target training

How our clients are using Conversational AI to deliver better organizational outcomes:

- FSI – Digital banking, customer service, onboarding, transfers, mortgage applications
- TMT – Digital Collections Agent, Product and Tech support, Field Technician support
- Industrials– Factory of the Future / Factory Floor Assistant, Learning & Development
- HR, IT, Finance – Shared Services
- Healthcare – Triage assistant, Alzheimer's assistance

POTENTIAL BENEFITS

- Conversational AI is the only interface everyone already knows how to use. Everyone speaks a language - providing a more natural user experience for humans to engage with technology and data without a learning curve
- Applies AI and analytics to personalize every interaction, and specifically target organizational outcomes like collections, customer satisfaction, and NPS
- Available 24/7/365 on every channel (phone, web, mobile, social) freeing up humans to do more high value and less repetitive work

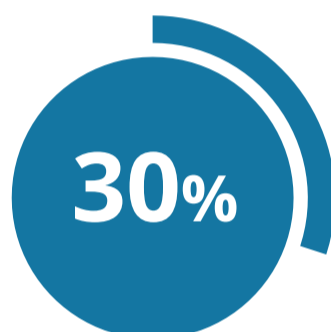
CONSIDERATION POINTS

- Building a bot is easy. Designing a bot that will achieve business outcomes is where Deloitte adds value. We aim to Elevate the Human Experience, not just automate processes
- Building a Conversational AI solution focuses on (1) training Natural Language Understanding, (2) training business processes, decision points, and exception paths, and (3) integration with APIs and enterprise systems
- Conversational AI can improve over time via supervised learning, but does not self-learn
- In contrast to RPA, Conversational AI is multi threaded (not single threaded); is deployed on enterprise infrastructure and platforms (not desktops), and requires deeper analysis of organization and technology requirements

DATA SIGNALS



According to We Are Social's Digital 2019 report, 70% of white-collar workers will interact with conversational platforms on a daily basis by 2022¹



According to Gartner, the global conversational AI market is expected to grow at a 30% CAGR from 2019-2024²



According to The Startup, 70% of millennials are reporting a positive experience with chatbots as younger generations seem to gravitate toward this technology³

CASE STUDIES

A Large Federal Agency Conversational AI: This agency supports nearly 100 grant programs for over 3,000 grantees and is utilizing a chatbot to assist parties applying for grants in tasks like finding resources in electronic handbooks

Large Pharmaceutical: Deloitte built a Chatbot Factory to enable at-scale deployment of global chatbots and reduce implementation costs by 50%. To date, Deloitte has deployed 25 bots around the world, across lines of business, and in a variety of languages. These bots support everything from assessment of drug implications to quality assurance of marketing practices. Deloitte's factory model included a custom development and deployment framework to bring chatbots to production.

1. We Are Social, "Digital 2019: Global Internet Use Accelerates"
2. Gartner, "Chatbots will Appeal to Modern Workers"
3. The Startup, "Chatbots and Millennials - A Match Made in Heaven?"

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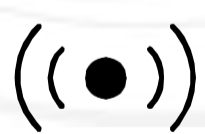
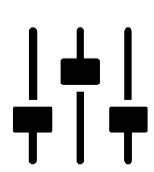


DATA IN MOTION

With 64 Billion Internet of Things (IoT) devices projected by 2026 ¹, there is a growing need for platforms and hardware to centralize and analyze this information. Data in Motion (DIM) harnesses the power of streaming IoT data by combining sensor data from disparate data sources with AI to implement mega-scale analytics. DIM leverages a variety of solution architectures, combining technologies including cloud, on-premise edge computing, and “smart devices”, to address time-sensitive, mission critical issues.

STATE OF PLAY

Data in Motion solutions blend both cloud and edge computing:

-  Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.
-  Edge Computing is a distributed computing paradigm that brings computation and data storage closer to, or even on, the device or location where it is needed, to improve response times and save bandwidth.

POTENTIAL BENEFITS

- DIM Edge devices can run AI locally, without the need for constant network communication
- DIM can ingest many types of data and will provide an algorithm library that can easily be retrained for other solutions
- DIM can easily support a variety of cloud services including GCP, AWS, and Azure

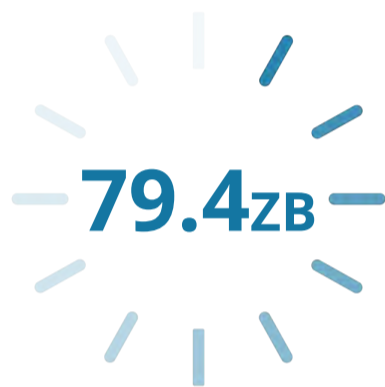
CONSIDERATION POINTS

- Technology is on the bleeding edge and could require additional planning to ensure optimal, human-centered use cases are implemented
- Integration with legacy tech stacks could require advanced computing and network capabilities for full functionality
- AI technologies such as machine learning, computer vision, speech recognition, etc. can derive insights from the sea of sensor data generated

DATA SIGNALS



Global IoT market projected to reach \$1.1T by 2026 according to Fortune Business Insights²



IDC estimates that 79.4ZB of data is expected to be generated by IoT devices in 2025³



According to one Deloitte survey, 55% of all IoT data could soon be processed near the source, either on device or through edge computing⁴

CASE STUDIES

San Diego Association of Governments (SANDAG):

Planners and data modelers are developing a nimble digital twin based on a Deloitte tool, FutureScape™, a modeling and simulation platform that creates digital replicas of large systems. Deloitte's implementation resulted in a 99.7% alignment to the SANDAG model and runs in <6 hours – at least 10x faster. SANDAG is using this tool to quantify and communicate the impact of projects to the public, and to rapidly assess and prioritize a wide range of projects from new mass transit, micromobility, and pricing strategies.⁵

A Major Sports Stadium: A major US park complex is redefining what a stadium project looks like, through 2500+ beacons, 2500+ Wi-Fi access points, 3000+ digital signs, and 100+ digital kiosks, enabling smart features for parking, wait-time checks, wayfinding, food delivery, event promotions, and gamification

1. Business Insider Intelligence, The Internet of Things 2020, December 2019

2. Fortune Business Insights, IoT Market Size, July 2019

3. IDC, Growth of Connected IoT Devices, June 2019

4. Deloitte Insights, Scaling to Meet the Enterprise Needs, June 2019

5. Deloitte Insights, Digital Twins Bridging the Physical and Digital, January 2020

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CLOUD ML

As agencies embrace public clouds, there are tremendous opportunities to leverage this infrastructure to build and scale data-driven AI solutions across the organization. Cloud service providers have evolved to include comprehensive AI stacks that deliver AI-as-a-service through pre-trained models and capabilities such as machine learning, conversational AI and engagement, text processing, and more. Leveraging the Cloud enables organizations to accelerate on their journey to becoming an AI-fueled organization, affecting business outcomes such as automating business processes, streamlining functions and operations, and enhancing analytics and reporting.

STATE OF PLAY

In recent years, a series of developments have led to AI on the Cloud, including:



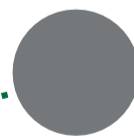
Developer playground

Cloud computing was attributed to **platforms for developers**



Cloud adoption

Customers could provision virtual machines and storage via **Infrastructure-as-a-Service**



Data move

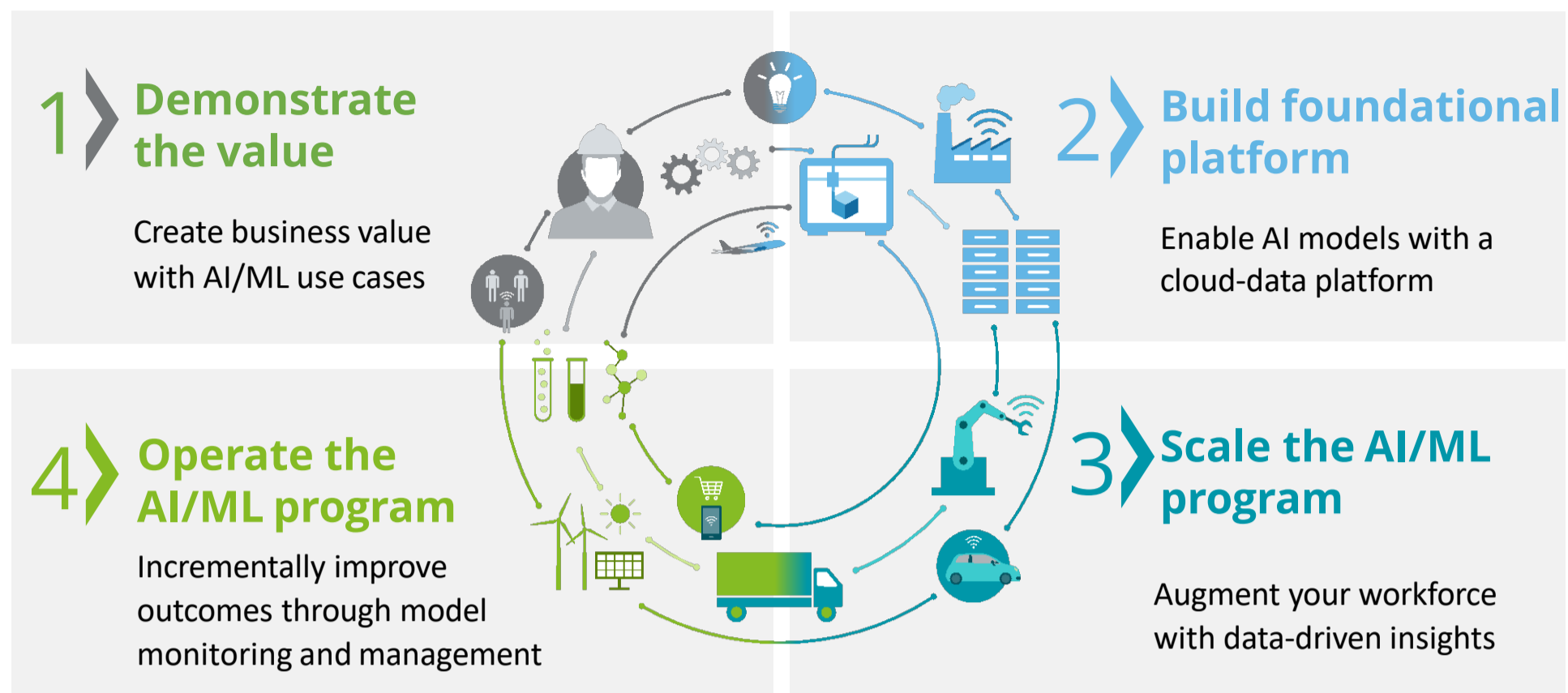
Across the major cloud providers, it was about compute, storage and databases on **public cloud**



Artificial intelligence
Cloud providers maturing and set to offer a comprehensive stack that delivers **AI-as-a-Service**

TODAY

Deloitte's Cloud ML offering can assist no matter where the client is on the AI/ML journey. Deloitte takes a comprehensive approach to assisting enterprises in the Cloud ML journey, using a time-tested framework of 42 unique capabilities. This assessment forms the baseline of a customized roadmap, which is scaled based on the client's unique business priorities.



POTENTIAL BENEFITS

- Provides an elastic cloud infrastructure that can scale up and down depending on the workload
- Elasticity, speed of provisioning, and disposability is ideal for AI experimentation
- Cloud can ingest, process and store high-velocity real-time streaming data as well as high volume batch data needed for AI
- Availability of pre-trained AI models are accelerators that shorten time-to market

CASE STUDIES

Large US Investment Advisor: Deloitte identified and prioritized areas suitable for AI/ML led transformation, conducted an executive workshop, and demonstrated the Art of the Possible. Deloitte developed two use case prototypes on a cloud ML platform – the first around data hub automation for efficiency gains and the second on analyzing meeting documentation to identify insights from sales conversations. This work was well received and has led the client to collaborate with Deloitte in starting data analytics transformation program to implement pilot use cases in the next phase of work. The strategic transformation of the data and analytics organization is targeting to save \$4-5M in annualized savings and additional growth from insights.

Candidate360 Asset: Deloitte GPS developed and implemented an analytics and machine learning solution. The asset uses Google Cloud Platform, a variety of data sources, and custom models to generate predictive, actionable insights to inform decision-making across the full recruiting and admissions lifecycle, allowing institutions to better meet their enrollment needs and plan for the future.

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CYBER EVERYWHERE

As the world becomes more connected, Cyber is moving beyond an organization's networks and permeating everyday life. As enterprises modernize their infrastructure, migrate to the cloud, and deploy innovative technology across the organization, they will need to tackle a set of expanded cyber risks. A shortage of talent and multi-dimensional threats makes it increasingly difficult to combat through just human capabilities. Artificial Intelligence provides an ability to improve performance & reliability, create more efficient processes, and develop net new capabilities to combat threats.

STATE OF PLAY

Organizations are considering the use of AI within cyber to address:

Increasing Threat Complexity and Frequency	<ul style="list-style-type: none">As cyber threats become increasingly more complex and frequent, AI will enable discovery of new threat vectors and bad actors that were never known about beforeAccording to Cybersecurity Ventures, the annual cost of cybercrime is expected to rise from \$3 trillion today to \$6 trillion by 2021¹The complexity and velocity of these threats are such that humans simply cannot keep up – machines can help process and identify the signals from the noise
Talent Shortages	<ul style="list-style-type: none">Cyber talent can be deployed to more challenging problems, leaving machines to deal with the volume and complexity that humans cannot handleThere is 0% unemployment in cybersecurity, which translates to high turnover, salary inflation, skill mismatches and numerous vacant positions; according to (ISC)², the cyber industry needs a 62% talent-increase to meet business demands²
Enormous Volume of Cyber Data	<ul style="list-style-type: none">Cyber capabilities create an enormous volume of data –both structured and unstructured– through which AI can parse and make decisions at low error ratesA medium-size network will transmit more than 5 gigabits of data every second and 50 terabytes of data in a 24-hour period³ – AI can draw insights from the sea of data, detecting threats in near-real-time, identifying the most likely threats against a network, revealing patterns of user and network behavior, and improving management of all devices connected to the network

POTENTIAL BENEFITS


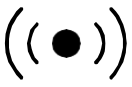


- Augments humans by analyzing and correlating across multiple sources of data in near real-time and is always learning and providing consistent coverage
- Handles increased volume and velocity, enabling organizations to detect compromises faster and drive to quicker, more contextualized decision making
- Improves threat hunting abilities of cyber analysts and existing systems to find the unknown
- Operates security controls consistently and effectively, eliminating human error and improving compliance to regulations and policies
- Enables a more proactive approach to cyber by reducing the burden of reactive operations

CONSIDERATION POINTS

- Cyber professionals will be enabled, not replaced, by AI technologies to be more efficient and effective at their job – machines can process big data 24/7
- AI can intelligently automate tasks and derive hidden insights, shifting hiring needs to more sophisticated cyber skillsets and changing overall operations, workflow hierarchy, and hiring processes
- Cyber could leverage an array of AI technologies (e.g., machine learning, deep learning, computer vision etc.) to drive greater insights and better decision making
- AI will provide greater visibility to data vulnerabilities and malicious cyber methods allowing for more efficient decision making, such as resource allocation

AI CAPABILITIES IN CYBER

Here is a sample of how AI can be applied to Cyber:

-  **Decision Making:** Analyzing massive volumes of data to help leaders and cyber analysts make decisions based on the organization's risk appetite and existing risk management frameworks
-  **Threat Sensing:** Identifying or predicting risks that are difficult for humans to identify, such as new types of risk or potential sources of future risk using untraditional data sources (e.g., public forums and social media)
-  **Anomaly Detection:** Tracking activities to establish a baseline of normal behavior in order to identify anomalies that create potential risks (e.g., device management, network activity, transactional activity, insider-threats, etc.)
-  **Automated Processes:** Intelligently automating labor-intensive, error-prone processes, such as third-party due diligence, cyber checklists and more to allow humans to focus on higher value activities

CASE STUDIES

Leading investment firm: Cyber analysts spent 30-45 minutes working through a checklist of activities for investigating a single cyber alert. To reduce investigation time, analysts began skipping steps resulting in less rigorous examinations. By intelligently automating the procedure, processing time was reduced to 40 seconds per inquiry, overall productivity of each analyst tripled, and overall morale improved.⁴

Google: A complete cyber overhaul was conducted to scale its system as the business grew and the attacks became more sophisticated. Google implemented a zero-trust concept by applying context-aware access policies to clues such as user identity, device attributes and IP addresses, all collected in real time. A global server then acts as a sophisticated rules engine to determine access rights based on the user and content. Today, Google's user- and device-centric security workflow allows authorized users to securely work from an untrusted network without the use of a VPN.⁵

1. Cybersecurity Ventures, "Global Cybercrime Damages Predicted to Reach \$6T Annually by 2021"
2. (ISC)², "(ISC)² Finds Cybersecurity Workforce Needs to Grow 145% to Close Skills Gap"
3. ComputerWorld, "Big data send cybersecurity back to the future"

4. Deloitte Insights, "AI-augmented Cybersecurity"
5. Deloitte Insights, "Tech Trends 2020"

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RISK AND COMPLIANCE

AI is about **human collaboration made greater *with* the machines we invent**. Achieving the potential of human machine collaboration requires building trust with all stakeholders. Lack of trust erodes confidence and is one of the largest barriers to organization adoption. Deloitte developed Trustworthy AI™ to help organizations develop the appropriate safeguards and measures for AI implementations.

This chapter introduces concepts to manage AI risks – specifically trust, ethics, and governance around the use of AI algorithms and applications.



AI GOVERNANCE AND CONTROLS

As AI becomes increasingly pervasive, organizations, and regulators are wrestling with governance, legal, and regulatory questions. Organizations are experimenting with different AI use cases and embedding it in more and more functions. As AI becomes entrenched in the enterprise, identifying relevant risks and designing appropriate controls becomes increasingly important. Developing a process for risk identification and control responses early on contributes to effective use of AI down the line. At the same time, governments are swinging into action and beginning to think about this technology in more comprehensive ways. While national regulations do not yet exist in the US, federal agencies have begun issuing sector-specific guidance, and both city and state governments are beginning to take action.

STATE OF PLAY



AI Governance includes developing AI strategy, determining the appropriate oversight, defining core values, creating operating structures and reporting lines, and developing the right talent to ensure effective usage of AI in order to achieve the organization's goals and compliance with applicable rules and regulations



AI Risk Management focuses on identification, assessment, and integration of AI risks across the AI lifecycle and appropriate risk management responses



AI Control Structures is designing and implementing robust controls for specific AI use cases and techniques, across the AI application layers (i.e., context, infrastructure, presentation, intelligence, data)

POTENTIAL BENEFITS

- Tackling AI governance, risks, and controls early promotes flexibility and effective usage down the road
- Appropriate governance and controls builds trust with employees, customers, regulators, and other stakeholders
- A risk management process enables identification of new types of risks that may require changes to controls and protocols
- AI risk management should complement and integrate with an organization's existing risk management structure

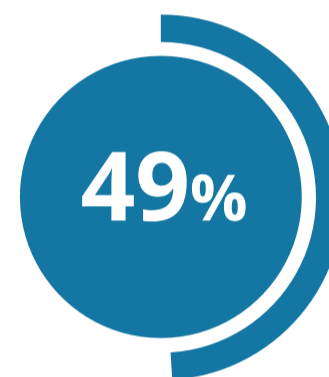
CONSIDERATION POINTS

- Finding the right balance between governance and implementation is critical to help ensure AI provides value to the enterprise without hindering an organization's ability to execute
- Both management and data scientists will need to collaborate and team together as it relates to the effective usage of AI
- The types of AI risk and speed at which they manifest will differ from traditional risks
- Regulations will change how organizations manage their AI implementations

DATA SIGNALS



- Federal agencies have issued sector-specific guidance (e.g. robo-advisors, self-driving cars) ¹
- Certain cities and states have begun to regulate elements of AI, including Illinois which limited the use of "interview bots" and San Francisco which banned facial recognition technology use by police and government agencies ²



49% of executives expect to increase use of AI for risk management and compliance efforts in next 12 months according to a Deloitte survey³

CASE STUDIES

CIBC: CIBC launched a program called "Clientnomics™" to use AI to deliver client insights and experiences. To ensure safe usage, they developed a governance process that included a survey that all new project stakeholders must answer, a central repository to store documents for auditors, and advanced data governance techniques to ensure appropriate usage and data privacy.⁴

Abbott: Abbott is exploring multiple data-enabled AI opportunities. To safeguard patient data, Abbott has enacted a number of enterprise governance initiatives including policies, procedures, and employee training and certification programs. Leaders have also made significant cybersecurity investments. They also rely on an ecosystem to maintain patient trust, including independent third parties and research groups to test products and services, and focus groups with patients themselves. ⁴

1. Forbes, "Wrestling with AI Governance around the World."
2. National Law Review, "Keeping an Eye on Artificial Intelligence Regulation and Legislation"
3. Deloitte, "AI Use Expected to Increase in Risk and Compliance Efforts."
4. Deloitte Insights, "Tech Trends 2020"

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TRUSTWORTHY ALGORITHMS

Today, advanced machine learning algorithms and artificial intelligence are being used by government agencies and organizations in applications ranging from helping guide parole decisions to improving hiring decisions. While the impact of algorithms is growing, our understanding of their appropriate design and use lags behind. In the same way that the finances of governmental organizations and large corporations are audited, algorithms should be subject to scrutiny and debate to ensure their fairness and robustness.

STATE OF PLAY

As algorithmic decision making becomes increasingly popular, organizations are more vulnerable to risks from model complexity and interpretability, data integrity, algorithmic biases, and evolving regulatory oversight. AI and its algorithms need to be managed at all levels – from executive-level reviews down to scientifically informed evaluations of algorithms by trusted third parties. From the onset, organizations should work to instill robust governance practices to control the risks inherent in such complex and consequential tools, and ensure all algorithms work as intended with no unintended outcomes.

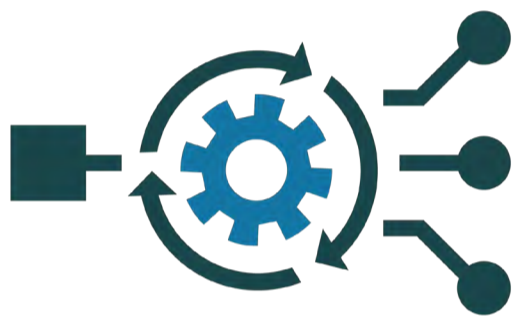
POTENTIAL BENEFITS

- Evaluations build trust that an algorithm is operating as intended
- Can demonstrate that an AI solution is compliant with policies/regulations
- Builds rapport with the general population and supports greater adoption of AI and algorithms to make critical decisions

CONSIDERATION POINTS

- It is extremely difficult to remove all forms of potential bias from historical data used to train algorithms
- Organizations need to prioritize metrics for algorithm trustworthiness – not all may be achieved at once
- Even evaluated algorithms will continue to need human input and oversight
- Algorithms and their applications in use cases should be continuously monitored for unexpected outcomes

DATA SIGNALS



ML/AI algorithms reflect the patterns that humans show them – algorithmic bias is a product of the underlying data used to train the algorithm and often comes from humans. Ultimately, it is up to humans and the governance and controls we devise to ensure trustworthy algorithms



\$27M was spent launching the Ethics and Governance of AI Initiative by Harvard Law School's Berkman Klein Center, and MIT Media Lab aimed at ensuring AI and ML is researched, developed, and deployed reflecting fairness, human autonomy, and justice¹

CASE STUDIES

Evaluating a client's decision-making process to inform a litigation strategy:

A higher education institution faced a potential lawsuit alleging that its decision-making process for financial aid displayed bias against legally protected classes. Deloitte quantified the impact of class membership on aid to identify areas of strength and vulnerability in anticipation of litigation.

Biased scoring of recidivism risk in criminal sentencing:

A review of software used to predict risk of re-offending found that black defendants were twice as likely to be incorrectly flagged as high-risk as white defendants – an error that led to black defendants receiving harsher sentences for similar crimes. This prompted important academic research about tradeoffs in different concepts of algorithmic fairness.

1. Deloitte, "AI Ethics: The Next Big Thing In Government"

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EXPLAINABLE AI (XAI)

Since the mid-90s, best practices for interfaces have included computers explaining themselves in the form of procedural status updates that communicate what a computer is currently doing. AI tools are commonly created by training machine learning algorithms on labeled historical data. Such algorithms are often trained to optimize predictive accuracy, without regard to interpretability. These algorithms provide end-users little or no insight as to why a specific output was generated. The user therefore has little insight into when the algorithm can be trusted or when it should be over-ridden. Explainable AI (XAI) is brokering trust with people by understanding how and why machines make the decisions they do.

STATE OF PLAY

Explainability is one of the main barriers to adopting AI in regards to implementation. Many sectors are strictly regulated and decisions must be traceable. Developers continue to struggle with the trade-off between the interpretability / understanding of the model and the completeness of the description. The question AI practitioners must address is how to explain AI models to stakeholders in plain English while maintaining the technical accuracy. In addition, the format and language used to explain AI, which is not standardized today, will vary by stakeholder (e.g., consumers, developers, investors, Board members, and others). In the future, organizations may explain their AI systems in the same way they explain their operations in annual reports today.

POTENTIAL BENEFITS

- Establishes trust with stakeholders who utilize AI for decision making
- Better understanding of when to accept, verify, or override an AI output
- Builds human knowledge by enabling learning through machines
- Preserves the decision autonomy of end users if desired

CONSIDERATION POINTS

- There is currently no clear dominant taxonomy or standardized language for explaining AI
- Explainability should deliver insights into AI decision making and incorporate organization intuitive terminology so senior management, board members, and all other stakeholders can understand AI-related outcomes
- The approach(es) should provide an ability to extract and inform the AI application with human insights and rules
- Explainability should be embedded as an integral part of the build and deployment for AI use cases that impact or interface with humans

DATA SIGNALS



Only 9% of respondents in a recent survey by the MIT Sloan Review reported trusting AI with their own financials¹



The use of explanations has shifted from an explanation that informs a single user to one that fosters institutional trust and macroscopic societal accountability



Operationally defining software learnability, design principles, interactive technologies, and interaction styles will determine the future of mass market explainable AI

EXAMPLES


Facebook: To make the platform easier to use, Facebook has added AI explainability measures with a “why am I seeing this post” feature on their newsfeed. This builds trust with users and allows users to more transparently see why they were targeted and why the algorithm is showing them specific posts.

AlphaGo’s Move 37: In game 2 of human vs. machine in the classic game of Go, AlphaGo made a move no human was able to explain. Some experts even believed it to be a mistake, but in fact the move changed the course of the game and AlphaGo went on to win Game 2. To learn from machines, it will be critical to explain AI’s choices in ways that humans can comprehend.

1. MIT Sloan Review, “Can We Solve AI’s Trust Problem”

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HUMAN-CENTERED AI



Human-centered AI (HC-AI) is the application of the social, psychological and design sciences to ensure that definition and scaling of AI fosters humane experiences that improve quality of life for people, and the quality with which they perform complex tasks. By focusing on the needs of humans we craft more performant and altogether more usable AI systems.

STATE OF PLAY

HC-AI is a field that is just beginning to take form in both government and commercial contexts. Like most of design, the field is comprised of an interdisciplinary set of practices, drawing from anthropology, sociology, behavioral economics, various branches of psychology, ethics, design, computer and data science. Tactically, the practice is bespoke, with approaches and methodology framed on a case-by-case basis. Practitioners are developing new means to explain and design for AI in support of the unmet and in many cases, previously unarticulated human needs they find. Iteration and experimentation is vital as both producers and end-users lack both the historical references and personal experience to evaluate the results on their own. We are just beginning to learn what it is to live with AI.

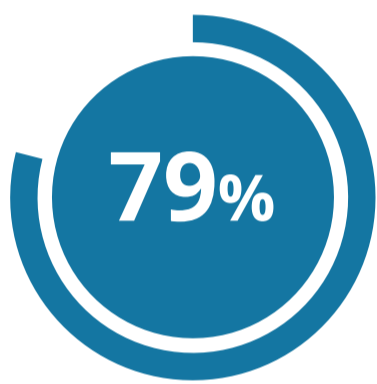
POTENTIAL BENEFITS

- Improving fit-to-purpose of AI with human needs
- Framing the context in which AI strives and thrives with people to improve functional performance
- Expands comprehension of human sociocultural and psychological behaviors to inform domains critical for successful stewardship of AI, such as ethical AI

CONSIDERATION POINTS

- Tight coupling of approach, methodology and outcomes to specific contexts of use often requires bespoke engagements
- Limited examples of human-centricity for AI experiences provide little guidance for best practices
- No current measurement frameworks to determine if human-centricity for AI has generated the intended benefit

DATA SIGNALS



According to Deloitte's State of AI in the Enterprise, 79% of U.S. business leaders agree that AI technologies empower people to make better decisions¹



Since January 2019, researchers, industry analysts and corporate thought leaders have published over 235 unique articles on HC-AI²



By 2025, technology companies will ship over 2.8 billion units of AI edge devices annually to embed AI in the everyday lives of people according to a Tractica report³

CASE STUDIES

Experience Design to Define the Future of Digital Criminal Investigation: Journey mapping the experience of how special agents work with data to create evidence guided the client in making a decision to invest \$2.5M into prototyping a first-of-its-kind, cloud experience for anytime, anywhere analysis of subpoenaed social data.

Behavioral economics to nudge Claim Accuracy: Implementing nudge tactics into the user interface and content of an unemployment benefits tracker for the State of New Mexico resulted in a 50% reduction in improper payment and 75% reduction in unrecovered overpayment to generate \$7M in annual savings.

1. Deloitte, "State of AI in the Enterprise, 2nd Edition"

2. Deloitte Analysis

3. Tractica, "Artificial Intelligence Edge Device Shipments to reach 2.6 Billion Units Annually by 2025"

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AI ENABLERS

The symbiosis of cloud and AI is one of the strongest drivers of AI adoption. While cloud-enabled AI platforms and tools have simplified an organization's ability to get started, determining how and where to start, choosing which provider, and establishing the infrastructure remain a challenge. **The future of AI is getting the technology into the hands of everyone.** Cloud is one step of this journey, but there are several methods to enabling AI across the enterprise. **Deloitte is developing domain and sector specific platforms** to package our assets and IP, helping organizations and stakeholders get started with AI.

This chapter introduces some enablers of AI that can help an organization accelerate and become AI-fueled.

CLOUD SERVICE PROVIDERS

There are a host of organizations vying for control of the cloud services market, and for good reason – the total US market is expected to reach \$250B through 2020 according to Gartner¹. Many cloud service providers (CSP's) provide useful services, including companies such as Amazon Web Services (AWS), Google Cloud (GCP), and Microsoft Azure.

STATE OF PLAY

Capability	AWS	GCP	Azure
Sight	Amazon Rekognition (image and video)	Cloud Vision API, Cloud Video Intelligence API, Document AI	Computer Vision, Face, Ink Recognizer, Video Indexer, Custom Vision, Form Recognizer, Ink Recognizer
Language	Amazon Comprehend (NLP), Amazon Comprehend Medical (NLP), Amazon Translate, Amazon Textract	Cloud Translation API, Cloud Natural Language API	Text Analytics, QnA Maker, Immersive Reader, Translator Text, Language Understanding
Speech	Amazon Lex, Amazon Polly (Text to speech), Amazon Transcribe (speech to text)	Diagflow, Cloud Text to Speech API, Cloud Speech to Text API	Speech to Text, Text to Speech, Translation, Speaker Identification, Bot Service
Decision	Amazon Personalize	Recommendations AI	Content Moderator, Anomaly Detector, Personalizer
ML Frameworks	TensorFlow, PyTorch, Apache MXNet, Gluon, Chainer, Torch, Microsoft Cognitive Toolkit	TensorFlow, scikit-learn, XGBoost, Keras	PyTorch, TensorFlow, scikit-learn
ML Management	Amazon SageMaker Ground Truth and Neo	Google ML Engine	Azure Machine Learning Service

POTENTIAL BENEFITS

- Reduced IT costs associated with new hardware, new software, or maintenance headcount
- Easy to scale and optimize for cost and resource constraints
- Enhanced collaboration between teams, projects, and geographical locations²

CONSIDERATION POINTS

- Network based infrastructure and software opens risks around data security and privacy
- Difficult to avoid vendor lock-in when choosing a holistic cloud service provider
- Potential for downtime if service outages occur³

DATA SIGNALS



- Offers the largest range of cloud services
- Commonly chosen for strategic, organization wide transformation



Google
Cloud Platform

- Enables portability through open source integrations and technologies
- Offers a strong ecosystem of services for big data processing



- Suitable for clients who are committed to Microsoft software and technologies
- Strong focus on hybrid cloud deployments

CASE STUDIES

Large insurance company: The client sought strategic capabilities to be able to investigate, report and analyze data in order to enhance customer experience, improve reliability, increase revenue, and enhance operational efficiencies. To meet client needs, Deloitte built a centralized cloud-based data platform enabling the client to automate, control, and analyze data for self-service reporting and analytics. The solution integrated over 10,000 data attributes across 40 years of historic legacy systems and generated \$70M in quantifiable benefits.

Services for Homeland Security: The Federal Science and Technology Directorate provides unbiased analysis and recommendations on viable technologies, but needed a real-time sensing and scanning capability to track innovation emerging in a wide variety of science and technical fields. Deloitte built a custom application to identify changes and opportunities in the technology marketplace, helping users stay abreast of emerging technologies and innovative companies that could be leveraged to enhance their mission space.

1. Gartner
2. Queensland Government, "Benefits of Cloud Computing"
3. Cloud Academy, "Disadvantages of Cloud Computing"

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DEMOCRATIZATION OF AI

Without data science, organizations are restricted to analyzing structured data and decisioning based on business rules. AI unlocks the value of data for insights, improved decision making, and action. In many ways, AI and data science are being done in pockets with limited value creation. Over the last decade, there has been a proliferation of AI tools to accelerate data science initiatives. Similarly, there has been a boost in AI related trainings and educational programs. Deloitte has collaborated with leading Cloud AI and fast growing Enterprise AI platforms to help organizations utilize a mix of new tools, staffing models, and training strategies to expand the usage of AI. The Democratization of AI involves bringing the power of AI and insights into the hands of more stakeholders, both technical and business, enhancing workflows and user engagement.

STATE OF PLAY

Democratization Method	Method Summary
Enterprise AI / Auto ML Platforms	Providing data scientists a platform to finding optimal solutions to structured, semi-structured, and unstructured datasets and managing the full ML cycle (e.g. AWS SageMaker, Google AutoML, DataRobot, Dataiku). This could include pre-trained AI models packaged for specific use-cases and industries in order to enable immediate insights
Low-Code Platforms	Low-code and no-code platforms allow nontechnical staff to accelerate AI app development and delivery; instead of code, these platforms utilize graphical interfaces, drag and drop approaches, and more
Self-Service ML Analytics	Self-service tools enable data-based insights from Machine Learning to be leveraged without the need for analytics specialists or data scientists. These tools enable end users to build their own reports without the need for specialists
Accelerating Learning	Data science and AI trainings teach professionals the value of AI, how to apply basic data skills to projects, and industry adaptation trends

POTENTIAL BENEFITS

- Data scientists' expertise in modeling and software development can be captured, shared, and reused, increasing consistency and productivity
- Increased efficiency in adopting AI across the enterprise via technology, collaboration, ML-Ops, and continuous improvement
- Reduces the war for talent, enabling organizations to implement and scale AI in a collaborative way

CONSIDERATION POINTS

- Success in AI depends on more than tools and technology. Domain knowledge and at least basic understanding of the underlying scientific methodologies are fundamental to success
- Requires the right mix of skills and expertise, and a clear understanding of use cases, data, and technology solutions
- Embracing AI will require cultural changes, onboarding, and training; without it, user provided self-service tools may not derive relevant insights or misapply the results
- Inadequate data controls and governance may lead to information silos, incorrect use of techniques, invalid analyses, and lack of accountability

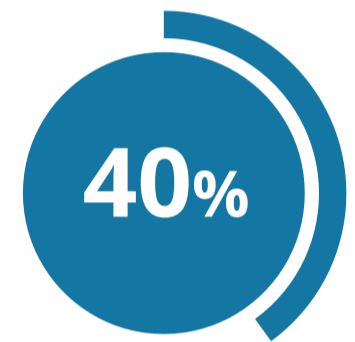
DATA SIGNALS



According to Deloitte, by 2024, there is expected to be a shortfall of 250K data scientists in the US alone¹



Forrester estimates low-code platforms are growing at ~50% with the market estimated at \$4B today²



In 2020, ~40% of data scientist tasks are expected to be automated according to Gartner³

CASE STUDIES

Enterprise AI at a Major Bank: A major bank leveraged DataRobot, an autoML platform, to build ML models to reduce the number of false negative results as part of their Anti-Money Laundering software alerts. DataRobot allowed financial investigators to focus efforts on alerts more likely to result in a SAR (suspicious activity reports) and to save hundreds of hours a month trying to manually separate out alerts unlikely to result in a SAR.

Enterprise AI at Pharmaceutical Company: One pharmaceutical company had difficulty moving models to production. Dataiku, an enterprise AI platform, enabled the company to scale their data operations by allowing users with vastly different capabilities to participate. Users were able to achieve cross-channel marketing and build sophisticated multi-channel marketing ROI calculations with limited involvement from data scientists.

1. Deloitte Insights, "Democratizing data science to bridge the talent gap"
2. Forrester, "What you need to know about low-code, even if you're not responsible for software delivery"
3. Gartner, "Gartner Says More than 40 Percent of Data Science Tasks Will be Automated by 2020"
4. Deloitte Insights, "Automated machine learning and the democratization of insights"

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AI PLATFORMS

Clients increasingly expect consulting firms to bring pre-built tools to accelerate delivery and overall implementation efficiency. In addition, new ideas and assets often have core capabilities that overlap. Without a common AI platform, capabilities are rebuilt for each asset causing duplication in effort and increased investment spend. An AI platform with core capabilities that are re-used enables reduced development and testing time – greatly accelerating the time to bring new capabilities to market. AI platforms also provide quality control as a common platform can ensure standards for asset delivery. Deloitte’s end-to-end industry and domain-specific platforms will help advance the firm’s asset business through the monetization of AI assets, insights, and capabilities.

STATE OF PLAY

An AI Platform will constantly evolve as technology and mission needs change. While the platform itself could be built in many ways, these are some core components in an end-to-end platform:



Infrastructure

Infrastructure:

Secure and scalable multi-cloud infrastructure to build and host AI applications

Data:

Centralized data storage to manage big data with varying volume and variety



Platform

Platform Capabilities:

Specific capabilities that an AI platform can provide based on the needs of the business. Some examples are: intelligent understanding, automation, natural language processing and engagement, advanced data management and processing, and data privacy and security



Assets

Assets:

Digital workforce (digital FTEs), pre-built applications, and custom applications

Insights and IP:

Curated datasets, algorithms, models, and patterns that serve as accelerators



Solutions

Go-to-Market:

Pre-configured assets and accelerators customized for specific missions and regulatory environments

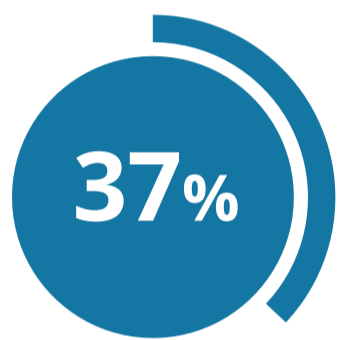
POTENTIAL BENEFITS

- Accelerates time to bring new capabilities and assets to market
- Reduces overall development and testing time
- Can automate manual tasks such as data extraction and wrangling
- Improves asset quality through common standards
- Enables democratization of AI by extending capabilities to non-developers

CONSIDERATION POINTS

- Capabilities in the platform should be business driven
- Keep the user in mind when considering an AI platform – capabilities required of the platform will differ for developers, data scientists, business users, etc.
- Platform architecture should be flexible to accommodate new use cases and technology in an ever-evolving landscape

DATA SIGNALS



IDC estimates spending on Cognitive and AI systems will reach \$77.6B by year 2022, growing at a CAGR of 37%¹

Several major technology players, from consulting firms to big-tech and startups, are building AI platforms. Deloitte's platform differentiator is providing end-to-end, sector and domain specific platforms pre-configured to address client issues in order to minimize cost and accelerate time to value.



IBM Watson



Amazon AI Services



Google AI Platform



Salesforce Einstein



Microsoft Azure AI Platform

CASE STUDIES

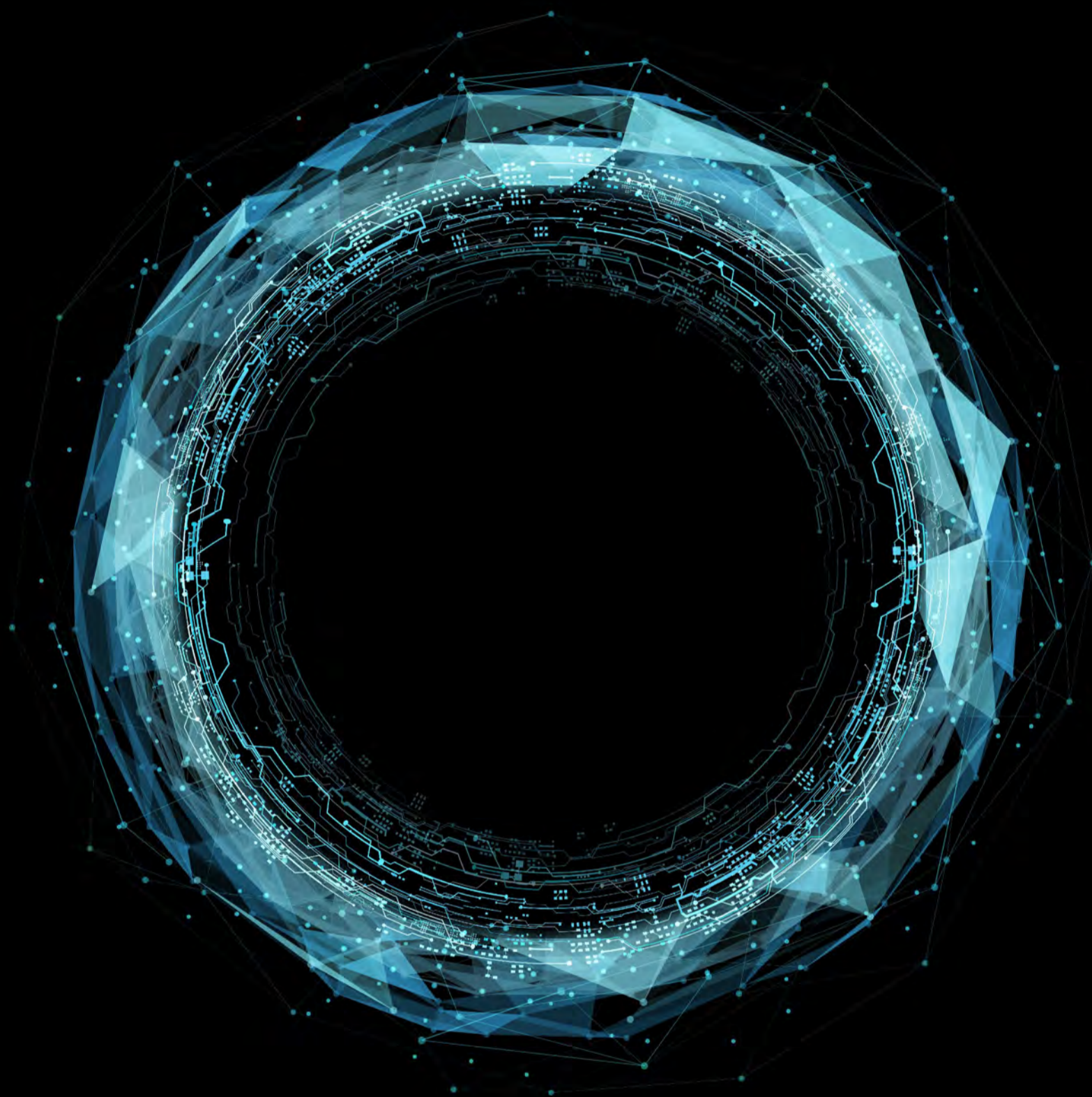
Intela: Deloitte Tax is building a global enterprise tax platform to enhance how Deloitte collects, transforms, and hosts client data; provides diagnostic, analytic, and visual insights; and evolves the talent model, policies, and business model to deliver the client experience envisioned. The platform will evolve to embed certain AI capabilities, in order to automate many steps in the tax lifecycle today and deploy AI to business users.

ConvergeHEALTH: ConvergeHEALTH enables life sciences and health care organizations to deliver more meaningful patient experiences and data driven insights. One example of the platform's AI capabilities is ConvergeHEALTH Miner™, which employs ML and deep learning to enable researchers to build and train disease-specific models. ConvergeHEALTH Miner helped one biopharmaceutical company triple performance speed and apply real-world evidence to improve decision support.

1. IDC, "Worldwide Spending on Cognitive and AI Systems Forecast to Reach \$77.6B in 2022"

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THANK YOU

AI TREND CARDS