



Deelnemerslijst  
AI Governance, Responsible AI en  
Data Governance: Connecting the Dots  
25 maart 2026

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Vlaanderen connect	Raf	Carpentero	data engineer





# Welcome Adept Events

## WHO WE ARE

 **AdeptEvents**

 **DW&BI SUMMIT**

 **BI-Platform.**

 **RELEASE.**

**Werner Schoots**  
Founder Adept Events



# BI-Platform.

- Launched in 2008 as online spin-off from Database Magazine (DB/M)
- Topics: Business Intelligence, Data Warehousing, Analytics, Data Management

*News*

*Job board*

*Selected Whitepapers*

*Events*

*Articles*

*Blogs*

*Video interviews*

*Cases*

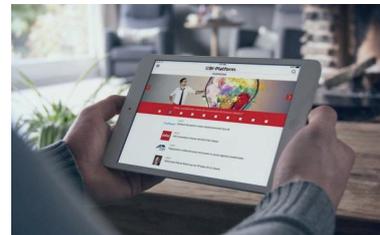
- We welcome your input: [redactie@biplatform.nl](mailto:redactie@biplatform.nl)

  [www.biplatform.nl](http://www.biplatform.nl) & weekly newsletter

  @BIplatform on X.com & YouTube

  Download the BI-Platform App

 Join our LinkedIn Discussion Group



# RELEASE.

- Launched in 1996 as Software Development spin-off from Database Magazine
- Topics: Software Engineering – Analysis, Design, Development, Testing and Deployment

*News*

*Job board*

*Selected Whitepapers*

*Events*

*Articles*

*Blogs*

*Video interviews*

*Cases*

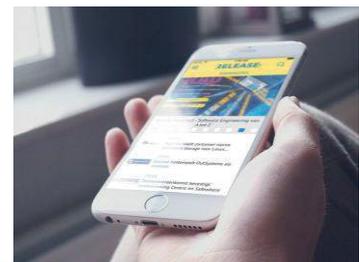
- We welcome your input: [redactie@release.nl](mailto:redactie@release.nl)

  [www.release.nl](http://www.release.nl) & weekly newsletter

  @Release\_nl on X.com & YouTube

  Download the Release App

 Join our LinkedIn Discussion Group



# SEMINARS

*All seminars and workshops are organised twice a year*

Alec Sharp	Business-oriented Data Modelling Masterclass Working with Business Processes Masterclass Concept Modelling for Business Analysts The Data-Process Connection (virtual half day session)
Rick van der Lans	Ontwerpen van een Nieuwe Data Architectuur
Mathias Vercauteren	Data Governance Sprint AI Governance, Responsible AI and Data Governance – Connecting the Dots
Chris Bradley / Winfried Etzel	Data Management Fundamentals
Lawrence Corr	Agile Data Warehouse Design & Dimensional Modeling
Christian Gijssels	Generatieve AI in Business Analyse
Juha Korpela	Data Mesh – Modeling Data Products and Domains
Thomas Gijssels	AI Agents in de Praktijk – Van Concept tot Implementatie
<i>Multiple speakers</i>	<i>Data Warehousing &amp; BI Summit – Yearly conference in March/April</i>

# IN-HOUSE

**All seminars and workshops can be organized in-company.**  
With local speakers and international speakers!



Please contact Werner Schoots

 +31 (0)172 742680

 [seminars@adeptevents.nl](mailto:seminars@adeptevents.nl)





# AI Governance, Responsible AI, and Data Governance Connecting the Dots

DW & BI Summit  
Utrecht – March 25, 2026

# Who is MATHIAS Vercauteren



- PhD in Data Governance
- MSc in Business Economics
- BSc in Sociology

(AMS, 2025 - 2029)  
(2012, Ghent University)  
(2009, Ghent University)



## Consulting & Advisory Services

- DAMA –DMBOK 3.0 (Project Manager)
- UZA (Hospital)
- MLOZ (Healthcare Insurance)
- Monument Group (Insurance)
- De Lijn (Logistics)
- MPET (Logistics)
- Securex (Professional Services)
- Federal Insurance (Insurance)
- Flemish Government (Governmental Institution)
- Belfius (Financial Services)
- Barry Callebaut (Manufacturing)
- Carrefour (Retail)
- Hilti (Manufacturing)

## Research

- President of Data & AI Governance Research Institute (2025, founding phase)
- PhD in Data Governance (AMS, 2024 - 2028)
- Book "Data Governance Sprints" (Technics Publication, est. Q2 2025)
- Ethical Technology Institute (2021 - 2024)

## Educational Services

### Training and Coaching Engagements - both in-house and classroom:

- Data Governance
- AI Governance / Responsible AI
- DAMA-DMBOK® / CDMP®
- Data Strategy
- Data Quality
- Master Data Management

### Speaking Engagements:

- DGIQ/EDW (San Diego, 2026)
- Data Modeling Zone (San Francisco, 2026)
- DGIQ/EDW (Anaheim, 2025)
- Data and AI Conference (London, 2025)
- Data Modeling Zone (Phoenix, 2025)
- DGIQ East (Washington DC, 2024)
- Data and AI Conference (London, 2024)
- DGIQ West (San Diego, 2024)
- Enterprise Data World (Orlando, 2025)
- DG & MDM Conference (London, 2023)
- DGIQ East (Washington DC, 2023)



# AGENDA: Welcome to “Connecting the Dots”

We'll cover the following topics

1  
Artificial Intelligence

2  
AI Risks

3  
AI Governance

4  
Responsible AI

5  
Data Governance

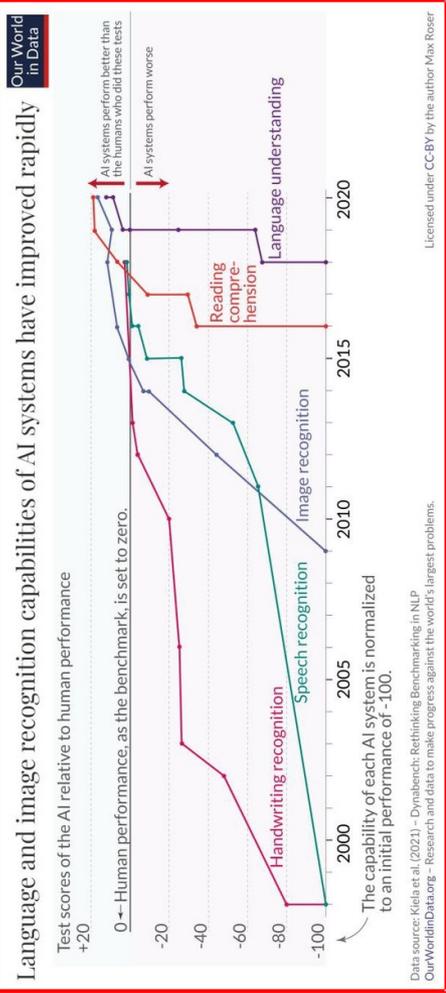
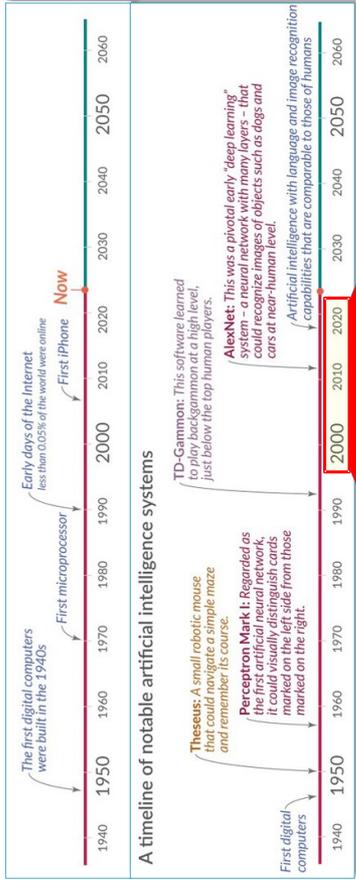
6  
Connecting the Dots

# Artificial Intelligence Orientation

[Back to Agenda](#)

# AI MATURATION has been rapid

The world of technology is young, but its evolution has been quick... and AI now performs better than humans.



<b>1940s</b>	<ul style="list-style-type: none"> <li>First digital computer</li> </ul>
<b>1950s</b>	<ul style="list-style-type: none"> <li>First artificial neural network (SMARC)</li> <li>First computer programs to play games / learn</li> <li>First AI program (<i>Logical Theorist</i>)</li> <li>First pattern recognition (<i>Perceptron</i>)</li> </ul>
<b>1960s</b>	<ul style="list-style-type: none"> <li>First industrial robot (<i>Unimate</i>)</li> <li>First heuristic program (<i>SAINT</i>)</li> <li>First NL understanding program (<i>STUDENT</i>)</li> <li>First interactive dialogue program (<i>ELIZA</i>)</li> <li>First expert system (<i>DENDRAL</i>)</li> </ul>
<b>1970s</b>	<ul style="list-style-type: none"> <li>First anthropomorphic robot (<i>WABOT-1</i>)</li> <li>First rule-based ordering system (<i>XCOM</i>)</li> </ul>
<b>1980s</b>	<ul style="list-style-type: none"> <li>First driverless car (Bundeswehr University)</li> <li>First chat-bot (Jabberwocky)</li> <li>Handwritten ZIP code recognition</li> </ul>
<b>1990s</b>	<ul style="list-style-type: none"> <li>Gen2 chat-bot (A.L.I.C.E.)</li> <li>First chess program beats human (<i>Deep Blue</i>)</li> <li>First pet robot (<i>Furby</i>)</li> </ul>
<b>2000s</b>	<ul style="list-style-type: none"> <li>First AI robot to walk as fast as humans (<i>ASIMO</i>)</li> <li>First robot to write without humans (<i>Stats Monkey</i>)</li> <li>Handwriting + speech recognition</li> </ul>
<b>2010s</b>	<ul style="list-style-type: none"> <li>Image recognition / reading + language comprehension</li> <li>First "deep learning" system</li> <li>NL computer beats Jeopardy champions (<i>Watson</i>)</li> </ul>
<b>2020s</b>	<ul style="list-style-type: none"> <li>Some AI already outperforms humans</li> </ul>

**AI Winters 1974-1980 1987-2000**

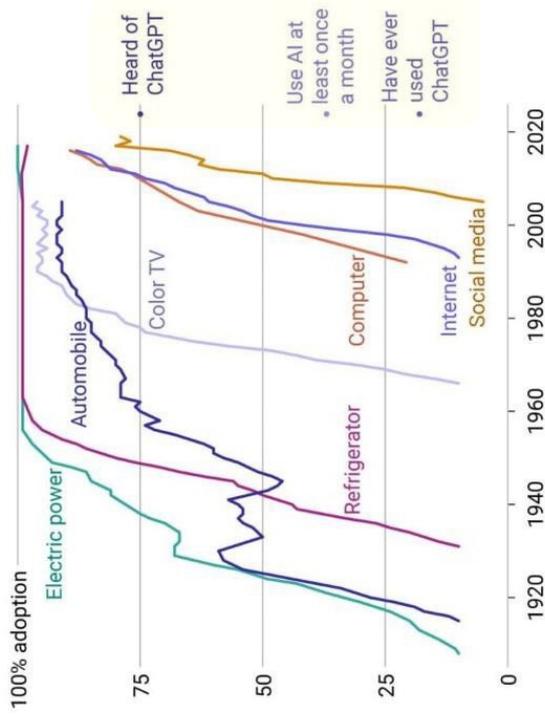
Source: Press, G. (2016, December 30). A very short history of artificial intelligence (AI). Forbes. <https://www.forbes.com/sites/press/2016/12/30/a-very-short-history-of-artificial-intelligence-ai/>

# AI ADOPTION rates outpaced most modern technologies

ChatGPT (AI text generation) reached 100M users faster than most technologies.

## Modern technologies are quicker to be adopted

It took five decades for U.S. households to go from 10% adoption of electricity to 99%. In contrast, it took just 15 years for social media to go from 5% adoption to 79%.



Note: The 2023 survey results are for American adults, while the historical data are for American households.

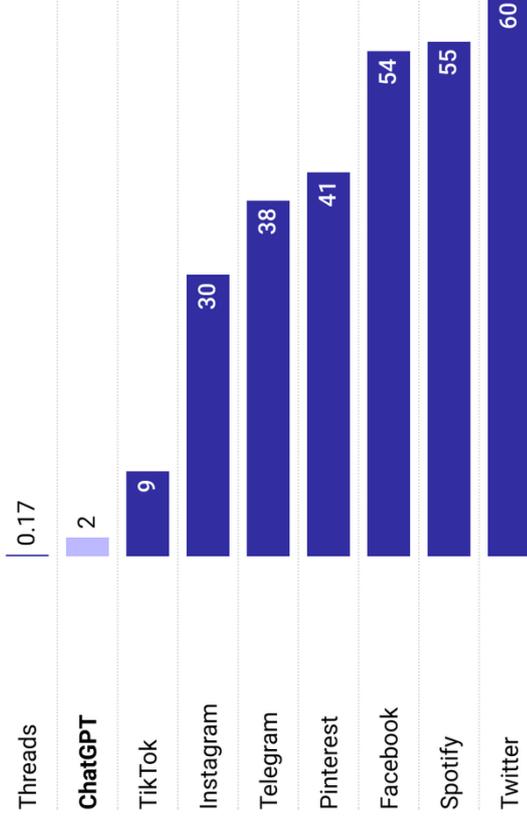
Data source: Our World in Data, Pew Research Center, YouGov

[Source: Verbit Editorial \(n.d.\). How quickly are consumers & businesses adopting AI tools compared to past technologies? Verbit. Retrieved February 22, 2024. from https://www.verbit.com/blog/ai-technology-adoption-2024](https://www.verbit.com/blog/ai-technology-adoption-2024)

## ChatGPT hit 100M users in just 2 months

The only app to beat it, Threads, did so in only five days because it used Instagram's existing social network.

### Months to 100M users



Data source: International Monetary Fund, company websites

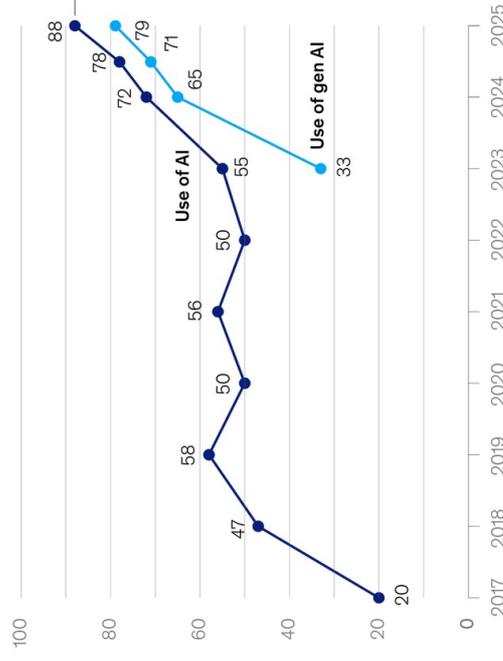
# AI moves from experiment to EVERYDAY BUSINESS

More companies than ever now use AI in at least one business function—and the curve is still climbing.

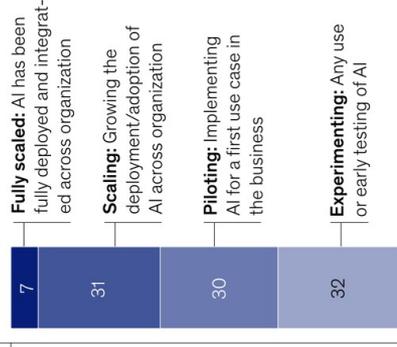
## Reported use of AI in at least one business function continues to increase.

- The share of companies using AI in at least one **business function** continues to rise year over year, signalling that AI has firmly entered mainstream operations.
- Adoption is no longer limited to digital leaders—most industries now report **widespread functional AI use** across marketing, operations, product development, and service.
- Organizations are increasingly moving beyond isolated pilots, **embedding AI into everyday workflows** where the impact is tangible and repeatable.
- With AI usage expanding across functions, the **competitive gap is shifting** from adoption to effective scaling and governance of AI systems.

Use of AI by respondents' organizations, % of respondents  
Organizations that use AI in at least 1 business function<sup>1</sup>



Phase of AI use among organizations using AI in 2025



<sup>1</sup>In 2017, the definition for AI use was using AI in a core part of the organization's business or at scale. In 2018–19, the definition was embedding at least 1 AI capability in business processes or products. From 2020, the definition was that the organization has adopted AI in at least 1 function, and in 2025, the definition was regular use of AI in at least 1 function.  
Source: McKinsey Global Surveys on the state of AI, 2017–25

Source: McKinsey & Company (2025, November 5). The state of AI in 2025: Agents, innovation, and transformation. <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai>

# AI Governance is ACCELERATING Globally

Business adoption and regulatory activity surge in 2024.

The urgency for AI governance has never been more pronounced. In 2025, 88% of organizations reported using AI systems, a dramatic increase from 55% percent in 2023, matched by unprecedented regulatory activity.

**88%**

Organizations using AI in 2025 (up from 55% in 2023)

**59**

U.S. federal AI regulations in 2024 (2x increase from 2023)

**21.3%**

Increase in global legislative AI mentions (75 countries)

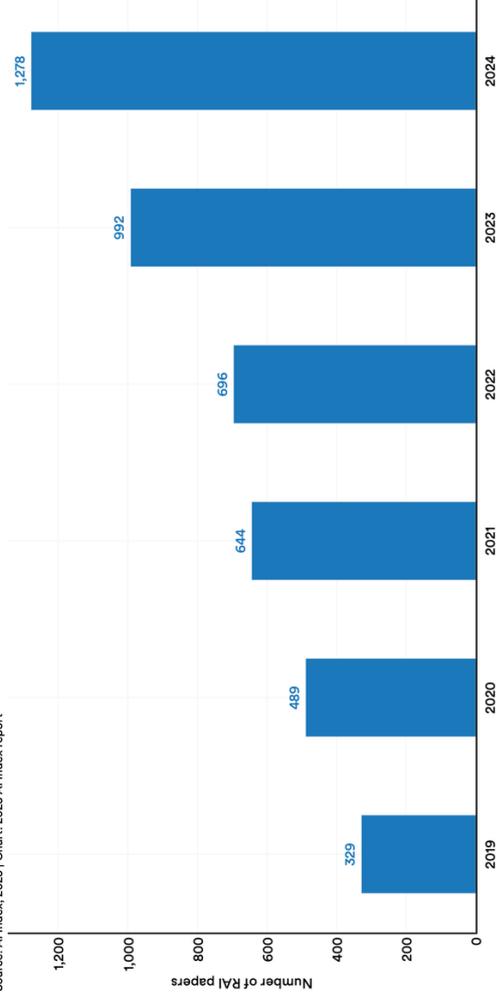
**9x**

Increase in AI legislation since 2016

This convergence creates an imperative for robust governance frameworks. Without proper guardrails, organizations face legal exposure, reputational damage, and operational disruption at scale.

**Number of responsible AI papers accepted at select AI conferences, 2019–24**

Source: AI Index, 2025 | Chart: 2025 AI Index report



Source: Stanford University, Human-Centered Artificial Intelligence. (2025). The 2025 AI Index report. [https://hai.stanford.edu/assets/files/hai\\_ai\\_index\\_report\\_2025.pdf](https://hai.stanford.edu/assets/files/hai_ai_index_report_2025.pdf)

# We face multiple DEFINITIONS of AI

There is no single, universally accepted definition of AI... nonetheless all share common elements.

## Dictionaries



### **Oxford English Dictionary:**

The capacity of computers or other machines to exhibit or simulate intelligent behaviour; the field of study concerned with this. In later use also: software used to perform tasks or produce output previously thought to require human intelligence, esp. by using machine learning to extrapolate from large collections of data. Also as a count noun: an instance of this type of software; a (notional) entity exhibiting such intelligence.

### **Miriam-Webster Dictionary:**

1: the capability of computer systems or algorithms to imitate intelligent human behavior. *also, plural artificial intelligences:* a computer, computer system, or set of algorithms having this capability.  
2: a branch of computer science dealing with the simulation of intelligent behavior in computers

## Government



### **US Department of Commerce (CSRC/NIST):**

1. A branch of computer science devoted to developing data processing systems that performs functions normally associated with human intelligence, such as reasoning, learning, and self-improvement.
2. The capability of a device to perform functions that are normally associated with human intelligence such as reasoning, learning, and self-improvement.

### **US Dept of State:**

A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments.

### **EU Parliament:**

The ability of a machine to display human-like capabilities such as reasoning, learning, planning and creativity.

## Technology



### **Garner:**

Applying advanced analysis and logic-based techniques, including machine learning (ML), to interpret events, support and automate decisions, and take actions.

### **Forrester:**

The theory and capabilities that strive to mimic human intelligence through experience and learning.

### **TechTarget:**

The simulation of human intelligence processes by machines, especially computer systems.

### **IBM:**

technology that enables computers and digital devices to learn, read, write, talk, see, create, play, analyze, make recommendations, and do other things humans do.

## Prof'l Orgs



### **DAMA International: (member login required)**

Software that performs a function previously ascribed only to human beings, such as natural language processing.

### **IAPP:**

A broad term used to describe an engineered system where machines learn from experience, adjusting to new inputs, and potentially performing tasks previously done by humans. More specifically, it is a field of computer science dedicated to simulating intelligent behavior in computers.

4 elements



computers



software



algorithms



automation



humans



cognition



intelligence



recommend



decide



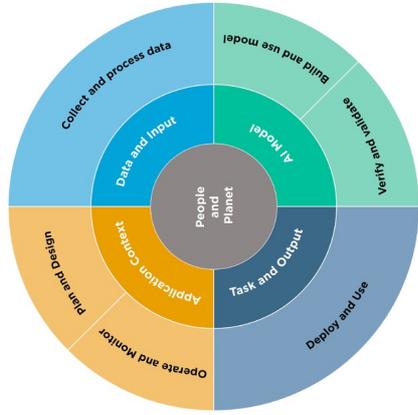
predict



create

TIP: Click any definition box in Slide Show mode (or Ctrl+click in Slide View/Edit mode) to view that definition's source

# Lifecycle and key dimensions of an AI SYSTEM



**Fig. 2.** Lifecycle and Key Dimensions of an AI System. Modified from OECD (2022) OECD Framework for the Classification of AI systems — OECD Digital Economy Papers. The two inner circles show AI systems' key dimensions and the outer circle shows AI lifecycle stages. Ideally, risk management efforts start with the Plan and Design function in the application context and are performed throughout the AI system lifecycle. See Figure 3 for representative AI actors.

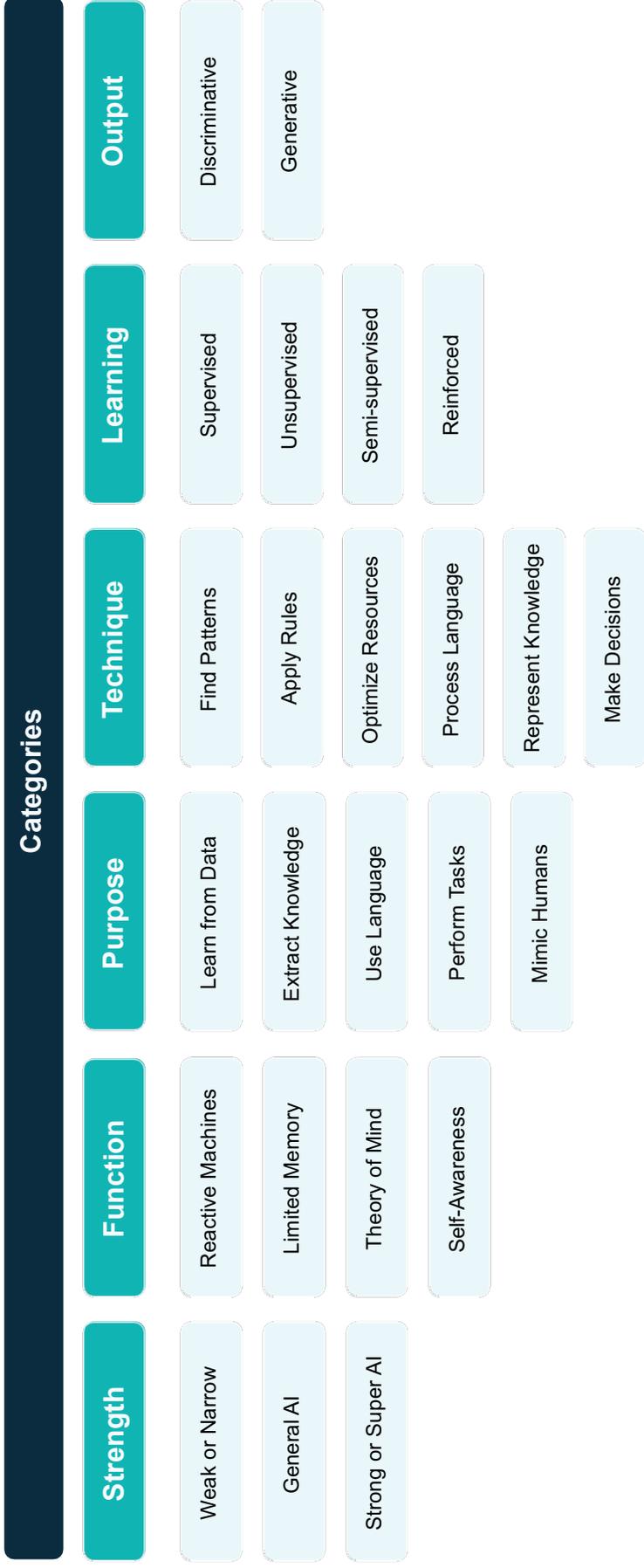
Application Context	Data & Input	AI Model	AI Model	Task & Output	Application Context	People & Planet
<b>Plan and Design</b> TEVV includes audit & impact assessment.	<b>Collect and Process Data</b> TEVV includes internal & external validation	<b>Build and Use Model</b> TEVV includes model testing	<b>Verify and Validate</b> TEVV includes model testing	<b>Deploy and Use</b> TEVV includes integration, compliance testing & validation	<b>Operate and Monitor</b> TEVV includes audit & impact assessment	<b>Use or Impacted by</b> TEVV includes audit & impact assessment
Articulate and document the system's concept and objectives, underlying assumptions, and context in light of legal and regulatory requirements and ethical considerations.	Gather, validate and clean data and document the metadata and characteristics of the dataset, in light of objectives, legal and ethical considerations.	Create or select algorithms; train models.	Verify & validate, calibrate, and interpret model output.	Pilot, check compatibility with legacy systems, verify regulatory compliance, manage organizational change, and evaluate user experience.	Operate the AI system and continuously assess its recommendations and impacts (both intended and unintended) in light of objectives, legal and regulatory requirements, and ethical considerations.	Use system/technology; monitor & assess impacts; seek mitigation of impacts; advocate for rights.
System operators; end users; domain experts; AI designers; TEVV experts; product managers; compliance experts; auditors; organizational management; C-suite executives; impacted individuals/communities; evaluators.	Data scientists; data engineers; data providers; domain analysts; human factors experts; TEVV experts.	Modelers; model engineers; data scientists; developers; domain experts; social-cultural analysts familiar with the application context and TEVV experts.	System integrators; developers; systems engineers; software engineers; domain experts; procurement experts; third-party suppliers; C-suite executives; with consultation of human factors experts, socio-cultural analysts, governance experts, TEVV experts.	System operators; end users; and practitioners; domain experts; AI designers; impact assessors; TEVV general public; policy makers; standards organizations; trade associations; advocacy groups; environmental groups; civil society organizations; researchers.	System operators; end users; and practitioners; domain experts; AI designers; impact assessors; TEVV general public; policy makers; standards organizations; trade associations; advocacy groups; environmental groups; civil society organizations; researchers.	End users, operators, and practitioners; impacted individuals/communities; general public; policy makers; standards organizations; trade associations; advocacy groups; environmental groups; civil society organizations; researchers.

**Fig. 3.** AI actors across AI lifecycle stages. See Appendix A for detailed descriptions of AI actor tasks, including details about testing, evaluation, verification, and validation tasks. Note that AI actors in the AI Model dimension (Figure 2) are separated as a best practice, with those building and using the models separated from those verifying and validating the models.

Source: National Institute of Standards and Technology. (2023). Artificial Intelligence Risk Management Framework (AIRMF-1.0). NIST AI 100-1.1. <https://doi.org/10.6028/nist.ai.100-1>

# We can describe AI using various CATEGORIES

Each category set describes a different aspect of AI (and these categories are not mutually exclusive).



# AI Risks

# Understanding Risks & Challenges

[Back to Agenda](#)

# The stakes are BOARD-LEVEL

Financial, legal, and reputational risks concentrate at deployment scale.

As AI systems transition from pilot projects to enterprise deployments, risk shifts from theoretical to board-level materiality. Recent incidents underscore the urgent need for robust AI governance to prevent and manage such occurrences.

**Deepfake Videos Allegedly Impersonate Singapore Prime Minister Lawrence Wong to Promote Scams** [#284](#)

**AI-generated Songs Impersonate Chinese Girl Group and Cause Confusion Without Authorization** [#490](#)

**Amazon and Google AI Generated Images Impersonate Kim Jong Il in Search Results** [#597](#)

**Alleged AI-generated Video Impersonates Spanish Foreign Minister Pedro Sánchez on a Republican Website** [#819](#)

**Amazon Flex Drivers Allegedly Fired After Automated Employee Evaluations** [#111](#)

**2010 Market Flash Crash** [#28](#)

**Rick van Vlietman on Side of Bus Shamed for Jaywalking** [#165](#)

**Scarfie Robot Drowns itself in a Fountain** [#165](#)



## The AI Incident Database

The AI Incident Database is dedicated to indexing the collective history of harms or near harms realized in the real world by the deployment of artificial intelligence systems.

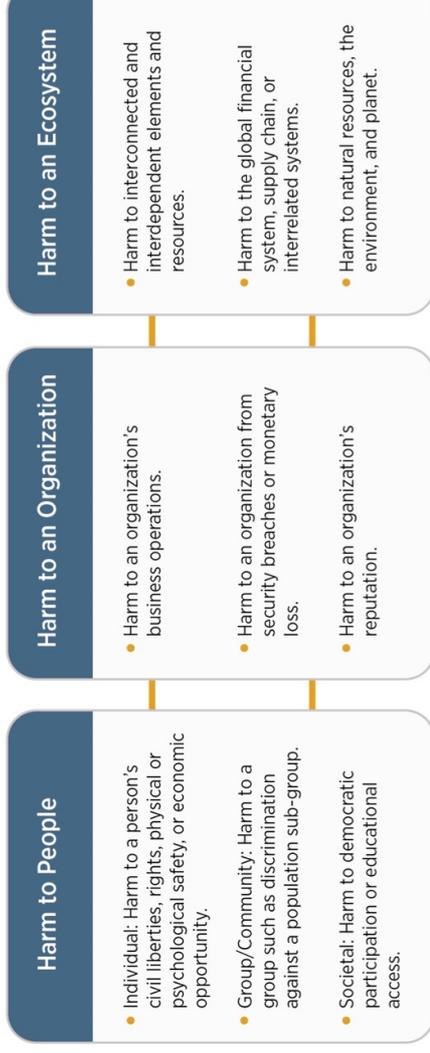
Source: WalkMe Team. (2025, June 23). 15 Potential Artificial Intelligence (AI) Risks. <https://www.walkme.com/blog/ai-risks/>

# Unintended **HARM**: The core challenge of AI systems

- AI systems, despite their promise, can lead to unintended negative consequences across various domains.
- The NIST AI Risk Management Framework (AI RMF) categorizes these potential harms into three main areas:

NIST AI 100-1

AI RMF 1.0



**Fig. 1.** Examples of potential harms related to AI systems. Trustworthy AI systems and their responsible use can mitigate negative risks and contribute to benefits for people, organizations, and ecosystems.

Source: National Institute of Standards and Technology (NIST), "Artificial Intelligence Risk Management Framework (AI RMF 1.0)," January 2023. Available at: <https://nvlpubs.nist.gov/nistpubs/ai/NIST.AI.100-1.pdf>

# Manifestations of AI harm become INCIDENTS

The [AI Incident Database](#) already contains 1000+ cross-referenced examples of AI harms.

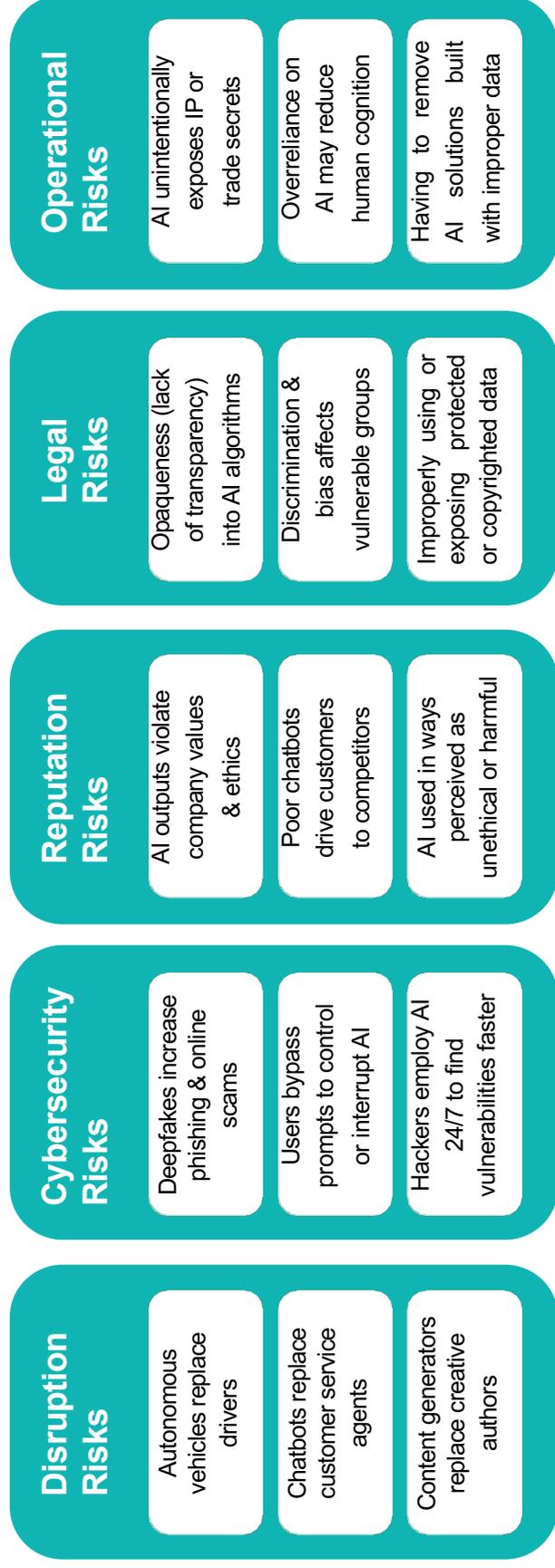
ID	Description
<a href="#">19</a>	Google ads showed (1) more executive & career building jobs to males (vs females); (2) more arrest references for searches on Black names in ads from Instant CheckMate
<a href="#">37</a>	Amazon shut down recruiting tool that downranked female applicants
<a href="#">47</a>	LinkedIn search engine favored male names
<a href="#">48</a>	New Zealand passport checker rejected Asian man's passport application after detecting his eyes as closed
<a href="#">87</a>	UK passport checker showed higher rejection rate for dark-skinned women
<a href="#">95</a>	HireVue removed AI employability scoring & ranking tool that analyzes facial movements, word choice & speaking voice during interviews after public outcry
<a href="#">265</a>	Black courier sued Uber Eats over racist facial recognition dismissal based on incorrect identification after increasingly frequent requests for more verification selfies
<a href="#">390</a>	Voice & video deepfakes & stolen PII used in online interviews of candidates applying for remote work & work-at-home positions
<a href="#">489</a>	Workday's AI screening system is alleged in a lawsuit to allow employers to discriminate against African-Americans, people over 40 & people with disabilities
<a href="#">618</a>	Largest US credit union rejected more than half of its Black applicants & approved Latinos at significantly lower rates vs. Whites
<a href="#">267</a>	Clearview AI (US-based facial recognition software) hit with multiple fines & complaints for illegally collecting billions of images online photos without consent
<a href="#">355</a>	UK/Portugal drivers win lawsuit against Uber & Ola for robo-termination based on AI-detected fraud, denying access to personal data & lack of transparency into how data used
<a href="#">412</a>	Finland's National Police Board reprimanded for illegal processing of personal data in a facial recognition trial that did not comply with data protection legislation
<a href="#">441</a>	S. Korea shared photos of 170 million travelers (without their consent) to private companies developing immigration screening
<a href="#">6</a>	Microsoft chatbot removed within 24 hours after generating multiple racist, sexist & anti-Semitic tweets due to inputs by Twitter users
<a href="#">352</a>	Twitter users derail GPT-3 tweet bot dedicated to remote jobs by exploiting a newly discovered prompt injection hack to make bot to repeat embarrassing & ridiculous phrases
<a href="#">473</a>	Bing Chat users leverage prompt injection to reveal its built-in initial instructions, including a list of statements governing ChatGPT's interaction with users
<a href="#">622</a>	User crafts prompt to get Chevrolet dealer's ChatGPT bot to sell a 2024 Chevy Tahoe for \$1 by manipulating the chatbot's objective to agree with any statement

▲ Click the ID to view that record in the online [AI Incident Database](#).

Source: Responsible AI Collaborative. (n.d.). AI Incident Database. | Discover. Retrieved April 3, 2024, from [https://incidentdatabase.ai/robots/discovers/is\\_incident\\_renowledge](https://incidentdatabase.ai/robots/discovers/is_incident_renowledge)

# AI presents new & different **BUSINESS** risks

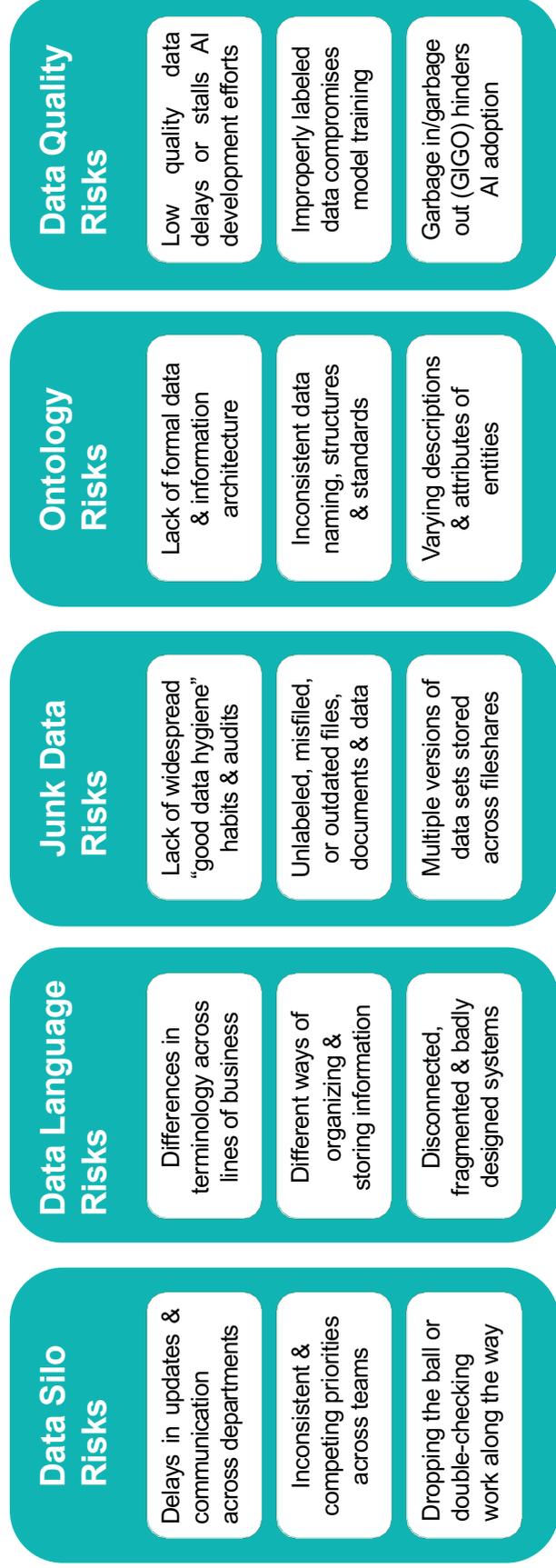
The potential for these exposure areas increases with ungoverned implementation & usage of AI solutions.



AI risk mitigation needs to be a critical component of strategic planning & risk management efforts

# AI can be impacted by DATA risks

The best AI comes from the best data... anything that hinders “trusted” data will also affect AI outcomes.



High-quality data increases business agility & establishes the data foundation essential to AI success

# MIT AI RISK Repository

- The AI Risk Repository has three parts:
  - The **AI Risk Database** captures 1700+ risks extracted from 74 existing frameworks and classifications of AI risks
  - The **Causal Taxonomy of AI Risks** classifies how, when, and why these risks occur
  - The **Domain Taxonomy of AI Risks** classifies these risks into 7 domains (e.g., “Misinformation”) and 24 subdomains (e.g., “False or misleading information”)

Source: MIT AI Risk Repository, Accessed 15/04/2025. Available at: <https://aishk.mit.edu/>.

AI Risk Database		High Level Causal Taxonomy		Mid Level Domain Taxonomy						
Title	Quadrant / E_x/B	Category level	Risk category	Description	Additional ex.	Entity	Intent	Timing	Domain	Mid-level Domain
TASK 8 Analysis of Causal Taxonomy and Mitigation of AI Risks	01.02.00	High Category	Type 2: Bigger than expected	Have one result: the scope of actions expected to have a large societal impact is much smaller than expected. AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 9 Analysis of Causal Taxonomy and Mitigation of AI Risks	01.03.00	High Category	Type 3: Worse than expected	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 10 Analysis of Causal Taxonomy and Mitigation of AI Risks	01.04.00	High Category	Type 4: Unlikely to occur	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 11 Analysis of Causal Taxonomy and Mitigation of AI Risks	01.05.00	High Category	Type 5: Criminal organizations	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 12 Analysis of Causal Taxonomy and Mitigation of AI Risks	01.06.00	High Category	Type 6: State Weaponization	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 13 Analysis of Causal Taxonomy and Mitigation of AI Risks	02.01.00	High Category	Harmful Content	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 14 Analysis of Causal Taxonomy and Mitigation of AI Risks	02.01.02	High Category	Harmful Content	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness
TASK 15 Analysis of Causal Taxonomy and Mitigation of AI Risks	02.01.03	High Category	Harmful Content	AI involves a wide range of activities, from simple tasks to complex ones, and the potential for harm is significant. The AI system safety failures, such as hallucinations, are not fully understood and could lead to unintended consequences.	7.1 AI System Safety, Failures, Limitations	7.1	2. AI	Pre-deployment	7.1	7.1 > Lack of capability or robustness

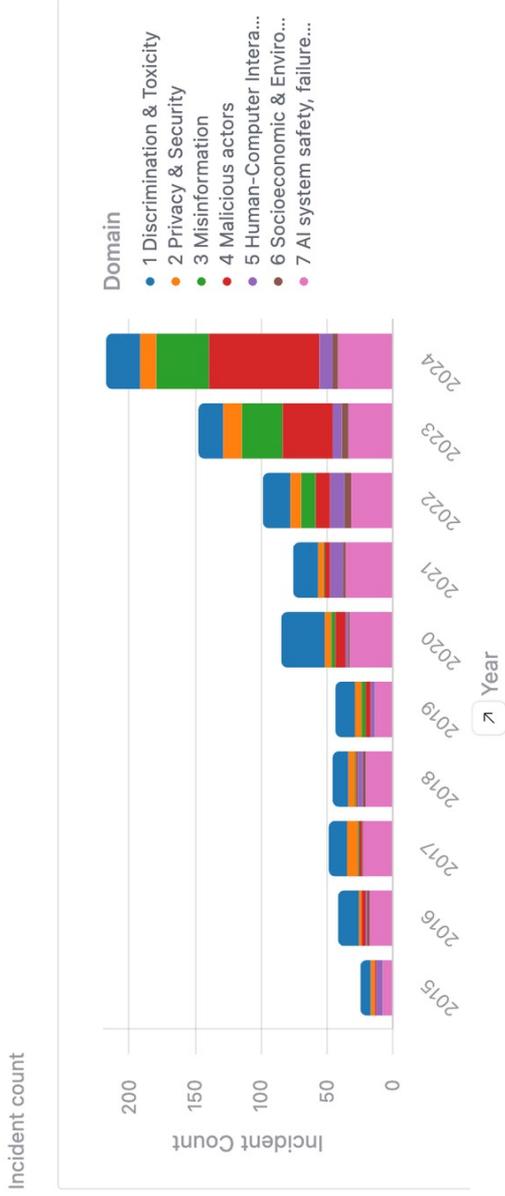
## Description of how the risk is presented in evidence

Category Level	Description of how the risk is presented in evidence
Entity	AI Human Other
Intent	Intentional Unintentional Other
Timing	Pre-deployment Post-deployment Other

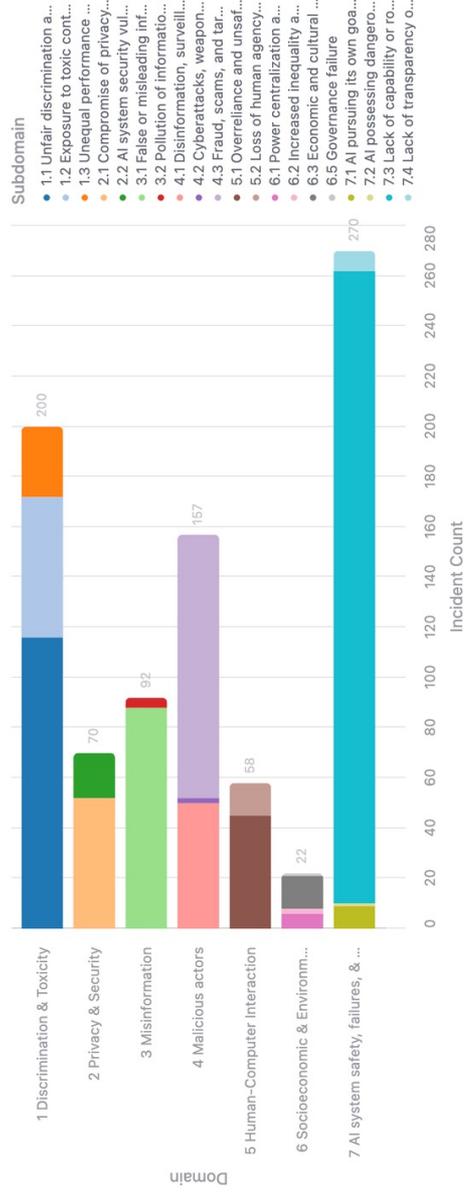
Domain / Subdomain	1 Discrimination & Toxicity
	1.1 Unfair discrimination and misrepresentation 1.2 Exposure to toxic content 1.3 Unequal performance across groups
	2 Privacy & Security 2.1 Compromise of privacy by obtaining, leaking or correctly inferring sensitive information 2.2 AI system security vulnerabilities and attacks
	3 Misinformation 3.1 False or misleading information 3.2 Pollution of information ecosystem and loss of consensus reality
	4 Malignant actors & Misuse 4.1 Disinformation, surveillance, and influence at scale 4.2 Cyberattacks, weapon development or use, and mass harm 4.3 Fraud, scams, and targeted manipulation

Domain / Subdomain	5 Human-Computer Interaction
	5.1 Overreliance and unsafe use 5.2 Loss of human agency and autonomy
	6 Socioeconomic & Environmental Harms 6.1 Power centralization and unfair distribution of benefits 6.2 Increased inequality and decline in employment quality 6.3 Economic and cultural devaluation of human effort 6.4 Competitive dynamics 6.5 Governance failure 6.6 Environmental harm
	7 AI system safety, failures, and limitations 7.1 AI pursuing its own goals in conflict with human goals or values 7.2 AI possessing dangerous capabilities 7.3 Lack of capability or robustness 7.4 Lack of transparency or interpretability 7.5 AI welfare and rights 7.6 Multi-agent risks

# MIT AI Risk Repository - Risk CLASSIFICATION



Incident Count by Domain/Subdomain



Source: MIT AI Risk Repository, Accessed 15/04/2025. Available at: <https://arisk.mit.edu>

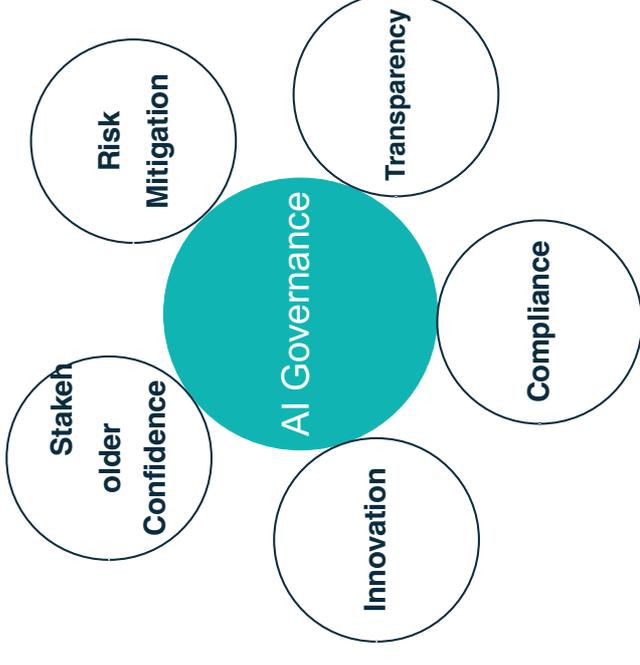
# AI Governance The Need & Definition

[Back to Agenda](#)

# ENSURING responsible, ethical, and effective AI

Why AI Governance matters.

- **Mitigating risks** is a primary driver for AI governance. This includes identifying and addressing potential ethical, social, economic, and legal risks associated with AI deployment, such as bias and discrimination.
- Robust AI governance fosters **transparency** in AI systems, promoting understanding of their purpose, algorithms, data sets, and outputs. **Explainability** is key to building trust and enabling human oversight.
- Implementing AI governance capabilities helps organisations ensure **compliance** with emerging AI-related regulations and ethical standards, minimising legal and reputational risks
- Strong AI governance enhances **stakeholder confidence** by demonstrating a commitment to responsible AI practices. This includes engaging with developers, users, policymakers, and affected communities.
- AI governance is not just about risk reduction; it also **enables innovation** by providing a structured and ethical pathway for the development and deployment of AI technologies, aligning them with business objectives and societal values.



## Intersection with Responsible AI and Data Governance

AI governance acts as an overarching capability that incorporates the principles of **Responsible AI** (ethical, fair, trustworthy AI) and relies heavily on strong **Data Governance** practices to ensure data quality, security, integrity, and ethical use of data, which are foundational for reliable AI.

# DEFINING AI Governance

“**Artificial intelligence (AI) governance** refers to the processes, standards and guardrails that help ensure AI systems and tools are safe and ethical. AI governance frameworks direct AI research, development and application to help ensure safety, fairness and respect for human rights.”

Source: IBM. “What is AI Governance?” IBM Think, 2025. Available at: <https://www.ibm.com/think/tools/ai/governance>.

## Core Definition Components

- **Principles & Policies:** Principles, policies, standards, and decision criteria that direct ethical and compliant AI use.
- **Processes & Practices:** Repeatable, auditable lifecycle activities from intake to retirement. Lifecycle workflows for design, development, validation, monitoring, and decommissioning.
- **Risk Controls & Guardrails:** Defined control mechanisms and safeguards to manage bias, privacy, misuse, security, and safety risks.
- **Alignment & Oversight:** Alignment with strategy, organizational values, legal obligations, and stakeholder expectations.
- **Evidence & Traceability:** Auditable documentation, traceability, and evidence that controls and policies are operating as intended.



## Three Interconnected Dimensions

- **Ethical Alignment:** Ensures fairness, transparency, accountability, human-centric design, and respect for rights.
- **Legal & Regulatory Compliance:** Compliance with applicable laws and standards (e.g., EU AI Act, GDPR, sector regulations)
- **Operational & Risk Resilience:** Robustness, security, reliability, and continuous monitoring of AI systems.

# The growing **COMPLEXITY** demands AI Governance

Navigating new risks in an evolving technological landscape.

## 1. **Increasing algorithmic complexity**

- Modern AI systems have evolved significantly from simple rule-based systems to sophisticated deep learning and generative AI models. This increasing algorithmic complexity makes understanding and predicting their behaviour more challenging.

## 2. **Vast and diverse datasets**

- These advanced AI models often integrate vast and diverse datasets, further complicating the analysis of inputs, processes, and outputs. The quality and governance of this underlying data are crucial.

## 3. **Ubiquitous nature of AI**

- The growing functionality of AI in Software as a Service (SaaS), cloud platforms, and vendor products means AI is increasingly accessible and potentially in use across organisations, sometimes without formal oversight. This ubiquitous nature of AI amplifies the need for centralized governance.

## 4. **New and different business risks**

- Ungoverned implementation and usage of complex AI solutions can lead to new and different business risks, including inaccuracies, biases, lack of transparency, and legal defensibility issues.

# AI GOVERNANCE is in its early stages

Challenges and slow-ish implementation are still common and there's no standard governance framework (yet).

## IAPP's definition

**Organizational AI governance refers to the internal guidelines and practices organizations follow to ensure responsible development, deployment or use of AI by that organization.**



### Most common AI governance challenges faced by organizations



Existence of an AI governance function by annual revenue in USD

	Under 100 million	100-999 million	1-8.3 billion	9-19.9 billion	20-58.9 billion	More than 60 billion
Established AI governance function	17%	26%	31%	18%	38%	52% ↑
Likely to establish an AI governance function in the next 12 months	28%	31%	31%	39%	29%	26%
No established AI governance function	45%	39%	34%	34%	32%	13% ↓
Unsure	11%	4%	5%	8%	0%	10%

Existence of an AI governance function by number of employees

	Under 100	100-999	1,000-4,999	5,000-24,999	25,000-79,999	More than 80,000
Established AI governance function	21%	18%	22%	34%	27%	45% ↑
Likely to establish an AI governance function in the next 12 months	21%	29%	27%	37%	27%	30%
No established AI governance function	43%	49% ↑	46% ↑	27% ↓	30%	20% ↓
Unsure	14%	4%	5%	3%	16% ↑	5%

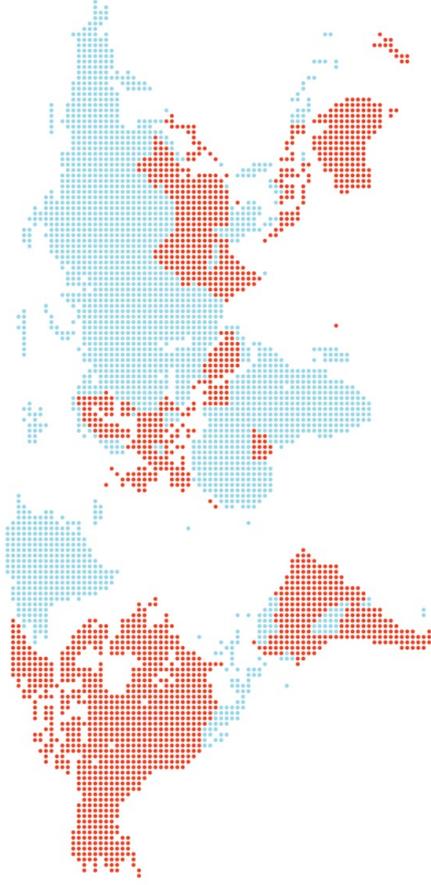
### Existence of an AI governance function by respondent's confidence in privacy compliance

	Not at all confident	Somewhat confident	Totally confident
Established AI governance function	12% ↓	30%	32%
Likely to establish an AI governance function in the next 12 months	19%	31%	37%
No established AI governance function	65% ↑	33%	28%
Unsure	4%	7%	4%

Source: International Association of Privacy Professionals & EY. (2023). IAPP-EY professionalizing organizational AI governance report. [IAPP-  
https://iapp.org/media/doc/resource\\_center/iapp\\_ey\\_professionalizing\\_organizational\\_ai\\_governance\\_report.pdf](https://iapp.org/media/doc/resource_center/iapp_ey_professionalizing_organizational_ai_governance_report.pdf)

# Global AI Law and Policy TRACKER

This tracker identifies AI legislative and policy developments in a subset of jurisdictions.



## Jurisdictions in focus

Argentina	Colombia	Mauritius	Taiwan
Australia	Egypt	New Zealand	United Arab Emirates
Bangladesh	EU	Nigeria	U.K.
Brazil	India	Peru	U.S.
Canada	Indonesia	Saudi Arabia	
Chile	Israel	Singapore	
China	Japan	South Korea	

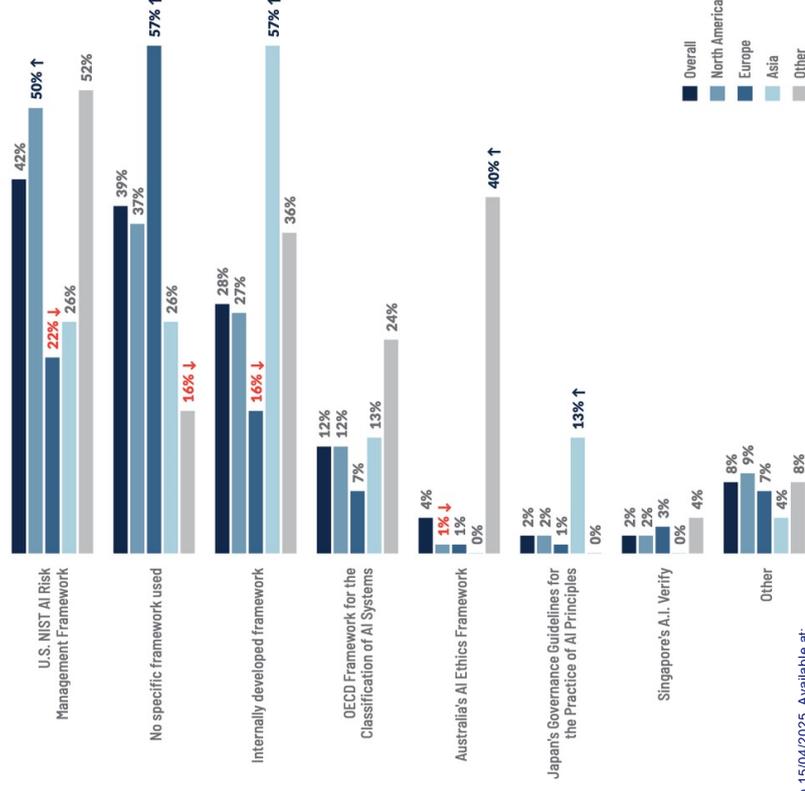
Region	Sovereignty	Assets
N. America	USA	<a href="#">Algorithmic Accountability Act (draft)</a> , <a href="#">NIST AI Risk Management Framework</a> , <a href="#">E.O. 13960</a> , <a href="#">E.O. 14110</a> , <a href="#">Blueprint for an AI Bill of Rights</a> , <a href="#">AI Safety Institute</a>
	Canada	<a href="#">AI &amp; Data Act (proposed)</a> , <a href="#">GenAI Code of Practice</a> , <a href="#">AI Ethics Framework</a> , <a href="#">AI Ethics Principles</a> , <a href="#">AI Standards Roadmap</a>
APAC	Australia	<a href="#">AI Guidelines</a> , <a href="#">Summary of regulations</a>
	China	<a href="#">Digital India Act, 2023 (proposed)</a> , <a href="#">India AI program</a>
	India	<a href="#">Social Principles of Human-Centric AI</a>
	Japan	<a href="#">Algorithm Charter</a> , <a href="#">Trustworthy AI in Aotearoa principles</a>
	New Zealand	<a href="#">Model AI Governance Framework</a> , <a href="#">VerifyAI</a> , <a href="#">Model AI Governance Framework for Generative AI</a>
LATAM	Singapore	<a href="#">Provision 2/2023 (published)</a> , <a href="#">Law 27.699</a> , <a href="#">Resolution 161/23</a>
	Argentina	<a href="#">Bill No. 2338/2023 (proposed)</a>
	Brazil	<a href="#">National Policy and Action Plan on AI</a>
EMEA	Chile	<a href="#">EU AI Act (approved)</a>
	EU	<a href="#">AI Standards</a> , <a href="#">AI Standards Hub</a>
	UK	<a href="#">Bletchley Declaration (AI Safety)</a>
Global Agreements & Standards	Bletchley	<a href="#">Hiroshima AI Process</a> , <a href="#">AI Code of Conduct</a>
	G7	<a href="#">AI Principles</a>
	OECD	<a href="#">AI Ethics</a>
	UNESCO	

Source: International Association of Privacy Professionals (IAPP), "Global AI Law and Policy Tracker," Accessed on 15/04/2025. Available at: <https://iapp.org/resources/articles/global-ai-legislation-tracker/>

# Use of AI Governance FRAMEWORKS

- Organizations primarily use governmental frameworks, notably the U.S. NIST AI Risk Management Framework (42%) and internally developed frameworks (28%); there's a notable overlap where 60% using NIST AI RMF also employ the NIST Privacy Framework, reflecting privacy governance's maturity.
- Regional Differences: Framework choice strongly correlates with geography — NIST AI RMF usage is high in North America, Japan's AI governance guidelines dominate in Asia, and Europe notably lacks a specific AI governance framework (57% use none), likely awaiting the EU AI Act for regulatory clarity.

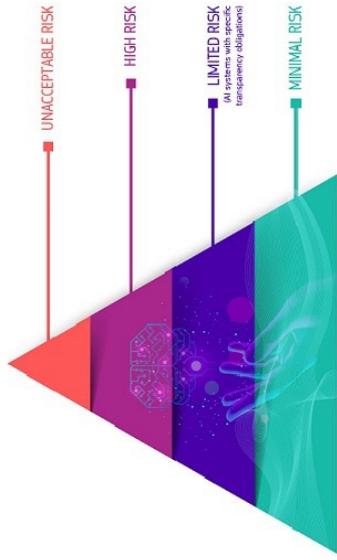
Frameworks used to develop and/or benchmark AI governance programs by continent



Source: International Association of Privacy Professionals (IAPP) & EY, "IAPP-EY Professionalizing Organizational AI Governance Report," Accessed on 15/04/2025. Available at: [https://iapp.org/media/odf/resource\\_center/iapp\\_ey\\_professionalizing\\_organizational\\_ai\\_governance\\_report.pdf](https://iapp.org/media/odf/resource_center/iapp_ey_professionalizing_organizational_ai_governance_report.pdf)

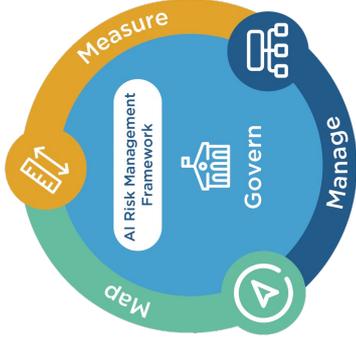
# AI Governance frameworks and REGULATIONS

In the rapidly evolving AI landscape, businesses face new rules and standards to ensure trustworthy and responsible AI. Organizations must navigate both government regulations and voluntary frameworks to manage AI risks and compliance.



**EU AI Act**

Source: [EU AI Act - Official Portal](#)



**NIST Risk Management Framework**

Source: [NIST AI Risk Management Framework](#)



**ISO/IEC 42001**

Source: [ISO/IEC 42001 – AI Management System Standard](#)

# NIST AI Risk Management Framework (AI RMF)

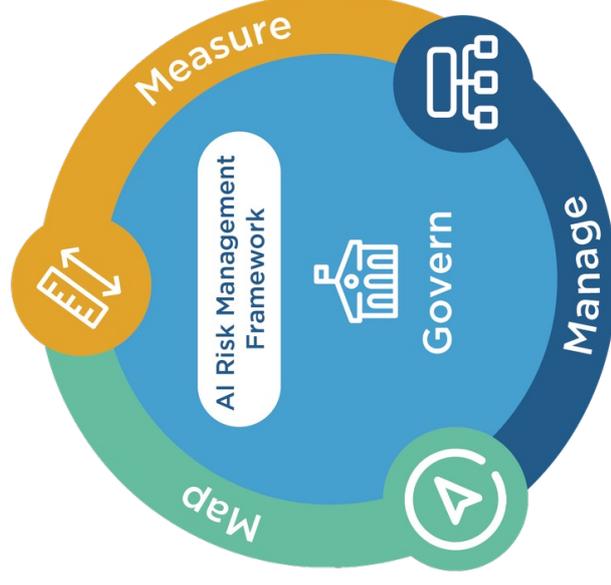


## Overview

The NIST AI Risk Management Framework provides organizations with a structured, risk-based approach to identify, assess, and mitigate AI risks throughout the AI lifecycle.

## Core Requirements

- **Risk Identification & Assessment:** Systematically map AI-related risks, from bias to security vulnerabilities.
- **Continuous Monitoring:** Implement iterative processes to update and mitigate risks over time.
- **Four Functional Pillars:** A core feature of the NIST AI RMF is its four functional pillars: Govern, Map, Measure, and Manage



## NIST Risk Management Framework

Source: [NIST AI Risk Management Framework](#)

## Business Impact

- Mitigates risks proactively, builds stakeholder confidence, and helps prepare for regulatory changes.

# ISO/IEC 42001 AI Management System

## Overview

ISO/IEC 42001 is the first international standard dedicated to AI management systems, providing a framework to govern AI processes and ensure responsible, transparent AI practices.

## Core Requirements

- **Lifecycle Management:** Covers every stage of AI deployment—from design and testing to maintenance and decommissioning.
- **Ethical and Legal Integration:** Embeds ethical, legal, and technical controls to ensure AI operates within defined boundaries.
- **Continuous Improvement:** Emphasizes ongoing evaluation and enhancement of AI systems for improved accountability and performance.

## Business Impact

- Adoption of ISO/IEC 42001 demonstrates a commitment to responsible AI, enhances stakeholder trust, and provides a competitive edge in markets increasingly focused on ethical technology.



## ISO/IEC 42001

Source: [ISO/IEC 42001 – AI Management System Standard](#)

# EU AI ACT (European Union Artificial Intelligence Act)

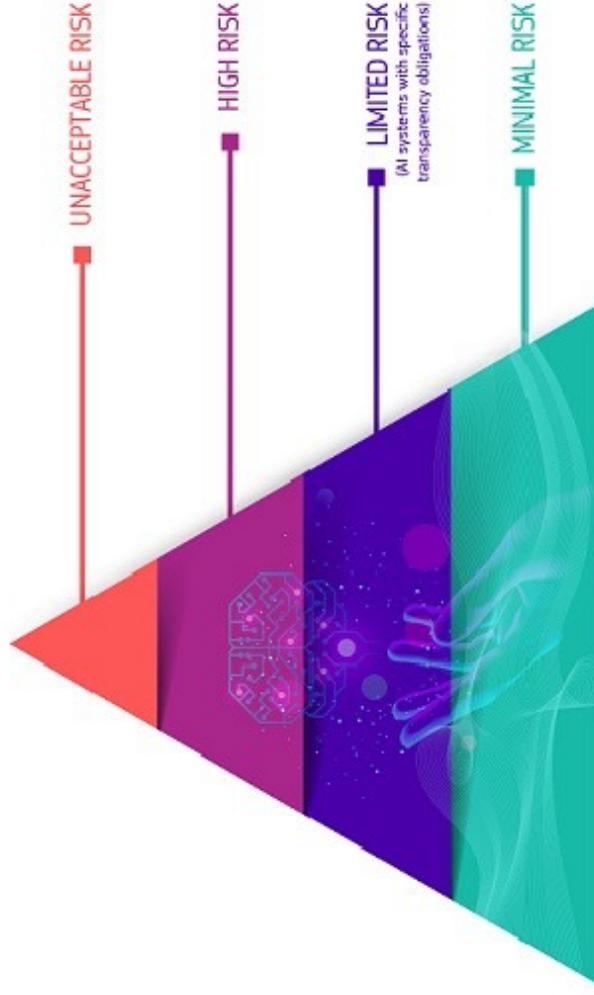


## Overview

The EU AI Act establishes a comprehensive, risk-based framework for AI regulation in Europe. It classifies AI systems into risk categories—minimal, limited, high, and unacceptable—and imposes strict requirements for high-risk applications.

## Core Requirements

- **Risk Assessment:** Organizations must rigorously evaluate the risks associated with high-risk AI systems according to 4 levels.
- **Transparency & Accountability:** Mandatory documentation, explainability, and human oversight are required.
- **Penalties:** Non-compliance can lead to severe fines (up to €30–40 million or 6–7% of global turnover).



Source: [EU AI Act - Official Portal](#)

## Business Impact

- Ensures AI deployments meet ethical, safety, and legal standards, protecting users and enhancing stakeholder trust.

# EU AI Act - Case CLASSIFICATION Walkthrough

## Applying the EU AI Act Risk Framework to Real Use Cases

### Predictive Maintenance (Minimal-Risk)

Typically minimal-risk unless equipment is safety-critical component under Annex I. No AI Act-specific requirements; GDPR applies if processing personal data.

### Retail Chatbot (Limited-Risk)

Chapter IV: Transparency. Must inform users they're interacting with AI. No QMS or conformity assessment required. GDPR applies if processing personal data.

### CV Screening (High-Risk)

Annex III, Section 4: Employment. Provider: Risk management, data governance, technical documentation, QMS, conformity assessment, CE marking. Deployer: Human oversight, monitor for bias, log decisions, FRIA.

### Credit Scoring (High-Risk)

Annex III, Section 5: Essential services. Provider: Full high-risk requirements including fairness testing, robustness validation. Deployer: Human review of adverse decisions, monitor across demographics, maintain logs.

### Emotion Detection in Classroom (PROHIBITED)

Article 5: Emotion inference in educational institutions. Cannot be deployed; no compliance pathway exists.

# Key governance ARTIFACTS

Effective AI governance relies on structured documentation artifacts that provide transparency, accountability, and evidence of compliance throughout the system lifecycle. These artifacts translate principles into operational controls and create an auditable governance trail.

## Essential Documentation Artifacts

<b>01 Classification Canvas</b> Structured template for categorizing AI systems by type, risk level, and regulatory applicability. Guides initial assessment and governance pathway selection.	<b>02 Risk Register</b> Comprehensive log of identified risks, their likelihood, impact, mitigation strategies, and ownership. Updated continuously throughout the lifecycle.
<b>03 TEWV Plan</b> Testing, Evaluation, Verification, and Validation plan detailing methodologies, metrics, test datasets, and acceptance criteria for model performance and fairness.	<b>04 Model Cards</b> Standardized documentation of model details, intended use, performance metrics, limitations, and fairness evaluations. Facilitates transparency and informed deployment decisions.
<b>05 Datasheets</b> Documentation of dataset characteristics, collection methodology, preprocessing steps, known biases, and recommended uses. Ensures data provenance and quality transparency.	<b>06 RASCI Charts</b> Responsibility Assignment Matrix defining who is Responsible, Accountable, Supporting, Consulted, and Informed for each governance activity and decision point.
<b>07 Technical Files</b> Comprehensive technical documentation including architecture diagrams, training procedures, validation results, and compliance evidence required for regulatory submissions.	<b>08 PMM Logs</b> Post-Market Monitoring logs tracking operational performance, incidents, model drift, fairness metrics, and corrective actions taken during production deployment.

# The TECHNICAL File (Annex IV)

**Purpose:** The technical file is the comprehensive documentation package demonstrating that a high-risk AI system meets all requirements. It must be maintained for **10 years** after the system is placed on the market and made available to authorities upon request. (Art. 18)

## Required Contents (Annex IV)

<b>System Description:</b>	Intended purpose, specifications, architecture, design choices	<b>Risk Management:</b>	Risk identification, analysis, mitigation, residual risks
<b>Data Governance:</b>	Training/validation/testing datasets, quality, bias mitigation	<b>Testing &amp; Validation:</b>	Test plans, procedures, results, robustness testing
<b>Human Oversight:</b>	Design measures enabling effective oversight, user instructions	<b>Performance Metrics:</b>	Accuracy, robustness, cybersecurity measures
<b>Logging &amp; Monitoring:</b>	Automatic logging capabilities, event recording, traceability	<b>Post-Market Monitoring:</b>	Plan for ongoing monitoring, incident handling, corrective actions
<b>QMS References:</b>	Links to quality management system documentation	<b>Declaration of Conformity:</b>	EU declaration and CE marking evidence

**Version Control:** The technical file must be *updated* with substantial modifications and system updates.

**Accessibility:** Must be available to authorities upon request; language requirements apply.

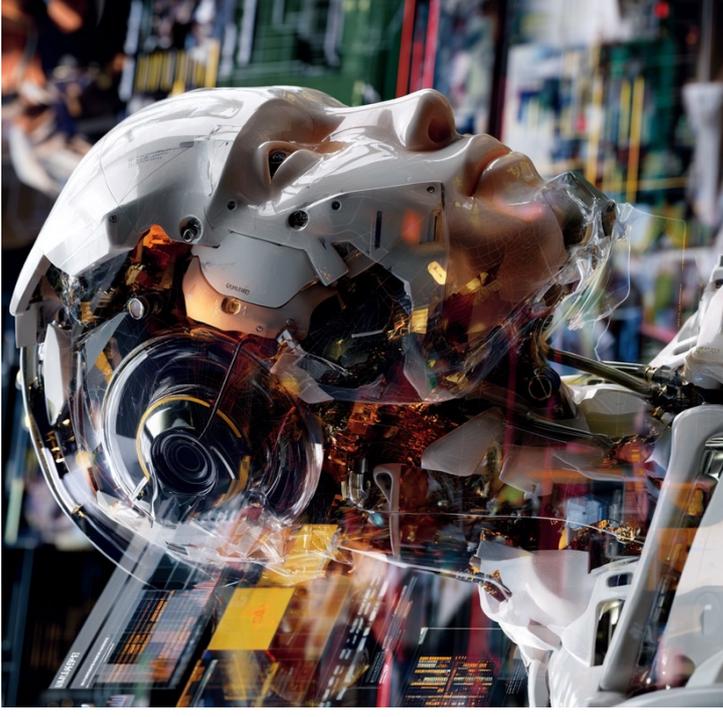


Image Credit: Image generated by Midjourney, OpenAI.

Source: European Union, Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 on artificial intelligence (AI Act), Annex IV: Technical documentation referred to in Article 11(1). Available at: <https://eur-lex.europa.eu/eli/reg/2024/1689/oj/eng>

# Responsible AI Ethical, Fair & Trustworthy

[Back to Agenda](#)

# What is RESPONSIBLE AI?

## Definition (Virginia Dignum)

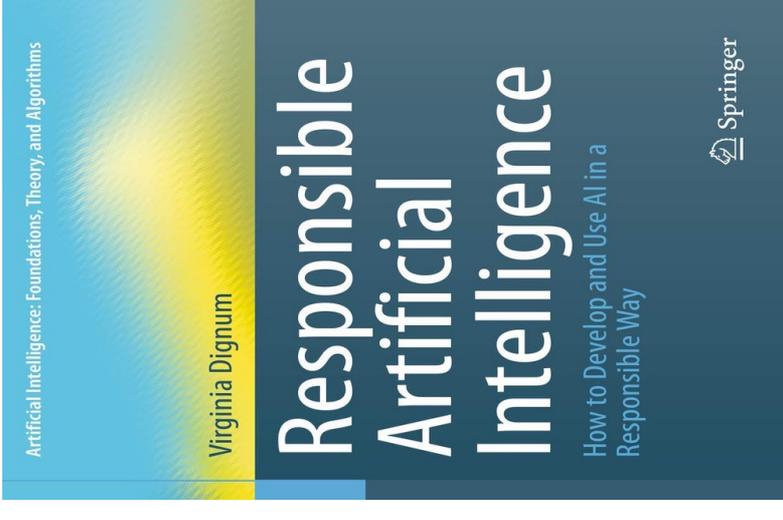
“Responsible AI is about **human responsibility** for the development of intelligent systems along fundamental human principles and values, to ensure human-flourishing and well-being in a sustainable world. ... **Responsible AI is not about the characteristics of AI systems**, but about our own role. We are responsible for how we build systems, how we use systems and how much we enable these systems to decide and act by themselves.”

Source: Virginia Dignum, Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way, Springer International Publishing, 2019. Available at: <https://link.springer.com/book/10.1007/978-3-030-30371-6>

## Definition (SiliconANGLE)

“Responsible AI is an **umbrella term** for aspects of making appropriate business and ethical choices when adopting AI. It encompasses **decisions around business and societal value, risk, trust, transparency, fairness, bias, mitigation, explainability, accountability, safety, privacy, regulatory compliance and more**. Before organizations design their AI strategy, they must define what responsible AI means within the context of their organization’s environment.”

Source: SiliconANGLE, “How IT leaders can embrace responsible AI,” September 11, 2022. Available at: <https://siliconangle.com/2022/09/11/leaders-can-embrace-responsible-ai/>



# Global AI Ethics FRAMEWORKS

## Three Pillars of Global AI Ethics Standards



### OECD AI Principles

1. Inclusive growth, sustainable development, and well-being
2. Human rights and democratic value, incl. fairness and privacy
3. Transparency and explainability
4. Robustness, security, and safety
5. Accountability

Adopted by 47 countries, these principles shape national AI strategies and create a foundation for cross-jurisdictional compliance.

Source: Organisation for Economic Co-operation and Development (OECD), "OECD AI Principles," Adopted May 2019 (updated 2024). Available at: <https://www.oecd.org/en/topics/sub-issues/ai-principles.html>



### EU HLEG Requirements

1. Human agency and oversight
2. Technical robustness and safety
3. Privacy and data governance
4. Transparency
5. Diversity, non-discrimination, and fairness
6. Societal and environmental well-being
7. Accountability

Over 500 stakeholders contributed. Provides detailed assessment criteria for system-level evaluation.

Source: European Commission, High-Level Expert Group on Artificial Intelligence (AI HLEG), "Ethics Guidelines for Trustworthy AI," 8 April 2019. Available at: <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>



### FEAT Principles

1. Fairness
2. Ethics
3. Accountability
4. Transparency

The FEAT framework helps guide the development and deployment of AI systems to ensure they are ethical, responsible, and trustworthy.

Source: Monetary Authority of Singapore (MAS), "Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore's Financial Sector," 2018 (updated). Available at: <https://www.mas.gov.sg/media/infocentre/news%20and%20publications/monographs%20and%20information%20papers/FEAT%20Principles%20Final.pdf>

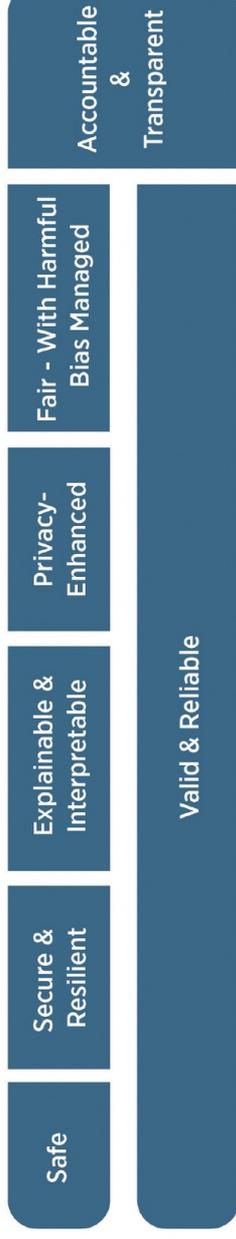
Image Source FEAT: <https://mas.gov.sg/digital-inclusion/using-the-feat-sourcebook-to-avoid-biased-ai/88f7b868>

## Key Takeaway

These frameworks converge on similar themes, creating a common global language for **responsible AI and AI ethics** that facilitates international cooperation and regulatory alignment. Organizations implementing AI governance should map their controls to multiple frameworks to demonstrate comprehensive compliance and build stakeholder trust across jurisdictions.

# Characteristics of TRUSTWORTHY AI Systems

Characteristics of trustworthy AI systems include: **valid and reliable, safe, secure and resilient, accountable and transparent, explainable and interpretable, privacy-enhanced, fair with harmful bias managed, and fair with harmful bias managed**. Creating trustworthy AI requires balancing each of these characteristics based on the AI system's context of use.



**Fig. 4.** Characteristics of trustworthy AI systems. Valid & Reliable is a necessary condition of trustworthiness and is shown as the base for other trustworthiness characteristics. Accountable & Transparent is shown as a vertical box because it relates to all other characteristics.

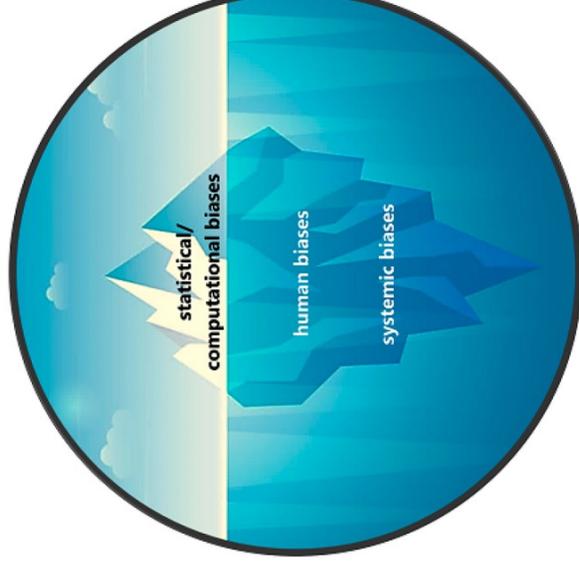
Source: National Institute of Standards and Technology (NIST), "Artificial Intelligence Risk Management Framework (AI RMF 1.0)," January 2023. Available at: <https://nvlpubs.nist.gov/nistpubs/ai/NIST.AI.100-1.pdf>.

## What exactly is AI **BIAS**?

- Bias, in general terms, represents a **skew or preference towards a particular outcome**, often unfair or prejudicial. It can arise from various sources and affect how information is perceived and decisions are made.
- In the context of Artificial Intelligence, bias refers to **systematic errors in AI outputs** due to flawed or unrepresentative data, flawed algorithms, or biased human input and interpretations. This can lead to AI systems making unfair, discriminatory, or inaccurate decisions.
- AI bias is not always intentional but can be **embedded in the data** that reflects existing societal inequalities or historical prejudices. Even well-intentioned AI development can inadvertently perpetuate these biases.
- **Recognising and understanding** the different forms and sources of AI bias is the crucial first step in mitigating its harmful effects. Without this foundational understanding, efforts to govern AI effectively will be undermined.
- Bias can manifest across the **entire AI lifecycle**, from data collection and preparation to model development, deployment, and even user interaction. Each stage presents opportunities for bias to be introduced or amplified.

# How AI can perpetuate and amplify existing **BIASES**

- AI systems learn patterns from their training data; if this data contains biases, the AI will learn and repeat these biases in its outputs. This creates a cycle where **existing inequalities are automated and scaled**.
- The **speed and scale** at which AI systems can operate mean that biases can be amplified far more rapidly and widely than through traditional human decision-making processes. A single biased algorithm can impact millions of individuals.
- AI can sometimes **mask or obscure the underlying biases** in its decision-making processes, making it harder to identify and challenge unfair outcomes. This lack of transparency can exacerbate the problem.
- **Feedback loops in AI systems can further amplify biases**. For example, if a biased AI makes a decision that reinforces an existing inequality, the data generated by that decision can then be used to retrain the AI, further strengthening the bias.
- The **NIST "socio-technical" approach** to bias recognises that AI operates within a larger social context. Biases can originate not just from data but also from human thought and institutional practices, all of which can be reflected and amplified by AI.

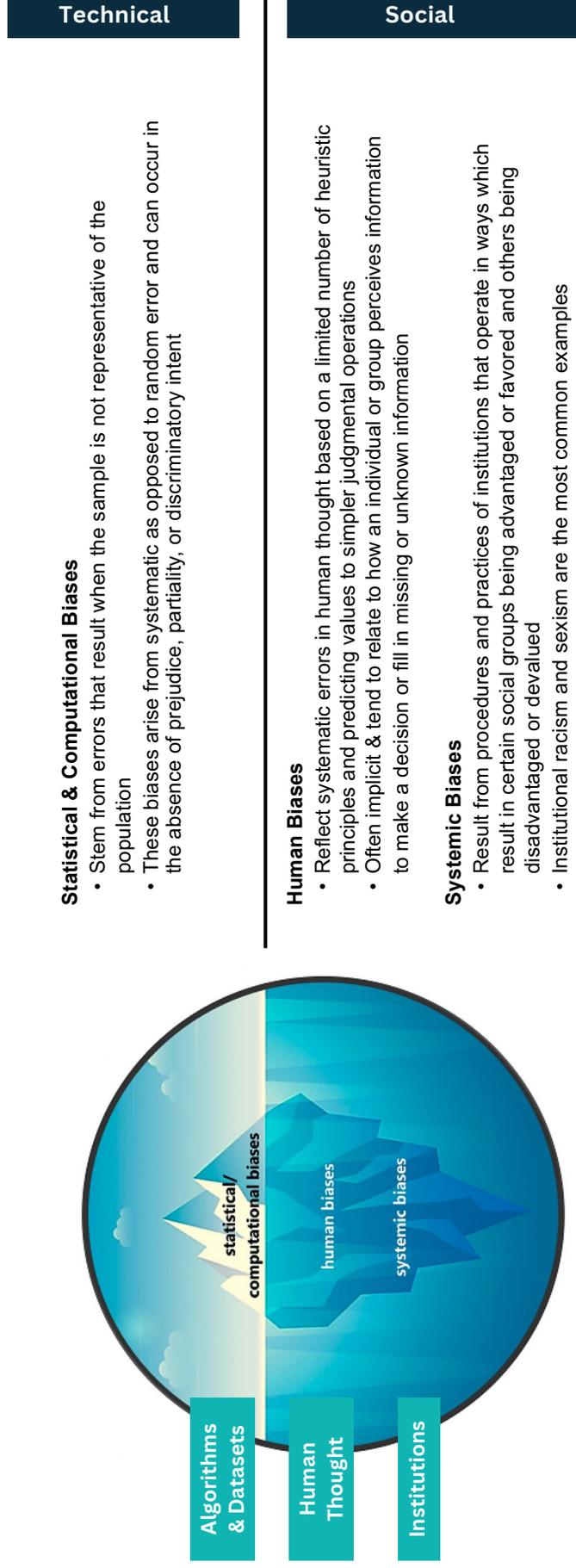


**Fig. 1.** The challenge of managing AI bias

Source: National Institute of Standards and Technology (NIST), "Towards a Standard for Identifying and Managing Bias in Artificial Intelligence," March 2022. Available at: <https://doi.org/10.6028/NIST.SP.1170>

# AI can perpetuate or amplify **BIAS**

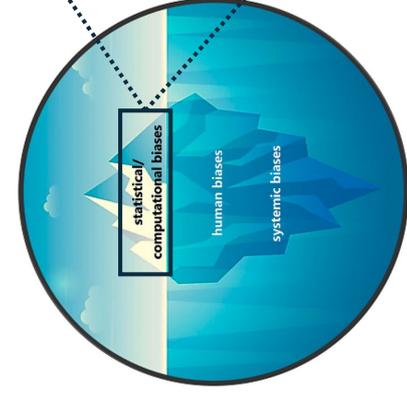
The NIST “socio-technical” approach to mitigating bias in AI recognizes that AI operates in a larger social context.



Source: National Institute of Standards and Technology. (2022). Towards a standard for identifying and managing bias in artificial intelligence. NIST Special Publication 1270. <https://doi.org/10.6028/NIST.SP.1270>

# Types of STATISTICAL & COMPUTATIONAL bias in AI (1 of 2)

Relate to errors that result when the sample is not representative of the population.



## Processing/Validation

1. amplification – Arises when the distribution over prediction outputs is skewed in comparison to the prior distribution of the prediction target
2. error propagation – Arises when applications built with ML are used to generate inputs for other ML algorithms
3. inherited – Arises when applications built with ML are used to generate inputs for other ML algorithms
4. model selection – Introduced while using the data to select a seemingly “best” model from a large set of models employing many predictor variables; or, when an explanatory variable has a weak relationship with the response variable
5. survivorship – Tendency for people to focus on the items, observations, or people that “survive” or make it past a selection process, while overlooking those that did not

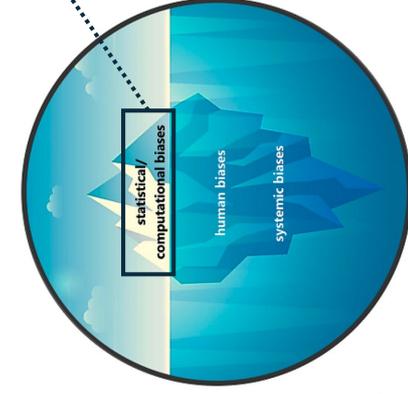
## Selection and Sampling

6. data generation – Arises from the addition of synthetic or redundant data samples to a dataset
7. detection – Systematic differences between groups in how outcomes are determined; may cause an over- or under-estimation of the size of the effect
8. ecological fallacy – When an inference is made about an individual based on their membership within a group
9. evaluation – When the testing or external benchmark populations do not equally represent the various parts of the user population or from the use of performance metrics that are not appropriate for the way in which the model will be used
10. exclusion – When specific groups of user populations are excluded from testing and subsequent analyses
11. measurement – Arises when features and labels are proxies for desired quantities, potentially leaving out important factors or introducing group or input-dependent noise that leads to differential performance
12. popularity – Occurs when items that are more popular are more exposed and less popular items are under-represented
13. population – Systematic distortions in demographics or other user characteristics between a population of users represented in a dataset or on a platform and some target population
14. representation – Arises due to non-random sampling of subgroups, causing trends estimated for one population to not be generalizable to data collected from a new population
15. Simpson’s Paradox – A statistical phenomenon where the marginal association between two categorical variables is qualitatively different from the partial association between the same two variables after controlling for one or more other variables
16. temporal – Arises from differences in populations and behaviors over time

[Source: National Institute of Standards and Technology. \(2022\). Towards a standard for identifying and managing bias in artificial intelligence. NIST Special Publication 1270. https://doi.org/10.6028/NIST.SP.1270](https://doi.org/10.6028/NIST.SP.1270)

# Types of STATISTICAL & COMPUTATIONAL bias in AI (2 of 2)

Relate to errors that result when the sample is not representative of the population.



## Use and Interpretation

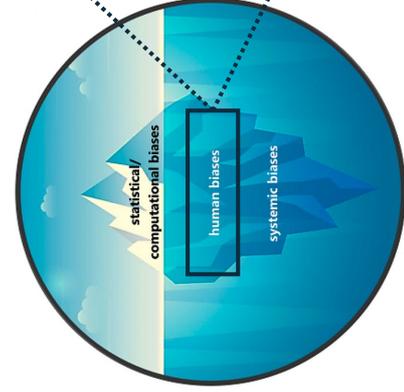
17. uncertainty – Arises when predictive algorithms favor groups that are better represented in the training data, since there will be less uncertainty associated with those predictions
18. activity – Occurs when systems/platforms get their training data from their most active users, rather than those less active (or inactive)
19. concept drift – Use of a system outside the planned domain of the application (a common cause of performance gaps between laboratory settings and the real world)
20. content production – Arises from structural, lexical, semantic, and syntactic differences in the contents generated by users
21. data dredging – A statistical bias in which testing huge numbers of hypotheses of a dataset may appear to yield statistical significance even when the results are statistically nonsignificant
22. emergent – Use of a system outside the planned domain of application (a common cause of performance gaps between laboratory settings and the real world)
23. feedback loop – Effects that may occur when an algorithm learns from user behavior and feeds that behavior back into the model
24. linking – Arises when network attributes obtained from user connections, activities, or interactions differ and misrepresent the true behavior of the users

Algorithms  
& Datasets

Source: National Institute of Standards and Technology. (2022). Towards a standard for identifying and managing bias in artificial intelligence. <https://doi.org/10.6028/NIST.SP.1270>

# Types of HUMAN biases in AI (1 of 2)

Relate to how people use data to fill in missing information.



## Group

25. deployment – Arises when systems are used as decision aids for humans, since the human intermediary may act on predictions in ways that are typically not modeled in the system.
26. funding – Arises when biased results are reported in order to support or satisfy the funding agency or financial supporter of the research study, but it can also be the individual researcher.
27. groupthink – A psychological phenomenon that occurs when people in a group tend to make non-optimal decisions based on their desire to conform to the group, or fear of dissenting with the group.
28. sunk cost fallacy – A human tendency where people opt to continue with an endeavor or behavior due to previously spent or invested resources, such as money, time, and effort, regardless of whether costs outweigh benefits.

## Individual

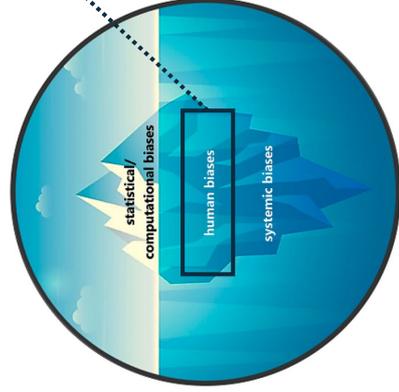
29. anchoring – A cognitive bias, the influence of a particular reference point or anchor on people's decisions.
30. annotator reporting – When users rely on automation as a heuristic replacement for their own information seeking and processing.
31. automation complacency – When humans over-rely on automated systems or have their skills attenuated by such over-reliance (e.g., spelling and autocorrect or spellcheckers).
32. availability heuristic – (also referred to as availability bias) A mental shortcut whereby people tend to overweight what comes easily or quickly to mind, meaning that what is easier to recall – e.g., more “available” – receives greater emphasis in judgement and decision-making.
33. behavioral – Systematic distortions in user behavior across platforms or contexts, or across users represented in different datasets.
34. cognitive – A broad term referring generally to a systematic pattern of deviation from rational judgement and decision-making. A large variety of cognitive biases have been identified over many decades of research in judgement and decision-making, some of which are adaptive mental shortcuts known as heuristics.
35. confirmation – (also referred to as confirmatory bias) A cognitive bias where people tend to prefer information that aligns with, or confirms, their existing beliefs.
36. consumer – Arises when an algorithm or platform provides users with a new venue within which to express their biases, and may occur from either side, or party, in a digital interaction.

Human Thoughts

Source: National Institute of Standards and Technology. (2022). Towards a standard for identifying and managing bias in artificial intelligence. <https://doi.org/10.6028/NIST.SP.1270>

# Types of HUMAN biases in AI (2 of 2)

Relate to how people use data to fill in missing information.



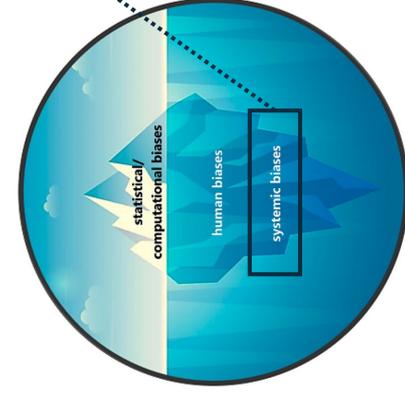
## Individual (continued)

37. Dunning-Kruger effect – A cognitive bias, the tendency of people with low ability in a given area or task to overestimate their self-assessed ability.
38. human reporting – When users rely on automation as a heuristic replacement for their own information seeking and processing.
39. implicit – An unconscious belief, attitude, feeling, association, or stereotype that can affect the way in which humans process information, make decisions, and take actions
40. interpretation – A form of information processing bias that can occur when users interpret algorithmic outputs according to their internalized biases and views.
41. loss of situational awareness – When automation leads to humans being unaware of their situation such that, when control of a system is given back to them in a situation where humans and machines cooperate, they are unprepared to assume their duties.
42. mode confusion – When modal interfaces confuse human operators, who misunderstand which mode the system is using, taking actions which are correct for a different mode but incorrect for their current situation.
43. presentation – Biases arising from how information is presented on the Web, via a user interface, due to rating or ranking of output, or through users' own self-selected, biased interaction.
44. ranking – (a form of anchoring bias) The idea that top-ranked results are the most relevant and important and will result in more clicks than other results.
45. Rashomon effect or principle – Refers to differences in perspective, memory and recall, interpretation, and reporting on the same event from multiple persons or witnesses.
46. selective adherence – Decision-makers' inclination to selectively adopt algorithmic advice when it matches their pre-existing beliefs and stereotypes.
47. streetlight effect – A bias whereby people tend to search only where it is easiest to look.
48. user interaction – Arises when a user imposes their own self-selected biases and behavior during interaction with data, output, results, etc.

Source: National Institute of Standards and Technology. (2022). Towards a standard for identifying and managing bias in artificial intelligence. <https://doi.org/10.6028/NIST.SP.1270>

# Types of **SYSTEMIC** biases in AI

Relate to institutions that operate in ways that disadvantage/disvalue certain social groups.



## Systemic

49. historical – Long-standing biases encoded in society over time.

50. institutional – A tendency exhibited at the level of entire institutions, where practices or norms result in the favoring or disadvantaging of certain social groups.

51. societal – (also referred to as social bias) Can be positive or negative, and take a number of different forms, but is typically characterized as being for or against groups or individuals based on social identities, demographic factors, or immutable physical characteristics.

Institutions

Source: National Institute of Standards and Technology. (2022). [Towards a standard for identifying and managing bias in artificial intelligence](https://doi.org/10.6028/NIST.SP.1270). NIST Special Publication 1270. <https://doi.org/10.6028/NIST.SP.1270>

# How biases contribute to **HARMS**

Fig. 5 provides examples of how the three categories of bias—systemic, statistical and computational, and human - interact and contribute to harms within the data and processes used in AI applications, and the validation procedures for determining performance.

	Systemic Biases	Statistical and Computational Biases	Human Biases
 <p><b>Datasets</b> <i>Who is counted, and who is not counted?</i></p>	<ul style="list-style-type: none"> <li>Issues with latent variables</li> <li>Underrepresentation of marginalized groups</li> </ul>	<ul style="list-style-type: none"> <li>Sampling and selection bias</li> <li>Using proxy variables because they are easier to measure</li> <li>Automation bias</li> </ul>	<ul style="list-style-type: none"> <li>Observational bias (streetlight effect)</li> <li>Availability bias (anchoring)</li> <li>McNamara fallacy</li> </ul>
 <p><b>Processes and Human Factors</b> <i>What is important?</i></p>	<ul style="list-style-type: none"> <li>Automation of inequalities</li> <li>Underrepresentation in determining utility function</li> <li>Processes that favor the majority/minority</li> <li>Cultural bias in the objective function (best for individuals vs best for the group)</li> </ul>	<ul style="list-style-type: none"> <li>Likert scale (categorical to ordinal to cardinal)</li> <li>Nonlinear vs linear</li> <li>Ecological fallacy</li> <li>Minimizing the L1 vs. L2 norm</li> <li>General difficulty in quantifying contextual phenomena</li> </ul>	<ul style="list-style-type: none"> <li>Groupthink leads to narrow choices</li> <li>Rashomon effect leads to subjective advocacy</li> <li>Difficulty in quantifying objectives may lead to McNamara fallacy</li> </ul>
 <p><b>TEVV</b> <i>How do we know what is right?</i></p>	<ul style="list-style-type: none"> <li>Reinforcement of inequalities (groups are impacted more with higher use of AI)</li> <li>Predictive policing more negatively impacted</li> <li>Widespread adoption of ridesharing/self-driving cars/etc. may change policies that impact population based on use</li> </ul>	<ul style="list-style-type: none"> <li>Lack of adequate cross-validation</li> <li>Survivorship bias</li> <li>Difficulty with fairness</li> </ul>	<ul style="list-style-type: none"> <li>Confirmation bias</li> <li>Automation bias</li> </ul>

**Fig. 5.** How biases contribute to harms

Source: National Institute of Standards and Technology. (2022). [Towards a standard for identifying and managing bias in artificial intelligence. NIST Special Publication 1270. https://doi.org/10.6028/NIST.SP.1270](https://doi.org/10.6028/NIST.SP.1270)

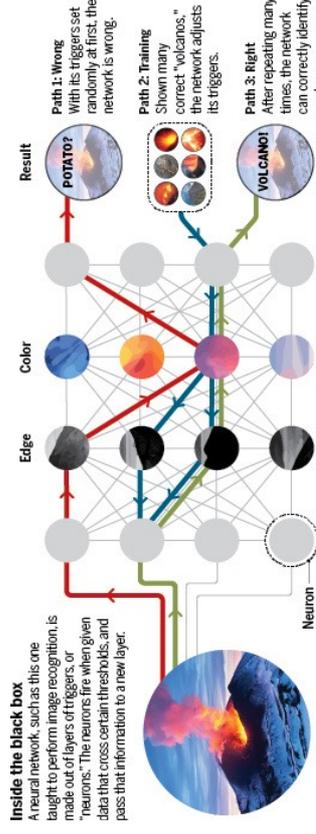
# BLACK-BOX decision-making

## What Are Black-Box AI Models?

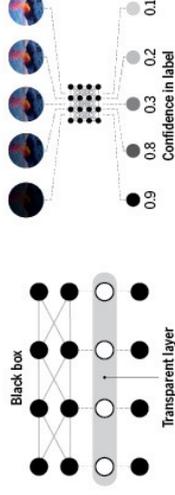
AI models whose internal workings are opaque; they produce outputs without providing insight into the decision-making process. Often based on complex neural networks with many hidden layers.

### Challenges in Understanding & Explaining AI Decisions:

- **Interpretability:** Difficult to trace how specific inputs lead to outputs, complicating error analysis and debugging.
- **Transparency:** Limited visibility into model behavior hinders explanation and verification.
- **Accountability:** Challenges in understanding decision rationale make it hard to hold systems or developers accountable.
- **Impact on Stakeholder Trust & Accountability:**
  - **Reduced Trust:** Opaque decision-making erodes confidence among users, regulators, and investors.
  - **Regulatory Risks:** Non-transparent AI can lead to compliance issues with emerging explainability standards and legal requirements.
  - **Operational Risks:** Difficulties in auditing and improving models may lead to persistent errors and reputational damage.

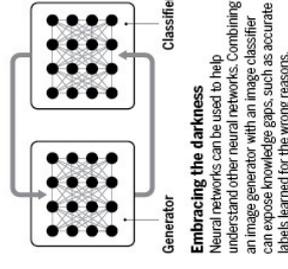


**Into the darkness**  
Researchers have developed three broad classes of tools to look inside neural networks.



**Controlling the black box**  
Some models guarantee relationships between two variables, like square footage and house price. These models are more transparent and can be wired into a neural network, helping control it.

**Probing the black box**  
Researchers perturb the inputs to a trained neural network to see what most affects its decision-making. The probing can reveal the cause for one decision, but not the overall logic.



**Embracing the darkness**  
Neural networks can be used to help understand other neural networks. Combining an image generator with an image classifier can expose knowledge gaps, such as accurate labels learned for the wrong reasons.

Source: <https://www.science.org/content/article/why-ai-detectives-are-cracking-open-black-box-deep-learning>

# NIST's Four Principles of EXPLAINABLE AI (XAI)

## Foundational Framework for Designing Effective Explanation Systems

### PRINCIPLE 1

#### Explanation

The system should provide evidence or reasons for its outputs. This establishes the baseline expectation that AI systems can articulate the basis for their decisions or predictions in some form accessible to relevant stakeholders.

→ *Local attributions (LIME, SHAP)*

### PRINCIPLE 2

#### Meaningful

Explanations should be understandable and useful to the intended audience. Meaningfulness requires tailoring explanation format, detail level, and technical sophistication to match the knowledge, goals, and decision-making context of specific user groups.

→ *Model cards, stakeholder-specific patterns*

### PRINCIPLE 3

#### Explanation Accuracy

What is asserted in the explanation should be correct for the model and case at hand. This addresses the critical challenge that many XAI techniques produce approximations or simplifications that may not faithfully represent actual model behavior.

→ *Calibration plots, fidelity metrics, stability testing*

### PRINCIPLE 4

#### Knowledge Limits

The system should identify when it is likely to error when inputs fall outside its scope of competence. Transparency about these limits enables appropriate use and prevents over-reliance on system outputs in contexts where they may be unreliable.

→ *Abstain/deferred policies, confidence thresholds*

Source: National Institute of Standards and Technology (NIST), "NIST Interagency/Internal Report (NIST IR 8312): Four Principles of Explainable Artificial Intelligence (XAI)," October 2021. Available at: <https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8312.pdf>

# AI outputs can also be impacted by **MODEL** issues

These challenges can surface during development, training, or deployment (and ongoing monitoring and retraining is critical).

1	<b>Hallucination</b>	<ul style="list-style-type: none"><li>• AI may perceive patterns or objects that are nonexistent or imperceptible to human observers</li><li>• Outputs can be nonsensical or inaccurate</li></ul>
2	<b>Plagiarism</b>	<ul style="list-style-type: none"><li>• AI creates new patterns by synthesizing the many examples in their training data sets</li><li>• Some output may be (too) identical to those inputs instead of new and unique</li></ul>
3	<b>Stagnation</b>	<ul style="list-style-type: none"><li>• After AI creates a model from its training data, that model may not change much</li><li>• Retraining models over time helps them adapt and overcome being limited to their initial static state</li></ul>
4	<b>Stupidity</b>	<ul style="list-style-type: none"><li>• AI often makes mistakes with counting and abstract or contextual uses of math</li><li>• AI thinks differently than humans do so its intelligence and stupidity will differ, too</li></ul>
5	<b>Quality</b>	<ul style="list-style-type: none"><li>• Low-quality data creates noise in the signals, increases processing, and reduces output quality</li><li>• Use trusted, governed data inputs to reduce signals &amp; increase AI effectiveness</li></ul>
6	<b>Replication</b>	<ul style="list-style-type: none"><li>• Deployed models using real-life data may not perform the same as during development or testing</li><li>• Ensure training data sets are diverse and representative of real-life scenarios and retrain models</li></ul>
7	<b>Security</b>	<ul style="list-style-type: none"><li>• Attackers can ask the right questions to get data they want (bypassing attempts to keep it secured)</li><li>• Conduct robust testing and ethical hacking to find and address any such holes before deployment</li></ul>

# Many AI efforts face common FAILURES

Implementation can be challenging as AI approaches are still being developed and refined.

	Failure	Lesson
1	<b>Misperceiving reality</b>	<ul style="list-style-type: none"> <li>Overestimation of “out of the box” functionality vs. aspirational capabilities</li> <li>Organizational processes that are incompatible with AI approaches</li> </ul>
2	<b>Unrealistic expectations &amp; budgets</b>	<ul style="list-style-type: none"> <li>Not understanding the problem or what’s needed for the solution</li> <li>Inadequate budget for the complexity of the task</li> <li>Lowballed estimates of the challenge</li> </ul>
3	<b>Overpromised functionality</b>	<ul style="list-style-type: none"> <li>New/emerging technologies may not be fully baked or cost-effective</li> <li>Blurred lines between what’s theoretical vs. ready and practical</li> <li>Underestimating effort and cost to reach the maturity of AI providers</li> </ul>
4	<b>Incorrect resources</b>	<ul style="list-style-type: none"> <li>Few to no internal resources already skilled in AI</li> <li>Difficulty finding/recruiting specialized roles for AI</li> </ul>
5	<b>Overly broad scope</b>	<ul style="list-style-type: none"> <li>Considering problems holistically may seem too broad to tackle</li> <li>Difficulty executing in an agile or iterative fashion</li> </ul>
6	<b>Overly complex technology</b>	<ul style="list-style-type: none"> <li>M&amp;A models often leverage discrete systems with costly integrations</li> <li>Differing architectures, languages and approaches add cost and complexity</li> </ul>
7	<b>Lack of training data</b>	<ul style="list-style-type: none"> <li>Data sources that are noisy and dirty</li> <li>Throwing all the data at AI and expecting meaningful results</li> </ul>
8	<b>Not laying the data foundation</b>	<ul style="list-style-type: none"> <li>Multiple disconnected initiatives with conflicting objectives or priorities</li> <li>Focusing on cost or deadlines over building basic data discipline</li> <li>Not looking past problems to see and understand the true underlying issues</li> </ul>

Source: Fairley, S., & Davemport, T. H. (2020). [The AI-covered enterprise: Harness the power of ontologies to make your business smarter, faster, and more profitable. LifeTree Media.](#)

# Human-Centric AI: **AUGMENTATION**, Not Replacement

*Preserving Human Autonomy and Meaningful Oversight*

Human-centric AI means designing systems that **augment human capabilities** while respecting autonomy and dignity. AI should enhance human decision-making, not replace it. The goal is not to eliminate human judgment but to provide tools that enable better-informed, more consistent, and more efficient decisions while preserving meaningful human agency.



Image Credit: Image generated by Midjourney, OpenAI.

## The Augmentation Principle

AI systems should be designed to complement human strengths and compensate for human limitations, not to bypass human judgment entirely. This requires understanding what humans do well (contextual reasoning, ethical judgment, handling novel situations) and what AI does well (processing large volumes of data, identifying patterns, maintaining consistency).

# Human OVERSIGHT MODES: HITL, HOTL, HIC



## Models of Human-AI Interaction

	Human-In-The-Loop (HITL)	Human-On-The-Loop (HOTL)	Human-In-Command (HIC)
Level of Human Involvement	Continuous; collaborative; active participation in decision-making	Supervisory; intervene only when necessary	Ultimate decision-making authority
AI Autonomy	Reliant on human handshake; varies; typically acts autonomously until human review is needed	Operates autonomously with human oversight	Can act autonomously but will never decide autonomously
Efficiency	Lower, due to the need for constant human input	Higher than HITL, balanced with oversight	Varies; prioritizes control over efficiency
Control & Safety	High control; allows for nuanced decisions	Balanced control; efficient for routine tasks	Maximum control
Typical Healthcare Use Cases	Clinical decision-making support; pathology analysis	Remote patient monitoring	Robotic surgery

Source: DeepScribe, "Optimizing Human-AI Collaboration: A Guide to HITL, HOTL, and HIC Systems." DeepScribe Resources. Available at: [https://www.deepscribe.ai/resources/optimizing-human-ai-collaboration-a-guide-to-hitl-hotl-and-hic-systems?iss\\_channel=ep-19018424](https://www.deepscribe.ai/resources/optimizing-human-ai-collaboration-a-guide-to-hitl-hotl-and-hic-systems?iss_channel=ep-19018424)

# Model CARDS & System Factsheets

Model cards and system factsheets serve as **standardized transparency artifacts** that document AI system characteristics, performance, and limitations. These tools operationalize transparency principles by providing structured, accessible information to diverse stakeholders.

## What Model Cards Provide

Model cards summarize intended use, training data characteristics, evaluation results (including disaggregated metrics across subgroups), known limitations, and ethical considerations. System factsheets extend this to system-level context: data lineage, oversight mode, escalation paths, recourse mechanisms, and change-control history.

## Key components of a Model Card

<b>Component</b>
Model Overview
Intended Use
Model Architecture & Training Data
Performance Metrics
Evaluation Data
Ethical Considerations
Bias & Fairness Analysis
Safety, Security & Robustness
Limitations
Maintenance & Versioning

Model Card for Breast Cancer Wisconsin (Diagnostic) Dataset

**Model Details**

**Overview:**  
This model predicts whether breast cancer is benign or malignant based on image features.

**Version:**  
1.0.0

**Owners:**  
Google Cloud

**References:**  
Breast Cancer Wisconsin Diagnostic Dataset

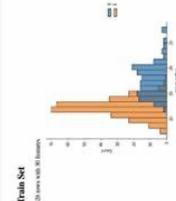
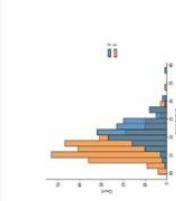
**Considerations**

**Intended Users:**  
Medical professionals

**Use Cases:**  
Breast cancer diagnosis

**Limitations:**  
Breast cancer diagnosis

**Ethical Considerations:**  
This model involves image analysis to detect small cancer lesions. It requires binary labels for each pixel.

Capability Benchmark	Gemini 2.5 Flash Preview (4k-PP) Training	Gemini 2.0 Flash Thinking	OpenAI o1-mini	Claude 3.7 Sonnet 4.0 (Extended Thinking)	Grok 3 Beta (Extended Thinking)	DeepSeek R1
Reasoning & Knowledge: <b>Humanity's Last Exam (no tool)</b>	51%	14.3%	8.9%	—	—	8.69*
Science: <b>GPQA diamond</b>	70.3%	60.7%	61.6%	78.2%	80.2%	71.5%
Mathematics: <b>AMC 2025</b>	78.0%	22.5%	92.7%	49.5%	72.3%	70.0%
Mathematics: <b>AMC 2024</b>	86.0%	32.0%	95.4%	61.3%	83.9%	79.8%
Code generation: <b>LiveCodeBench vs</b>	63.5%	34.5%	—	60.0%	63.3%	—
Code editing: <b>Aider Polyglot</b>	51% / 44.2%	22.2%	68.9% / 58.2%	—	79.4%	—
Factuality: <b>SimpleQA</b>	29.7%	29.9%	—	—	43.6%	30.3%

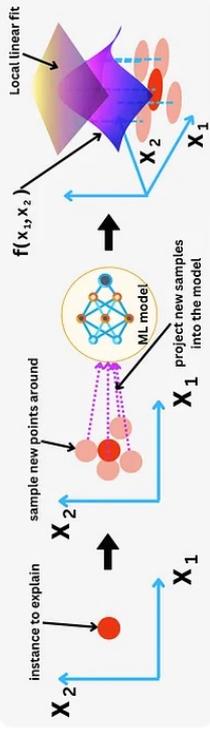
# Model-Agnostic XAI TOOLS – LIME & SHAP

	(Local Interpretable M
<b>Definition</b>	A method that explains <b>one</b> simple, local model around 1
<b>Mechanism</b>	Perturbs (slightly changes) t trains a simple model (like a and uses that to say which f
<b>Strengths</b>	- Simple and intuitive idea - Fast and flexible - Works with almost any mo

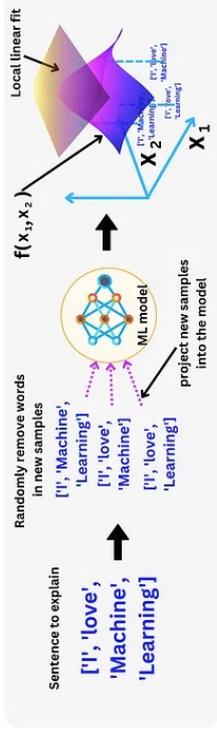
# Model-Agnostic XAI TOOLS – LIME & SHAP

## Explainable AI: LIME

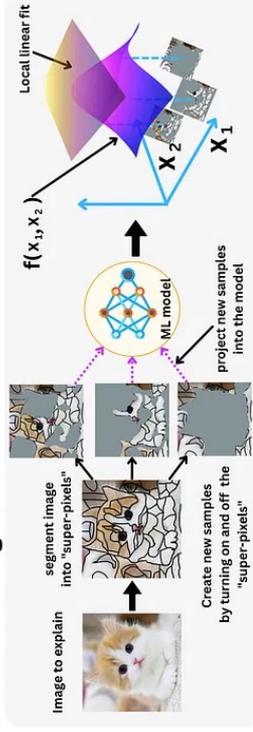
### LIME with Tabular data



### LIME with Text data

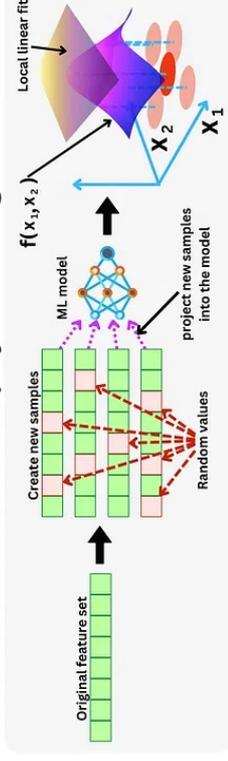


### LIME with Image data

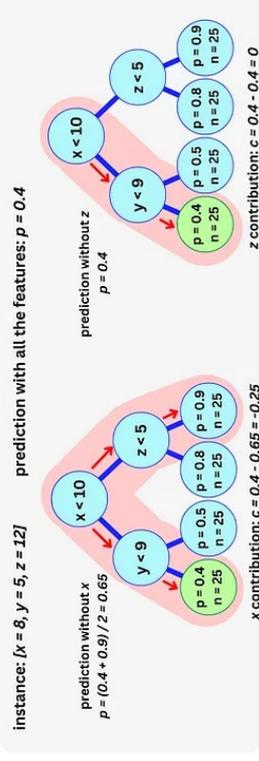


## Explainable AI: SHAP

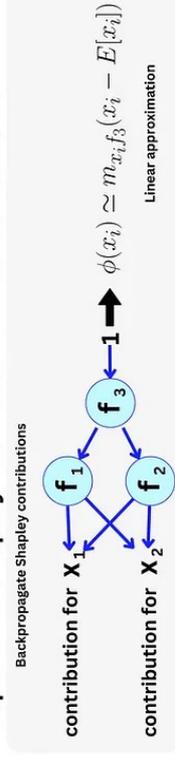
### Kernel SHAP: LIME with Shapley Smoothing Kernel



### Tree SHAP: Shapley estimates for Trees



### Deep SHAP: Shapley estimates for Neural Networks



Source: The AI Edge, "Explainable AI – LIME and..." The AI Edge Newsletter. Available at: <https://newsletter.theaiedge.io/issue-ai-edge-explainable-ai-lime-and-...>

# Data Governance Central Role of Data

[Back to Agenda](#)

## Data: A strategic **ASSET** powering AI advantage

AI is fundamentally dependent on data because it relies on historical examples and patterns within that data to learn, adapt, and make predictions.

- In the age of AI, data has evolved into a **key strategic asset**. Organizations that possess unique, high-quality, and well-managed data gain a significant competitive edge in developing superior AI solutions.
- AI can unlock hidden **insights and value** from data, leading to better decision-making, personalized customer experiences, and innovative products and services.
- Governing data effectively transforms it from a potential liability into a **valuable asset** that fuels AI-driven growth and innovation.
- Consider how **data rights and data sovereignty** impact the strategic use of data for AI initiatives.



Image Credit: Image generated by Midjourney, OpenAI.

# Quality, Quantity, and Relevance in AI DATA

The critical trio.

- **Data Quality:** Accurate, consistent, complete, and timely data is essential for building reliable AI models. Poor data quality leads to flawed learning and inaccurate predictions.
- **Data Quantity:** Many AI techniques, especially deep learning, require large volumes of data to learn complex patterns and generalise effectively. Insufficient data can lead to overfitting and poor performance on new data.
- **Data Relevance:** The data used to train an AI must be directly relevant to the task the AI is intended to perform. Irrelevant data can introduce noise and hinder the model's ability to learn meaningful relationships.

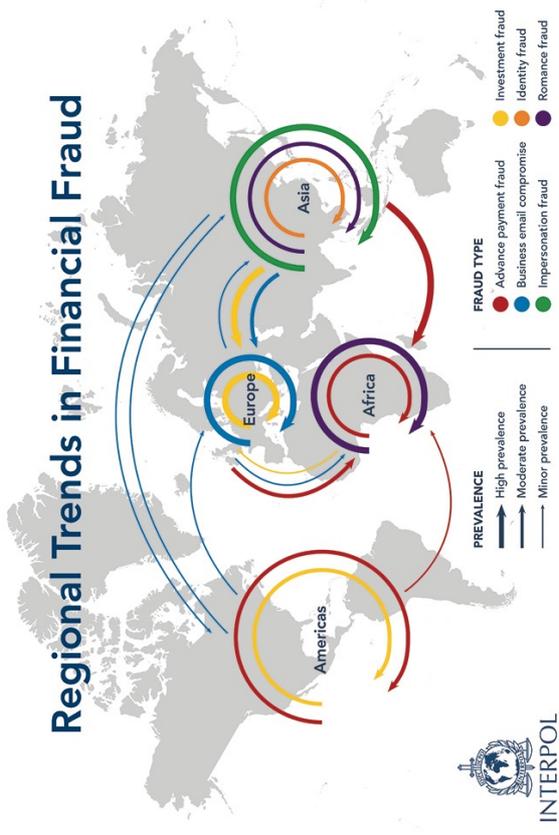
## Example: Fraud Detection

An AI designed to detect fraudulent transactions needs historical transaction data that is **accurate** (correct amounts, dates), **complete** (all relevant fields filled), and **relevant** to fraudulent activity (including both fraudulent and legitimate transactions).



INTERPOL has identified a global surge in financial fraud, attributing the rise to technological advancements and the proliferation of AI and cryptocurrencies. The organization emphasizes the need for urgent action to address the increasing scale and sophistication of fraud affecting individuals, businesses, and governments worldwide.

## Regional Trends in Financial Fraud



Source: [INTERPOL - "INTERPOL Financial Fraud assessment: A global threat boosted by technology", 2024. Available at: https://www.interpol.int/en/News-and-Events/News/2024/INTERPOL-Financial-Fraud-assessment-A-global-threat-boosted-by-technology](https://www.interpol.int/en/News-and-Events/News/2024/INTERPOL-Financial-Fraud-assessment-A-global-threat-boosted-by-technology)

# QUALITY of Data – The cornerstone of reliable AI

- **Data Quality** is paramount for effective AI. It encompasses accuracy, completeness, consistency, and timeliness.
- In fraud detection, high-quality data ensures the AI learns from correct transaction details, complete customer information, and consistent reporting formats.
- Inaccurate or incomplete data can lead to **false positives** (legitimate transactions incorrectly flagged as fraud) or **false negatives** (genuine fraud going undetected). This can result in customer frustration and financial losses.
- **Poor data quality masks data quality issues** for generative AI, making it harder to trust outputs.

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## Data quality for accurate AI fraud and risk scores

In the tech realm, the adage “garbage in, garbage out” underscores the importance of data quality. With an astonishing 120 zettabytes of data generated in 2023 alone, distinguishing between quality data and noise is more critical than ever. And with new AI solutions on the market every day, promising to be the next best solution to your problems, knowing what makes AI perform at its best is critical.

This article explores the significance of data quality, particularly in the context of developing AI for accurate fraud risk scoring, exploring what it entails and how to attain or cultivate quality data effectively.



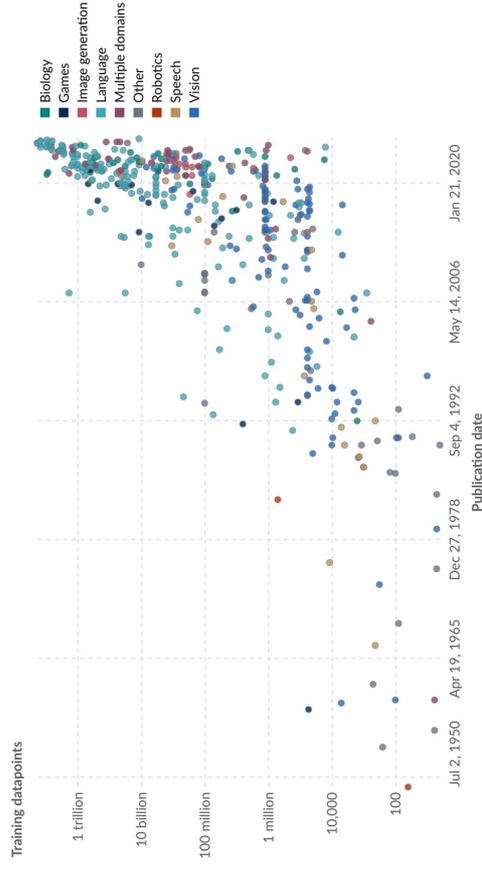
Source: Mastercard. “Data quality for accurate AI fraud and risk scores.” accessed: 15/04/2025. Available at <https://b2b.mastercard.com/news-and-insights/blog/data-quality-for-accurate-ai-fraud-and-risk-scores/>

# QUANTITY of Data – Fuel for effective AI models

- Many AI techniques, especially machine learning, require **large volumes of data** to learn complex patterns and generalize effectively.
- For fraud detection, a **substantial dataset** of both fraudulent and legitimate transactions allows the AI to discern subtle differences and identify sophisticated fraud schemes.
- **Insufficient data** can lead to overfitting, where the AI learns the training data too well and performs poorly on new, unseen transactions. It might fail to recognize new types of fraud.
- The **availability** of data for AI is crucial for data quality. Consider the need for historical data to train the model effectively.

## Datapoints used to train notable artificial intelligence systems

Each domain has a specific data point unit; for example, for vision it is images, for language it is words, and for games it is timesteps. This means systems can only be compared directly within the same domain.



Data source: Epoch (2025)

OurWorldinData.org/artificial-intelligence | CC BY

[Source: Our World in Data. Datapoints used to train notable artificial intelligence systems. 2025. Available at: https://ourworldindata.org/grapher/artificial-intelligence-number-of-training-datapoints.](https://ourworldindata.org/grapher/artificial-intelligence-number-of-training-datapoints)

## RELEVANCE of Data – Precision leads to actionable AI

- Data Relevance is critical; the data used to train the AI must contain **features and patterns directly related** to the phenomenon being predicted – in this case, fraudulent activity.
- For fraud detection, relevant data includes transaction amounts, timestamps, location information, user behaviour patterns, and device details.
- **Irrelevant data** can introduce **noise** and distract the AI from identifying the key indicators of fraud. Including unrelated demographic information, for example, might introduce bias without improving fraud detection accuracy.
- Consider the **target population** for the fraud detection model and ensure the training data is a good match.

# Data is a strategic ASSET

## BlueCross HealthCare



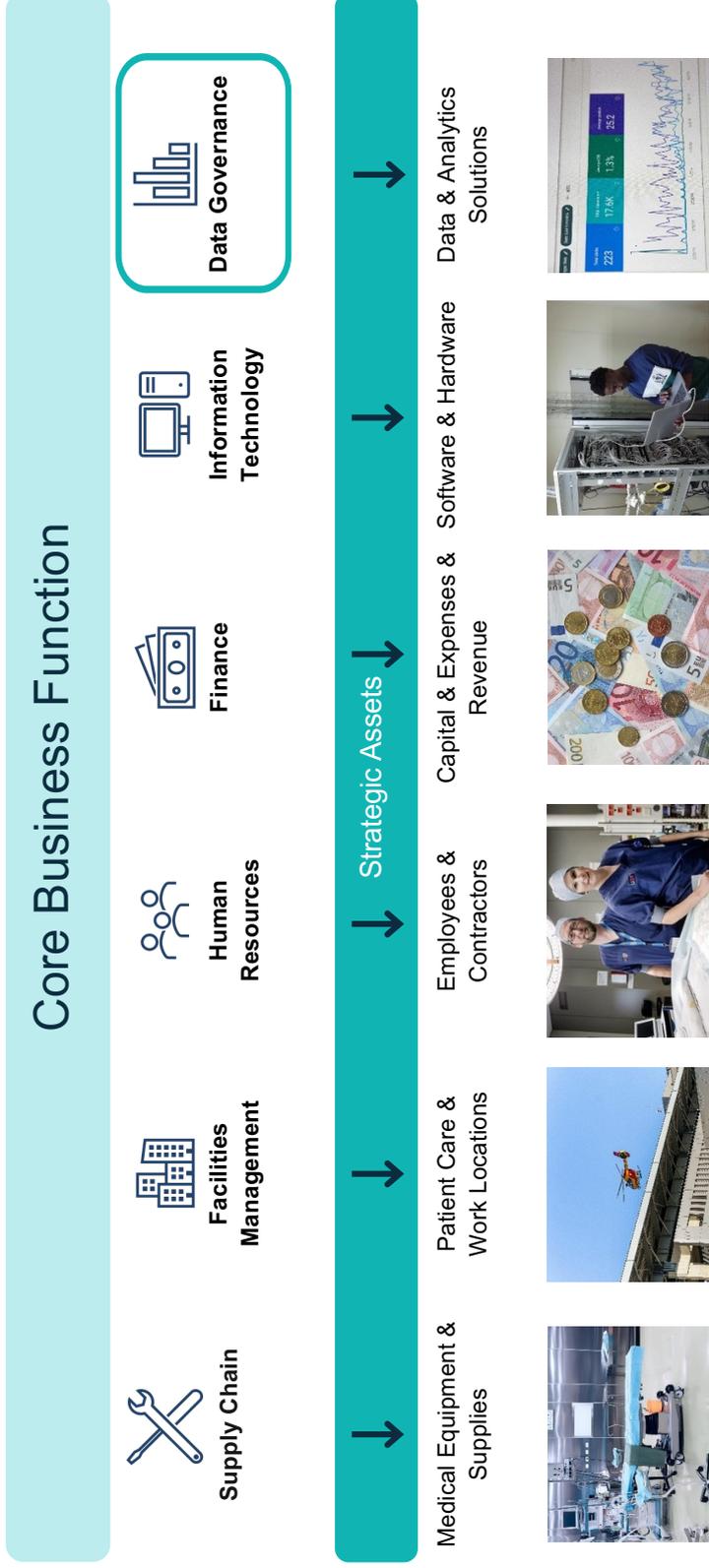
• **Vision Statement:** “To be a beacon of excellence in healthcare, providing qualitative, innovative, and patient-centered services that promote wellness and improve the quality of life for the communities we serve.”

• **Company Objectives:**

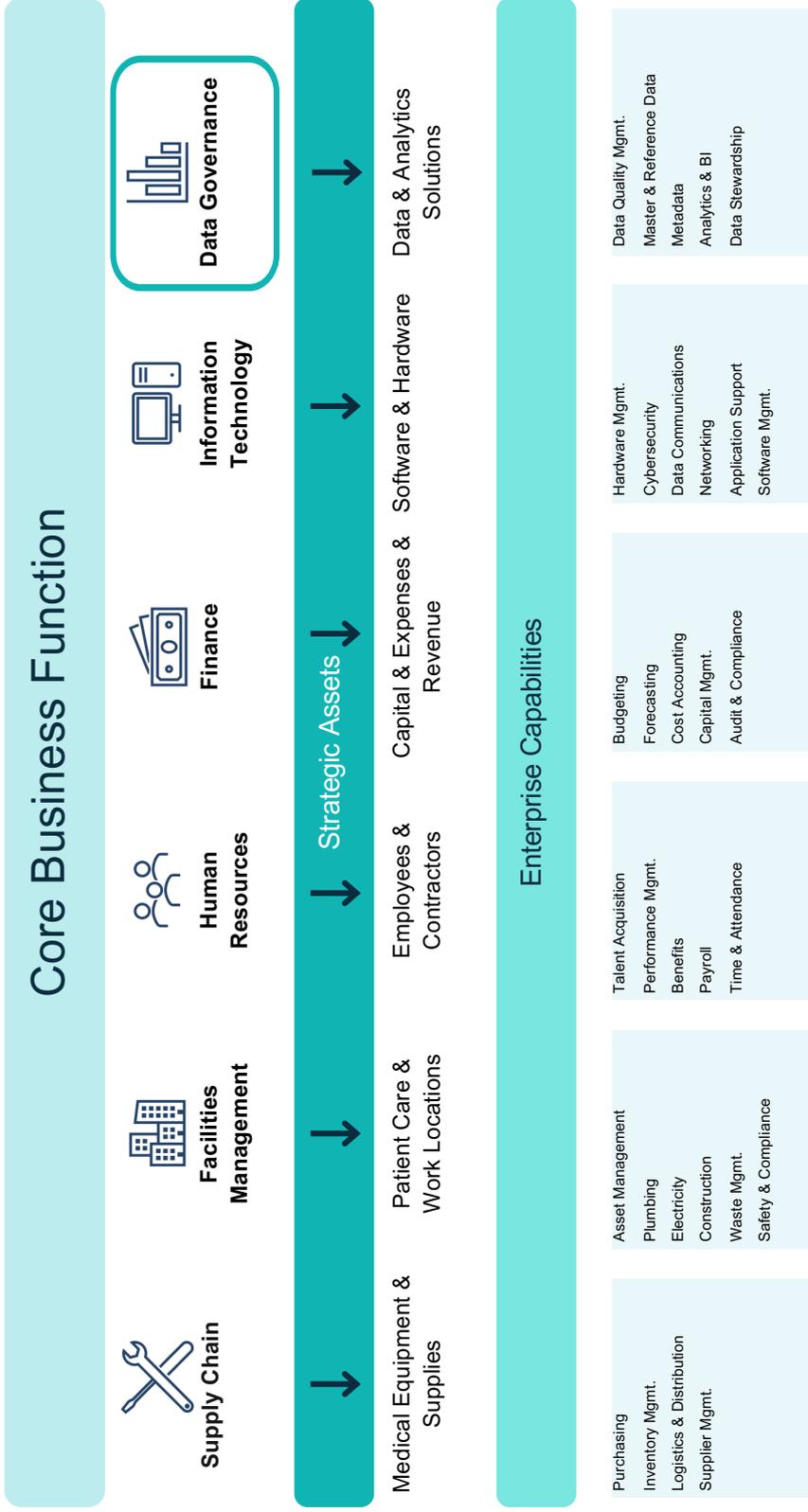
- Deliver Exceptional Patient Care
- Foster a Culture of Continuous Improvement
- Expand Community Health Initiatives



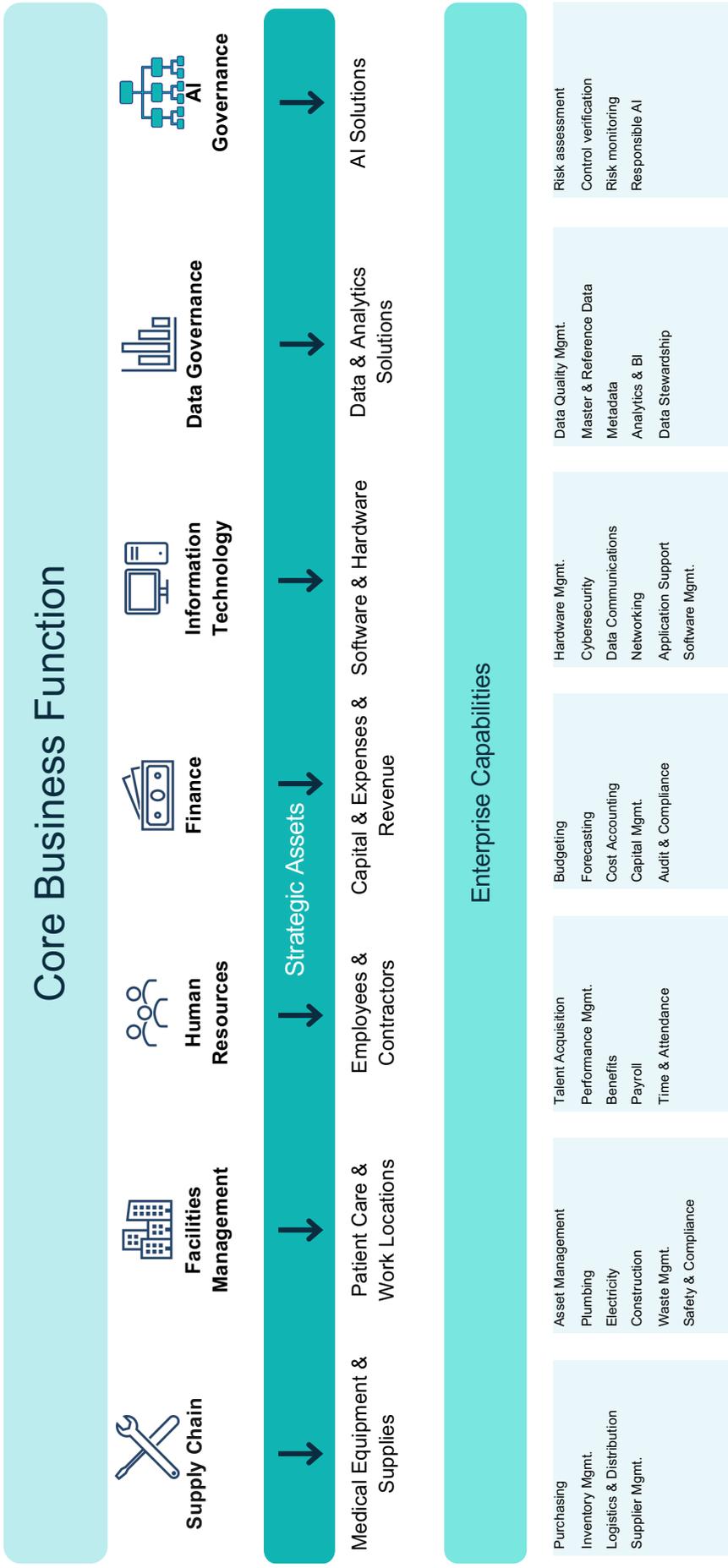
# Data is a strategic **ASSET**



# Mindset Shift: Data Governance is **MANAGING** data as an asset



# Mindset Shift: Is AI Governance also **MANAGING** AI as an asset?



# Mindset Shift: Is AI Governance also **MANAGING** AI as an asset?

## Human Resource Management

- Manages employee assets enterprise-wide
- Establishes hiring, promotion, and benefits policies
- Provides support, tools, and systems
- Clarifies roles and organizational structure
- Enables consistent HR practices
- Addresses complex employee issues

## Finance Management

- Manages financial assets enterprise-wide
- Sets financial standards and compliance policies
- Provides budgeting and reporting tools
- Clarifies roles and financial accountability
- Enables consistent financial practices
- Addresses financial issues and compliance

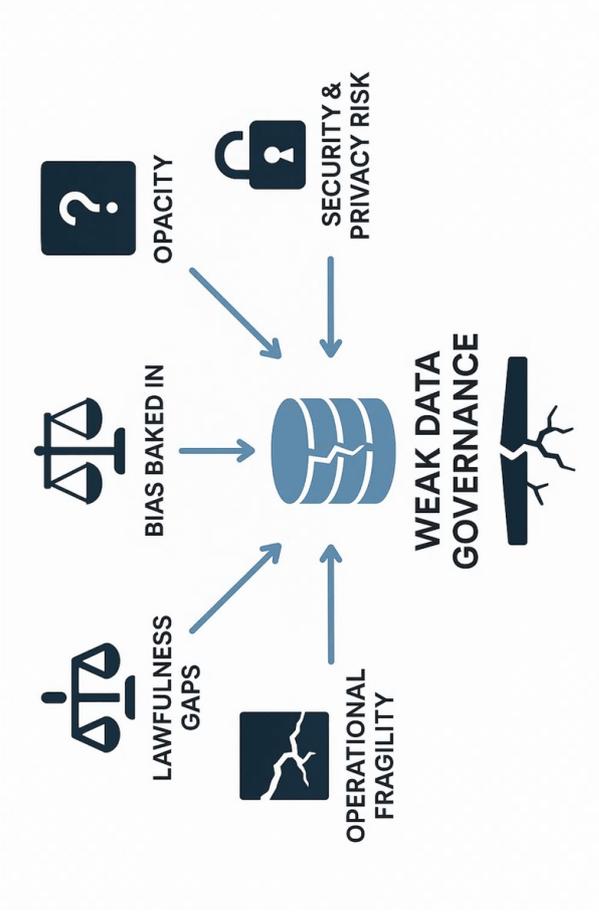
## Data Governance

- Manages data assets enterprise-wide
- Defines standards, policies, and guidelines
- Provides templates, tools, and expertise
- Clarifies roles for data management
- Enables consistent data practices
- Addresses data privacy, security, compliance issues

## Why **DATA GOVERNANCE** matters for AI

Poor data governance creates cascading failures across legal, ethical, operational, and technical dimensions.

Data governance is not merely a compliance exercise—it is the foundational capability that determines whether AI systems are lawful, fair, transparent, and trustworthy.



Weak data governance manifests in five interconnected **failure modes** that expose organizations to regulatory penalties, reputational damage, discriminatory outcomes, security breaches, and operational instability.

# Five FAILURE modes in detail

Each failure mode represents a distinct dimension of risk arising from inadequate data governance. These modes are not mutually exclusive— organizations often **experience multiple failures** simultaneously, creating compounding regulatory and operational consequences.

Failure mode	Short description	How it manifests in practice	Typical consequences
Lawfulness gaps	AI is built or used without satisfying legal/contractual requirements.	No clear lawful basis for using personal data; missing DPIA; breach of terms of use for scraped data; high-risk AI deployed without required documentation or oversight.	Regulatory enforcement; inability to use system; loss of partners.
Bias baked in	Structural or statistical bias is embedded in data, labels, or model design.	Training data under-represents key groups; labels reflect human prejudice; no subgroup performance checks; model optimizes only for global accuracy, ignoring group disparities.	Discriminatory outcomes; reputational damage; loss of trust.
Opacity	System behavior is not understandable or traceable to humans.	No documentation of model intent, data, or assumptions; lack of model cards or datasheets; no explanation interface for decisions; code and configuration changes unlogged.	Inability to explain outcomes; regulatory non-compliance; loss of accountability.
		Weak access controls; no adversarial testing.	Data breaches.

# The amplified **IMPACT** of Data Governance on AI outcomes

- **Robust data governance is foundational** for responsible and effective AI. It provides the necessary framework for ensuring data quality, integrity, security, and ethical use in AI systems.
- **Poor data governance** significantly amplifies the risks associated with AI, including bias, inaccuracies, privacy violations, and lack of transparency.
- Effective data governance practices, such as **data quality** management, **metadata** management, and **data lineage** tracking, are crucial for building trust and explainability in AI models.
- Consider how data governance aligns with AI governance frameworks and **regulatory requirements**, such as the EU AI Act and the NIST AI Risk Management Framework.
- **Example:** *Without proper data governance, an AI used for loan applications might unknowingly be trained on historical data containing gender or racial bias, leading to discriminatory outcomes.*

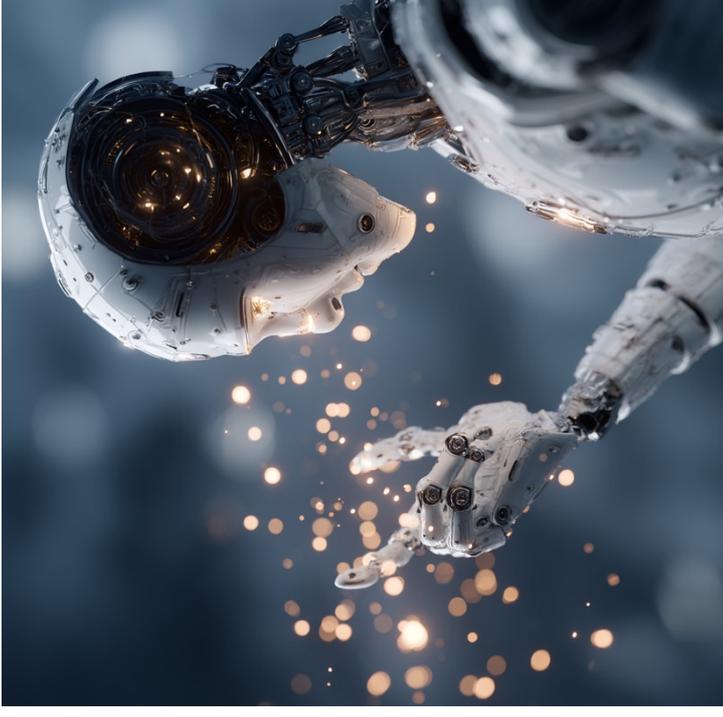


Image Credit: Image generated by Midjourney, OpenAI.

# The tangible **COSTS** of poor Data Governance in AI initiatives

- **Increased development costs and delays** due to the need to clean, validate, and correct flawed data used for AI training.
- **Reduced accuracy and reliability** of AI models, leading to poor decision-making and potentially harmful outcomes.
- **Higher operational costs** associated with managing errors, rework, and customer dissatisfaction resulting from flawed AI outputs.
- **Significant reputational damage** and loss of customer trust due to biased, unfair, or inaccurate AI applications.
- **Increased legal and compliance risks**, including potential fines and penalties for violating data privacy regulations or deploying discriminatory AI systems.



Image Credit: Image generated by Midjourney, OpenAI.

# Building a solid FOUNDATION

*Integrating Data Governance throughout the AI lifecycle.*

- **Embed data governance principles and practices** at every stage of the AI lifecycle, from data acquisition and preparation to model training, deployment, and ongoing monitoring.
- Establish clear data quality standards, metadata definitions, and data lineage tracking specifically for AI datasets.
- Define **roles and responsibilities** for data owners, data stewards, and AI practitioners to ensure accountability for data quality and ethical use in AI.
- Implement mechanisms for **continuous monitoring** and evaluation of data used in AI systems to detect and mitigate issues like bias, drift, and quality degradation.
- Foster a **data-centric culture** that recognises the critical role of well-governed data in driving successful and responsible AI innovation.

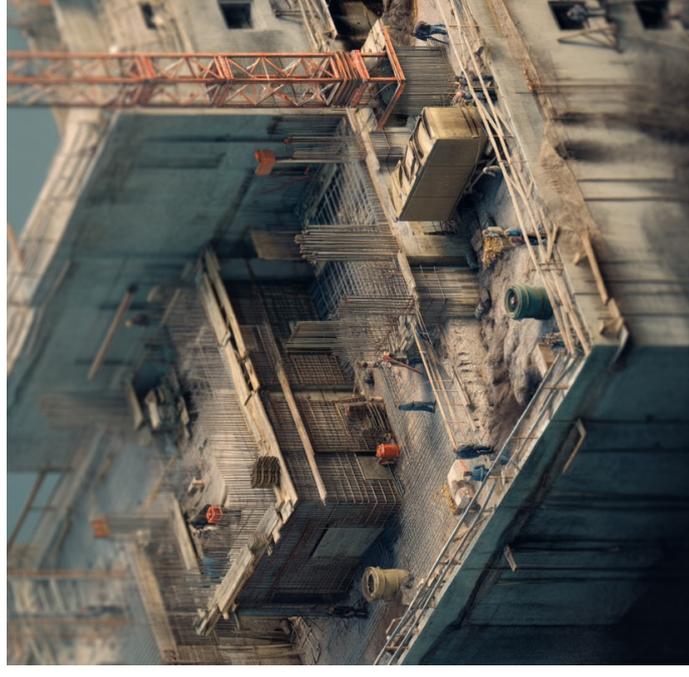


Image Credit: Image generated by Midjourney, OpenAI.

# How AI Governance relies on strong DATA GOVERNANCE

- **Data Quality is Foundational for Effective AI Governance:** AI systems, especially complex models, depend on high-quality, trustworthy data for accurate predictions and reliable performance. Data governance ensures the quality, integrity, and appropriate handling of this crucial input.
- **Addressing Bias Requires Data Governance:** Many AI biases originate from the data used to train the models. Data governance practices, including careful data selection, bias identification, and mitigation strategies, are essential components of responsible AI and fall under the AI governance umbrella.
- **Transparency and Explainability are Enhanced by Data Governance:** Understanding the lineage, provenance, and characteristics of the data used by AI systems contributes significantly to their transparency and explainability. Data governance establishes the processes for documenting this vital information.
- **Regulatory Compliance Intersects:** Emerging AI regulations, such as the EU AI Act, explicitly mandate data governance and management practices for training, validation, and testing datasets used in high-risk AI systems. AI governance frameworks must incorporate these data governance requirements.

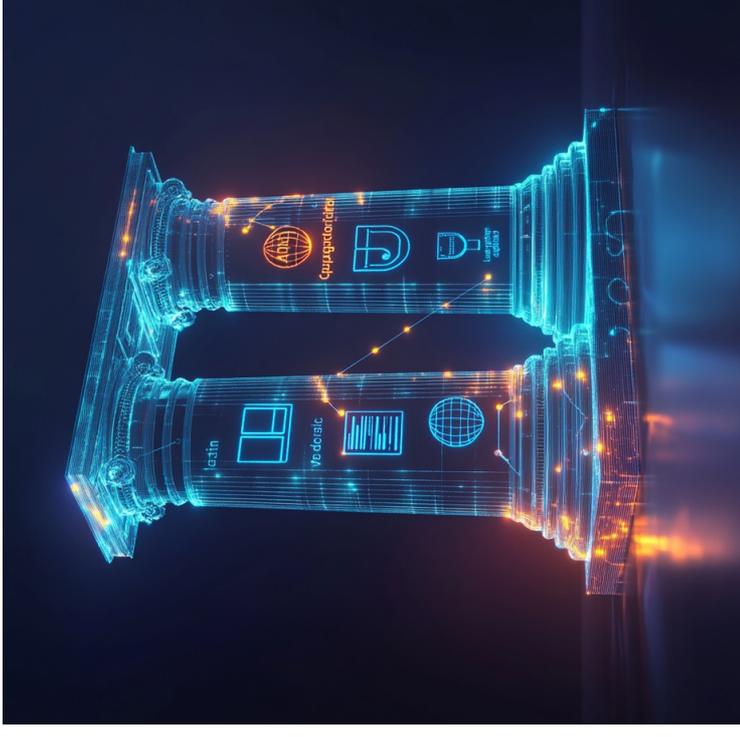


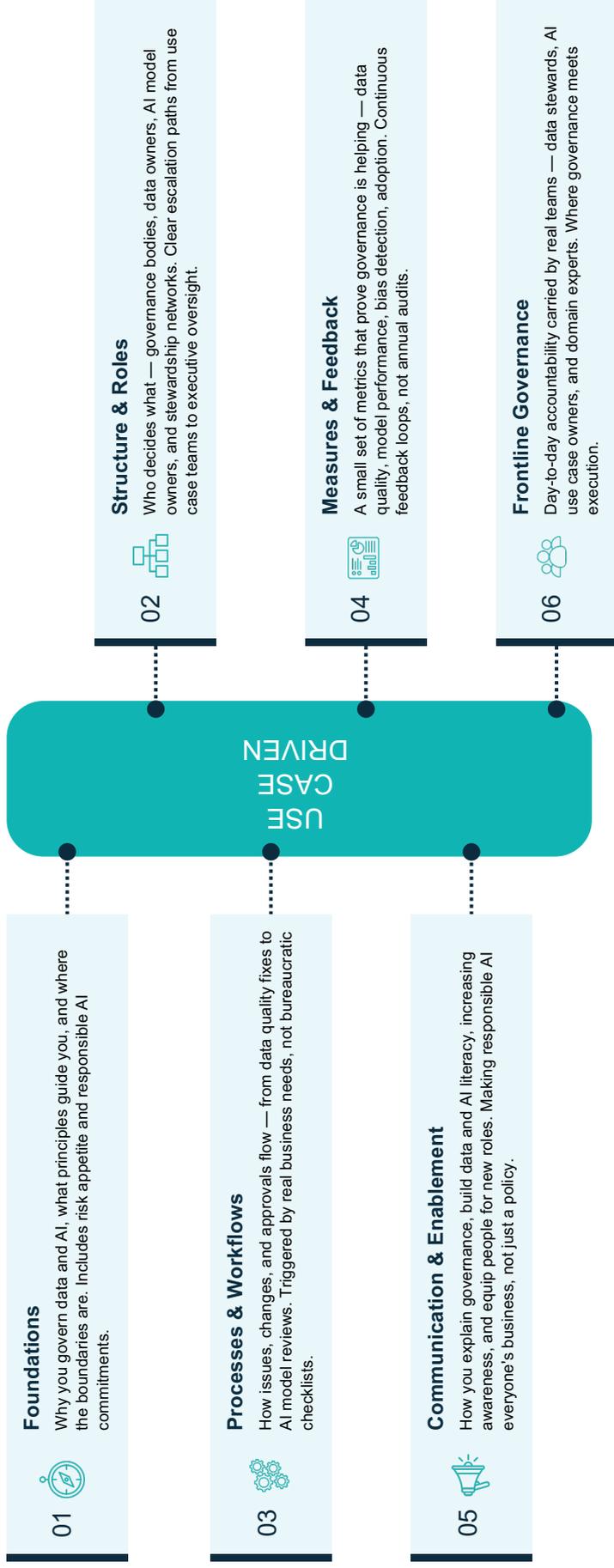
Image Credit: Image generated by Midjourney, OpenAI.

# Connecting The Dots A Practical Framework

[Back to Agenda](#)

# A practical Data & AI Governance FRAMEWORK

Six capabilities to govern data and AI — from strategy to execution



 Underpinned by Responsible AI — Fairness, Transparency, Accountability, Safety & Human Oversight woven into every capability

# Consider assessing relevant AI **READINESS** factors

AI success hinges on several dependencies that should proactively be evaluated.

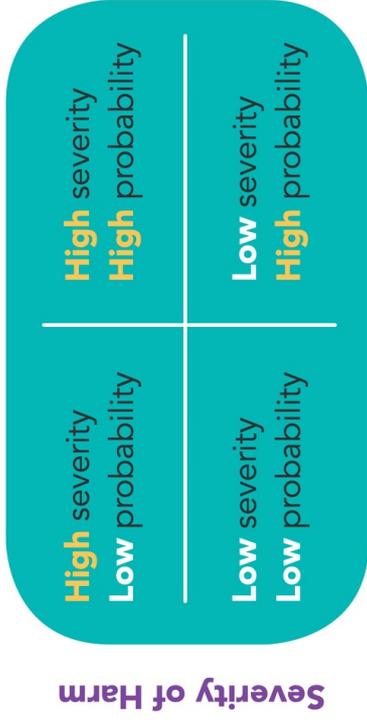


Consider completing a formal AI readiness assessment to baseline current state and measure improvement over time

Source: Guidehouse. (2024, April 10). The state of GenAI today: The early stages of a revolution. <https://guidehouse.com/news/advanced-solutions/2024/the-state-of-genai-today>  
Source: TDWI. (2024, April 15). TDWI AI readiness assessment guide. <https://tdwi.com/research/2024/04/fabw-ai-ai-readiness-assessment-guide.aspx>

# Consider the level of HUMAN OVERSIGHT for AI

Use a rubric to estimate the severity & probability of harm and determine the appropriate level of AI autonomy.



## Probability of Harm

### Other factors to consider:

- Nature of harm (physical or intangible)
- Reversibility / ability of humans to obtain recourse
- Operational feasibility / meaningfulness of involving a human



Source: Info-communications Media Development Authority & Personal Data Protection Commission. (2020). Artificial Intelligence Governance Framework Model, Second edition. <https://www.odcc.gov.sg/media/files/outlineofai/governance-framework2.pdf>

Source: Gow, G. (2023, August 28). A simple AI governance framework in the age of ChatGPT. Forbes. <https://www.forbes.com/sites/glenngow/2023/08/06/a-simple-ai-governance-framework-in-the-age-of-chatgpt/>

# Consider a **LEGALLY DEFENSIBLE** AI governance approach

Establish appropriate standards and controls now to maximize defensibility of our AI efforts as we mature.

1

**Stay abreast of AI regulations**

- Some exist, more are coming – the EU AI Act is viewed by many as the primary model
- Available regulations (and guidelines) for AI should be translated to internal policies & controls
- Aim for the strongest requirements (where financially feasible) to foster global consistency & efficiency

2

**Using AI requires a formal framework**

- Consider an AI policy with official terms and definitions, lifecycle stages, development guidelines, etc.
- Establish formal AI development processes and tollgates (*similar to DevOps for software/application development*)
- Clarify roles and responsibilities with a RACI matrix and segregate duties where possible

3

**Transparency and explainability are key**

- Measure processes (tollgates and audits), roles (performance, compliance), and outputs/outcomes (quality, value)
- Incorporate AI assessments into strategic planning, risk management, and auditing functions
- Address consumer rights with informed consent, opt-out, and complaint intake/feedback processes

4

**The best AI needs the best data**

- AI uses large volumes of data which significantly increases the need for data privacy/security/protection controls
- There's no AI without IA (information architecture) - which means strong data governance and data quality processes
- AI is most efficient with high quality data and consistent, well-defined taxonomies, ontologies and metadata

5

**Adopting AI means culture change**

- AI is here to stay - we should embrace it proactively and foster AI literacy skills across the organization
- An educated and properly trained workforce will (theoretically) create less risks with using AI
- We need to promote culture change to promote managing data as an asset and using AI responsibly and ethically

Source: Milano, M. (2023, December 3). [Legally defensible AI governance. Presentation at the Data Governance & Information Quality Conference \(DGIQ\) 2023, East, Washington, D.C.](#)

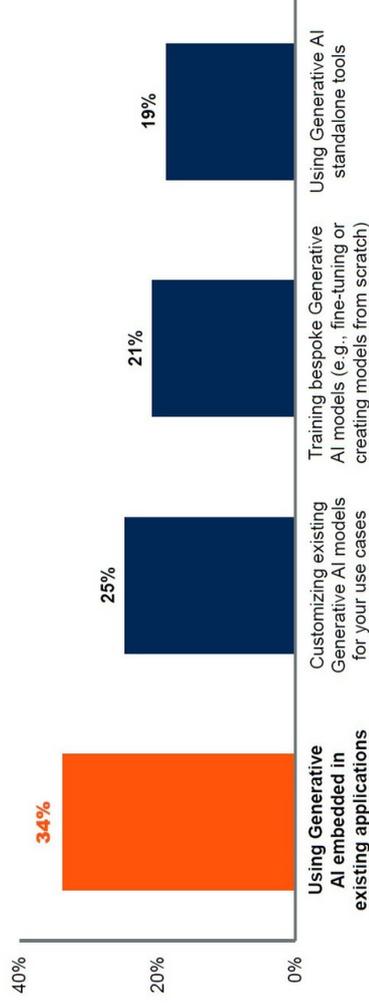
# Existing technologies are increasingly using **EMBEDDED** AI apps

AI solutions in systems and platforms already in use also need to be governed to manage risk.

- [Adobe AI, AI Assistant, FireFly AI](#)
- [Apple Intelligence](#)
- [Atlassian Intelligence](#)
- [Google Gemini](#)
- [Grammarly for Windows](#)
- [Microsoft 365 Copilot](#)
- [Okta AI](#)
- [Oracle AI](#)
- [Red Hat Enterprise Linux AI](#)
- [Salesforce Einstein](#)
- [SAP Concur AI](#)
- [ServiceNow AI](#)
- [Tableau Pulse](#)
- [Zoom AI Companion](#)

## Embedded AI Apps Are the No.1 Way to Consume GenAI

Top method to fulfill Gen AI use cases



n = 118, generative AI sample, excluding unsure  
GAI: How is your organization primarily fulfilling Generative AI use cases?  
Source: 2023 Gartner AI in the Enterprise Survey

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Gartner

# Identify existing AI **TEAMS** across the organization

Leverage accessible resources to find teams and members developing AI internally.



- Leadership
- Org Charts
- Employee Directory
- HR Reports
- IT Managers
- Job Postings
- Skills Inventories
- LinkedIn Profiles



- Email (GALs)
- Company Intranet
- Collaboration Tools
- Teams etc.
- Slack, etc.
- Wikis
- Knowledge Bases
- Content Mgmt



- Portfolio Mgmt
- Project Mgmt
- Project Repositories
- Helpdesk Tickets
- Application Portfolio
- Change Mgmt
- Technical Docs
- Training Content



- Phone-A-Friend
- Procurement
- BI & Analytics
- Audit & Compliance
- Cyber Security
- Legal
- Policy
- Risk Mgmt

# Identify existing AI SOLUTIONS across the organization

Assess assets, documentation, standards, and oversight processes across all identified AI teams.



**Identify Solutions**

- AI in Development
- Deployed AI
- Experimental AI
- Embedded AI
- Algorithms
- Models
- Chat Bots
- Vendors



**Assess Documents**

- Storage Locations
- Templates
- Use Cases & Req's
- Architecture Docs
- Model Specs
- Data Sources & Sets
- Audit & Test Results
- Performance Metrics



**Confirm Standards**

- Policies
- RACIs
- Decision Makers
- Best Practices
- Industry Standards
- Compliance Checks
- Risk Management
- Status Reporting



**Identify Oversight**

- Guiding Principles
- Ethics Principles
- Policies
- Plans & Goals
- Strategic Alignment
- Intake & Triage
- Project Priorities
- CAB Approvals

# Identify existing AI FRAMEWORKS

Assess current standards and processes associated with AI development and usage.



**Design Processes**

- HITL Assessment
- Bias Assessment
- Risk Assessment
- Usage Guidelines
- Performance Metrics
- Data Requirements
- Tollgates
- Review Points



**Development Processes**

- Model Selection
- Data Collection
- Data Preprocessing
- Data Transformation
- Feature Engineering
- Model Training
- Model Tuning
- Risk Identification



**Testing Processes**

- Model Diagnostics
- Model Testing
- Model Refinement
- Bias Testing
- Security Testing
- Compliance Testing
- Error Analysis
- Audits



**Deployment Processes**

- Source Control
- Version Control
- Hand-Offs
- Model Monitoring
- Issue Tracking
- Model Retraining
- Lifecycle Mgmt
- Feedback

# Identify relevant AI LAWS and regulations

Track proposed & enacted laws & how they apply to operational & geographical footprints.



- AI-Specific
- Data Protection
- Consumer Protection
- Industry-Specific
- Liability & Safety
- Intellectual Property
- Patent & Copyright
- Telecommunications



- Local
- Regional
- National
- Multi-National
- International
- Data Localization
- Model Registration
- Disclosures



- Documentation Audits
- Bias Detection
- Risk Mitigation
- Testing Results
- Performance Results
- Legal Reviews
- Compliance Audits
- Remediation Efforts



- New Laws
- Changes to Laws
- Policy Changes
- Impact Analysis
- Process Changes
- Communication
- Coordination
- Training & Awareness

# Conduct an AI MATURITY assessment

Assess current state against frameworks & standards and define a roadmap to remediate gaps.



**Areas of Assessment**

- Standards
- Frameworks
- Info Architecture
- Documentation
- Model Quality
- Data Quality
- Skills & Resources
- Readiness



**Short-Term Goals**

- Strategy
- Policies
- Guidelines
- Governance Bodies
- Records Repository
- Audits & Reviews
- Risk Reduction
- Performance KPIs



**Long-Term Goals**

- Continuous Integration
- Business Value
- Benchmarking
- ESG & Scalability
- Crisis Response
- AI Literacy
- Ethics Board
- Chief AI Officer



**Plans & Roadmaps**

- Executive Briefings
- Culture Change
- Training & Education
- Knowledge Sharing
- Hands-On Workshops
- AI Stewards
- Certifications
- Center of Excellence

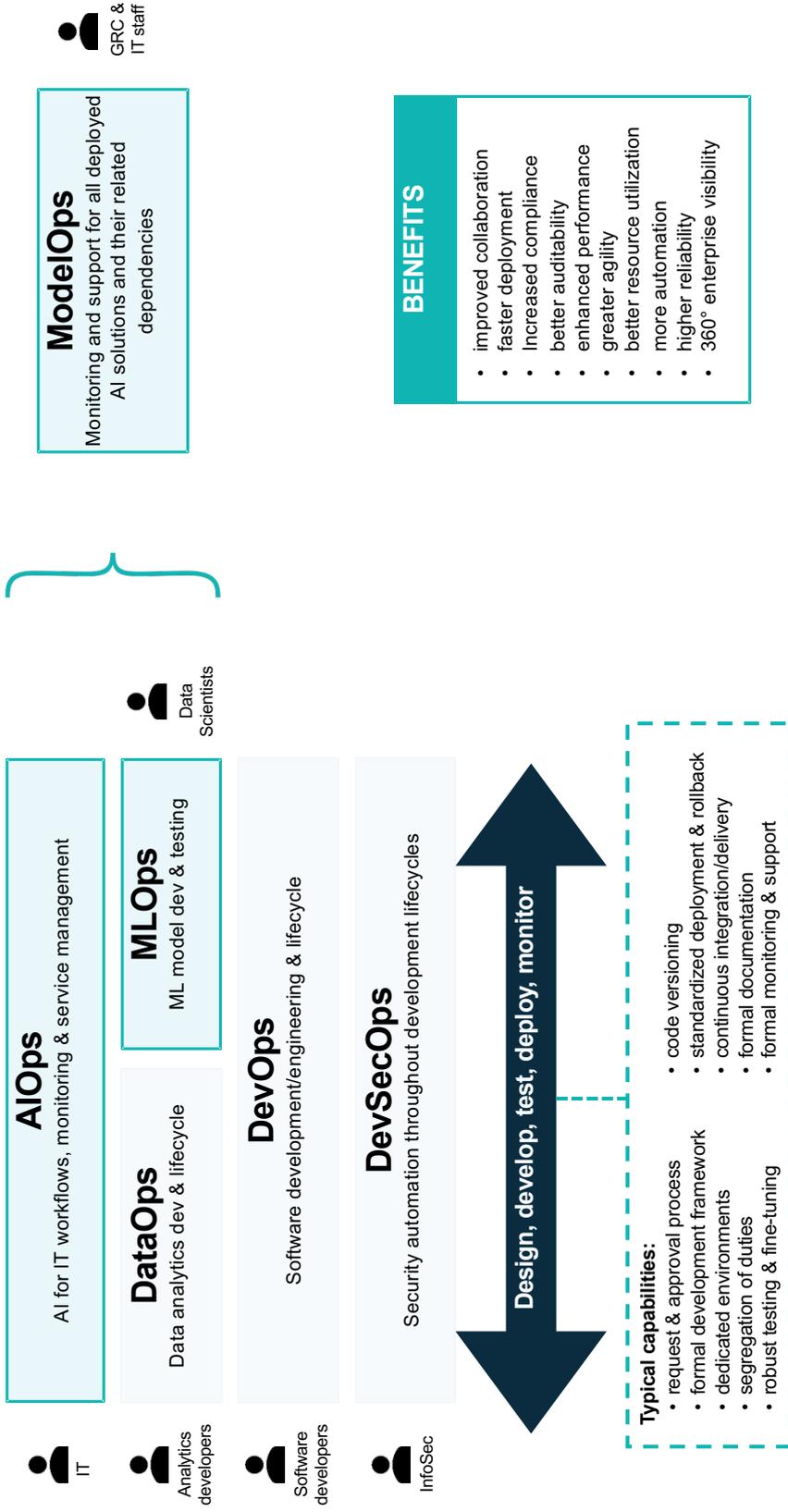
## RECOMMENDATIONS for formalizing AI governance

Define key objectives for implementing enterprise AI governance (each with a bolus of more detailed work to accomplish).

1. Separate AI dev & operations frameworks vs. AI oversight & decision-making frameworks
2. Formalize an AI governance oversight team & purview
3. Formalize AI strategy, guiding principles & AI ethics principles
4. Formalize AI oversight structure & organizational model
5. Formalize AI policies for public, developed & embedded/third party AI
6. Formalize MLOps, AIOps, ModelOps frameworks & standards
7. Formalize controls & processes to comply with AI regulations
8. Formalize controls & processes to measure AI value, performance, bias, risks, etc.
9. Standardize AI terminology & publish terms to the enterprise glossary
10. Launch AI literacy training + consider an AI Center of Excellence
11. Consider AI governance certifications for staff
12. Consider AI certifications for the organization

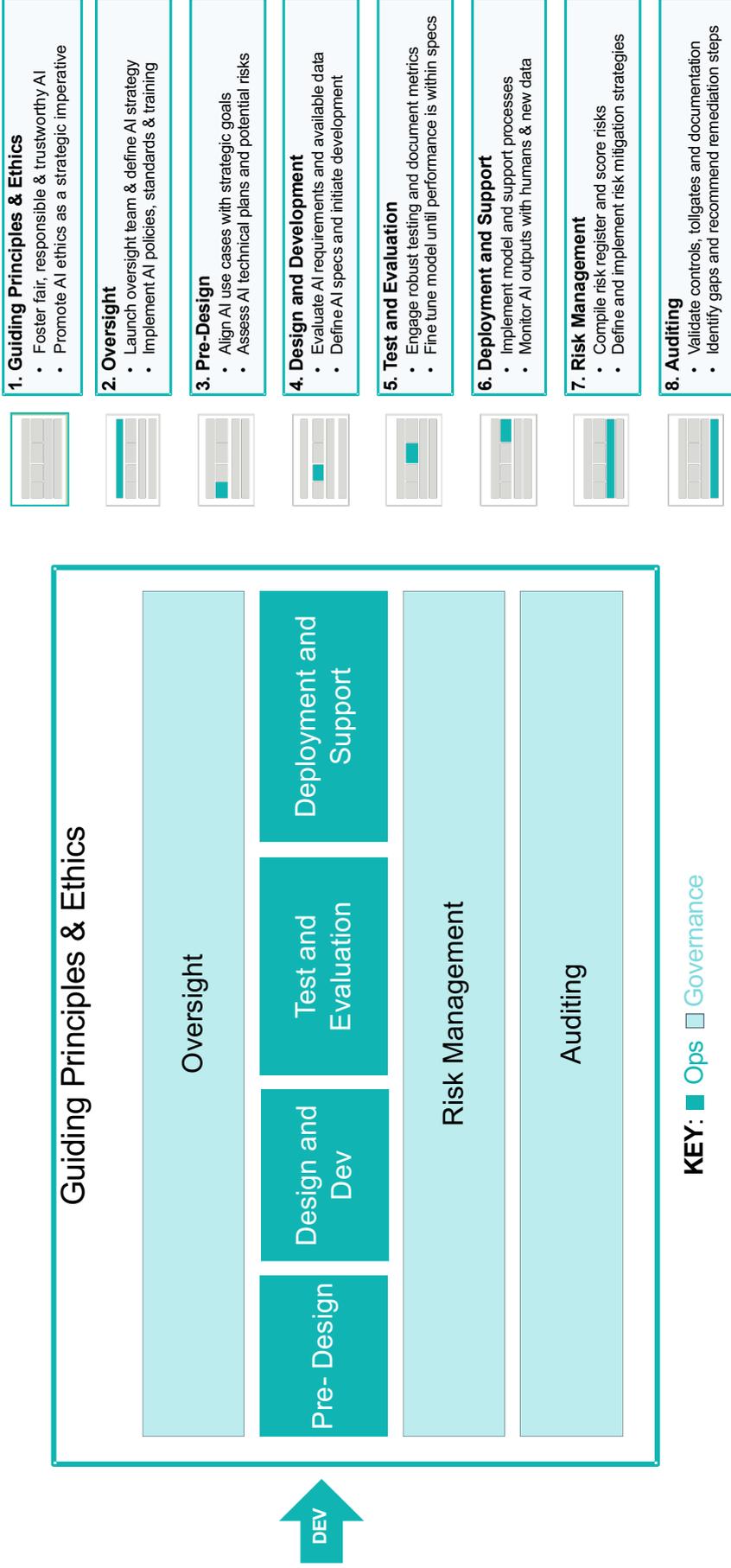
# Understand the burgeoning AI OPS functions

Concepts, lessons and benefits of established “Ops” functions are being adopted for AI.



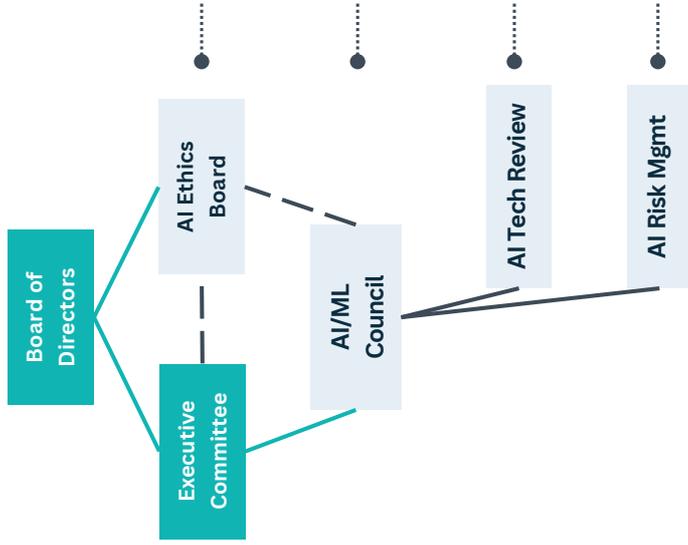
# Build an AI oversight & decision-making FRAMEWORK

Wrap an interconnected set of functions around AI “Ops” functions to proactively manage AI across the organization.



# Formalize AI OVERSIGHT structure

Ensure diverse perspectives and membership across all levels of governance.

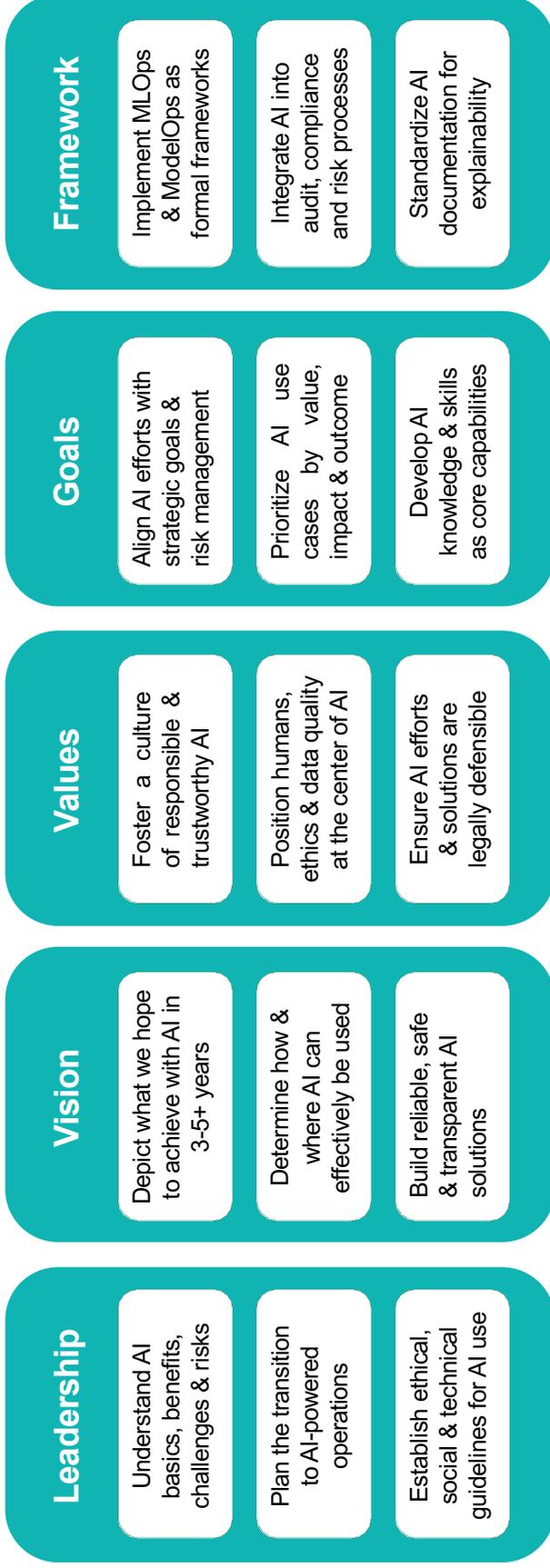


Team	Responsibilities	Members	Audit	Compliance	DG	Info Security	Privacy	Risk Mgmt
AI Ethics Board <i>(Board Dir/CxO/VP/Sr Dir)</i>	<ul style="list-style-type: none"> <li>Educate Board of Directors about AI</li> <li>Establish &amp; communicate AI ethics principles</li> <li>Oversee AI ethics enterprise-wide</li> </ul>	<ul style="list-style-type: none"> <li>1-3 Board Directors ★</li> <li>CDO / AI Exec ☆</li> <li>1 Exec per LOB using AI</li> <li>1-2 External AI SMEs</li> </ul>		✓	✓	✓		✓
AI/ML Council <i>(Sr Dir/Dir/Mgr/Sr Staff)</i>	<ul style="list-style-type: none"> <li>Establish AI principles</li> <li>Manage AI literacy training</li> <li>Set AI goals &amp; priorities</li> <li>Review &amp; strategically align AI requests</li> <li>Establish AI policies &amp; standards</li> <li>Oversee AI development &amp; risk management</li> <li>Resolve escalated issues</li> </ul>	<ul style="list-style-type: none"> <li>CDO / AI Exec ★</li> <li>Chief Compliance Officer ☆</li> <li>1 CxO/VP per LOB using AI</li> <li>AI/ML Leader</li> <li>AI/ML Leader</li> <li>Enterprise Data Architect</li> <li>1 Dir/Mgr per LOB using AI</li> </ul>		✓	✓		✓	✓
AI Tech Review <i>(Sr Dir/Dir/Arch/Sr Staff)</i>	<ul style="list-style-type: none"> <li>Set AI design, development, testing standards</li> <li>Assess AI model design &amp; algorithms</li> <li>Assess AI model metrics</li> <li>Monitor AI validation &amp; testing</li> <li>Monitor AI deployment &amp; support</li> </ul>	<ul style="list-style-type: none"> <li>AI/ML Leader ★</li> <li>AI/ML Leader ☆</li> <li>Enterprise Data Architect</li> <li>Application/Software Architects</li> <li>1 AI/ML Sr Dev per LOB using AI</li> </ul>	✓	✓	✓		✓	✓
AI Risk Mgmt <i>(Sr Dir/Dir/Mgr/Sr Staff)</i>	<ul style="list-style-type: none"> <li>Evaluate AI input/training/output data sets</li> <li>Evaluate AI model documentation</li> <li>Enforce AI/data regulatory compliance</li> <li>Enforce AI/data policy compliance</li> <li>Identify AI risks &amp; manage mitigation efforts</li> </ul>	<ul style="list-style-type: none"> <li>Risk Mgmt Leader ★</li> <li>AI/ML Leader ☆</li> <li>Enterprise Data Architect</li> <li>Application/Software Architects</li> <li>1 Dir/Mgr per LOB using AI</li> </ul>	✓	✓	✓		✓	✓
AI Developers	Follow all AI governance standards & processes							

★ = Chair ☆ = Co-Chair ✓ = Include

# Formulate an AI STRATEGIC PLAN

Plot the organization's trajectory toward an AI-enabled workforce & a better future.



Integrate AI with existing strategic planning processes

# Establish AI GUIDING PRINCIPLES

Evangelize core values & beliefs to drive AI decision-making mindsets and behaviors.

Accountability	Diversity	Human-Centered ★	Objectivity	Safety
Accuracy	Equity	Impact	Personalization	Security ★
Auditability	Ethical ★	Impartiality	Privacy	Sustainability
Autonomy	Explainability ★	Inclusiveness	Reliability	Transparency ★
Awareness	Fairness ★	Justice	Responsibility ★	Trustworthiness ★
Disclosure	Governable	Lawful	Robustness	Well-being



Consider adopting examples from external sources: [Deloitte EU](#) | [Google IBM](#) | [MicrosoftNIST](#) | [OECD](#) | [Singapore PDPC](#)

commonly ★  
cited

## Publish **DEFINITIONS** for AI guiding principles

Explain each principle with plain language that is easy to understand and memorable.

**Trust is must**

Ensure AI is **trustworthy** via safe, secure, responsible & ethical AI development

**Make it easy**

Promote **transparency** into AI purpose, content, function, outputs & use

**Document it**

Create **explainability** through formal documentation of all AI components

**Humans first**

Place **humans** at the center of AI (above/within/over the loop)

**Let them know**

Facilitate **awareness** & disclosure/informed consent for subjects of AI solutions

**No bias**

Promote **fairness** by identifying and mitigating bias in every step

**Win audits**

Support **auditability** via formal standards, processes & change management

**TIP:** Consider using names that are

short

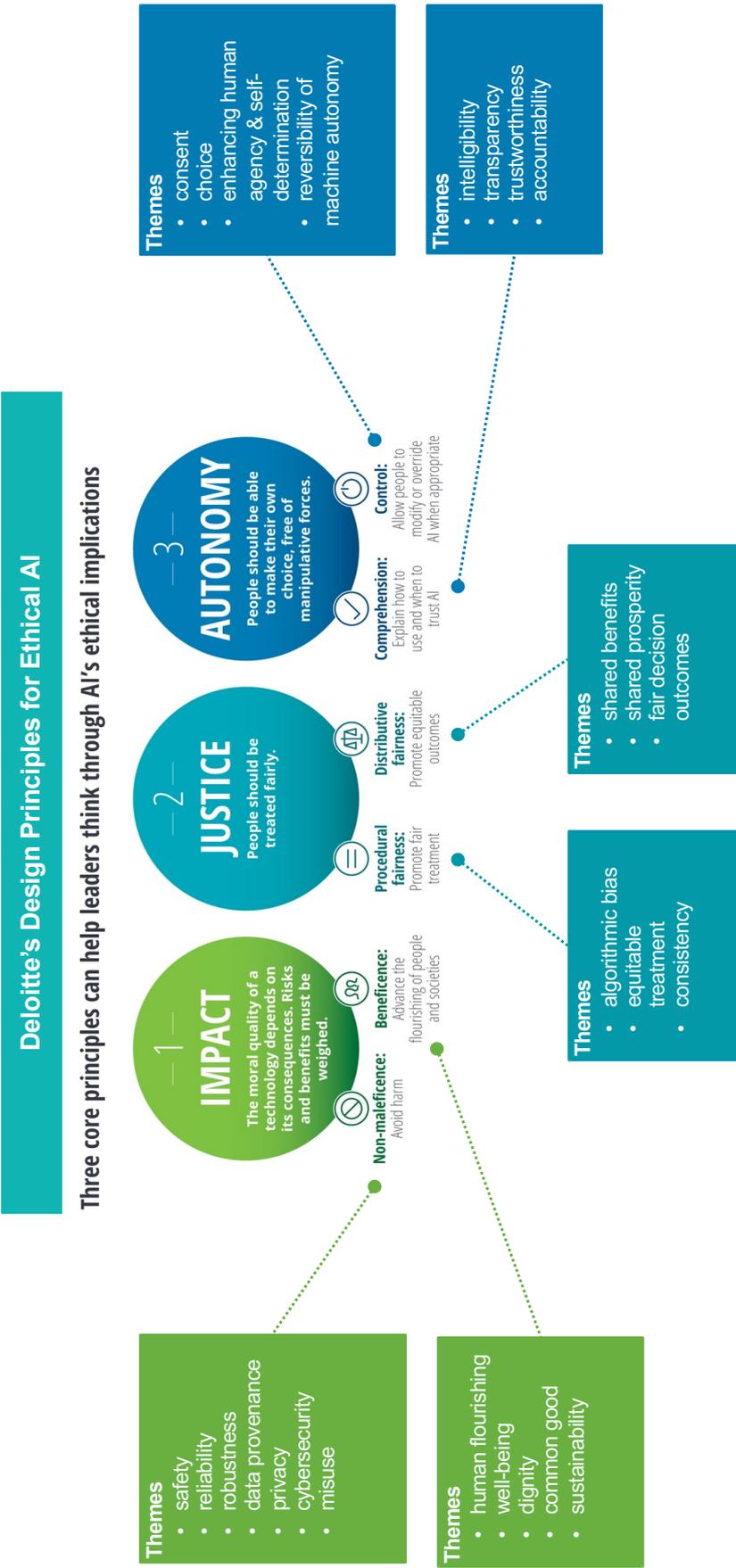
sticky

desirable

feasible

# Establish AI ETHICS principles too

Deloitte grounds deliberations in a scientific understanding of the strengths & weakness of both AI/ML & human cognition.



Source: Giuszsa, J., Lee, M., Ammanath, B., & Kuder, D. (2020, January 28). Human values in the loop: Design principles for ethical AI. Deloitte Insights. <https://www2.deloitte.com/us/en/insights/focus/consultive-technologies/design-principles-ethical-artificial-intelligence.html>

# Implement an enterprise AI POLICY

Codify critical AI principles & standards in an official corporate policy (SAMPLE CONTENT).

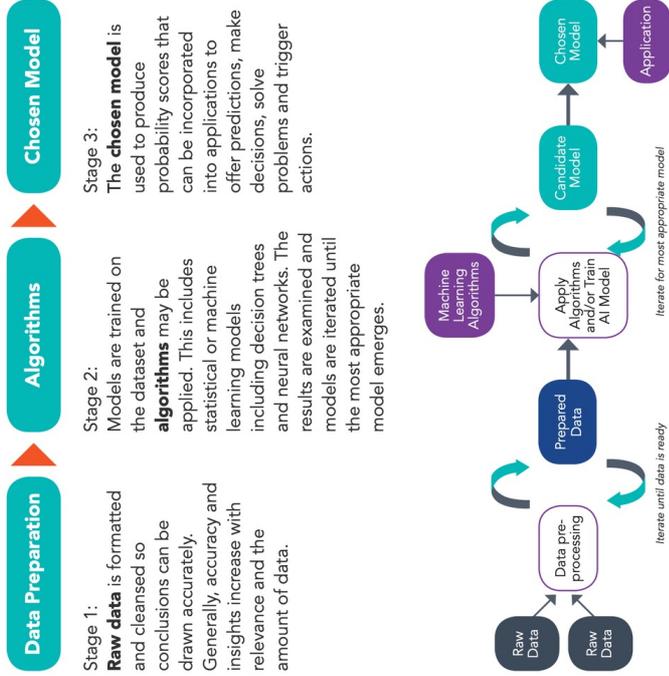
<b>Purpose</b>	<p>The purpose of this policy is to guide the ethical and responsible use of artificial intelligence (AI) technologies across the organization. This policy outlines the principles, standards, and expectations for AI use and is designed to ensure compliance with legal and ethical standards while promoting innovation and effective use of AI technologies.</p>
<b>Scope</b>	<p>This policy applies to all employees, contractors, business partners, and stakeholders who interact with or use AI technologies for business operations. It covers all AI applications, systems, and related technologies (developed, publicly available, or embedded in existing platforms) within our organization.</p>
<b>Principles</b>	<p>Our company is committed to leveraging AI technologies responsibly and ethically while ensuring respect for individual rights and data privacy. This includes:</p> <ul style="list-style-type: none"><li>• <u>Ethical Development and Use</u>: AI must be designed, developed, and used in a manner that is fair, transparent, and free from discrimination or bias.</li><li>• <u>Security</u>: AI systems must comply with applicable data privacy regulations and ensure the protection of personal data from unauthorized access or misuse.</li><li>• <u>Accountability</u>: Employees and stakeholders must be accountable for their use of AI technologies and adhere to this policy's standards.</li><li>• <u>Transparency</u>: The development and deployment of AI systems must be transparent, with clear explanations of how AI processes data and makes decisions.</li><li>• <u>Compliance with Standards</u>: All AI technologies and practices must align with all approved frameworks and standards.</li></ul>
<b>Standards</b>	<p>We have adopted the following standards for AI:</p> <ul style="list-style-type: none"><li>• Deloitte's Trustworthy AI Framework and AI Ethics Principles</li><li>• EU AI Act</li><li>• OECD Framework for the Classification of AI Systems</li><li>• Singapore's Model AI Governance Framework (Second Edition)</li><li>• NIST AI Risk Management Framework (Pub. 100-1)</li><li>• NIST Towards a Standard for Identifying and Managing Bias in AI (Pub. 1270)</li></ul>
<b>Definitions</b>	<ul style="list-style-type: none"><li>• <u>AI Bias</u>: The presence of systematic errors in AI outcomes that result in unfair or discriminatory treatment.</li><li>• <u>AI Data Privacy</u>: The protection of personal data used in AI applications to ensure compliance with relevant privacy laws and regulations.</li><li>• <u>AI Ethics</u>: A set of moral principles guiding AI development and usage to ensure fairness, transparency, and accountability.</li><li>• <u>Artificial Intelligence (AI)</u>: The simulation of human intelligence in machines designed to think and learn.</li><li>• <u>Machine Learning (ML)</u>: A subset of AI that involves algorithms allowing systems to improve their performance over time through experience or data analysis</li></ul>

Consider additional policies: GenAI, AI documentation, AI risk assessments...

# Clarify EXPECTATIONS across the AI lifecycle

AI Framework Example: Define stages and responsible measures for documentation, transparency, and trust in AI solutions.

## Singapore's AI Framework



### Data Preparation

- Document data lineage (forward, backward, end-to-end)
- Maintain data provenance records & risk assessments
- Measure & ensure data quality as well as data privacy requirements
- Identify & minimize inherent bias
- Use different datasets for training, testing & validation
- Engage periodic reviewing & updating of datasets

### Algorithm & Model

- Identify which features will most impact stakeholders and consumers
- Select measures of transparency that will most build trust
- Apply measures for the entire model (or a subset of features commercially sensitive or intellectual property is involved)
- Store all measures, assessments & records in a centralized repository

### Stakeholder Communication

- Provide general disclosure on how & why AI is used, its benefits, efforts to identify & mitigate risks, and the role/extent of AI in decision-making processes
- Develop a policy on what information to provide to individuals & when
- Tailor easy-to-understand communications based on audience
- Consider providing an option to opt-out + collect feedback
- Ensure AI governance practices & processes align with ethical standards

Source: Info-communications Media Development Authority & Personal Data Protection Commission. (2020). Artificial Intelligence Governance Framework Model. Second edition. [https://www.pdpc.gov.sg/\\_/media/files/aiocpcc/files/resource-for-organisation/ai-sm-model-govframework.pdf](https://www.pdpc.gov.sg/_/media/files/aiocpcc/files/resource-for-organisation/ai-sm-model-govframework.pdf)

# Establish a RACI for the AI lifecycle

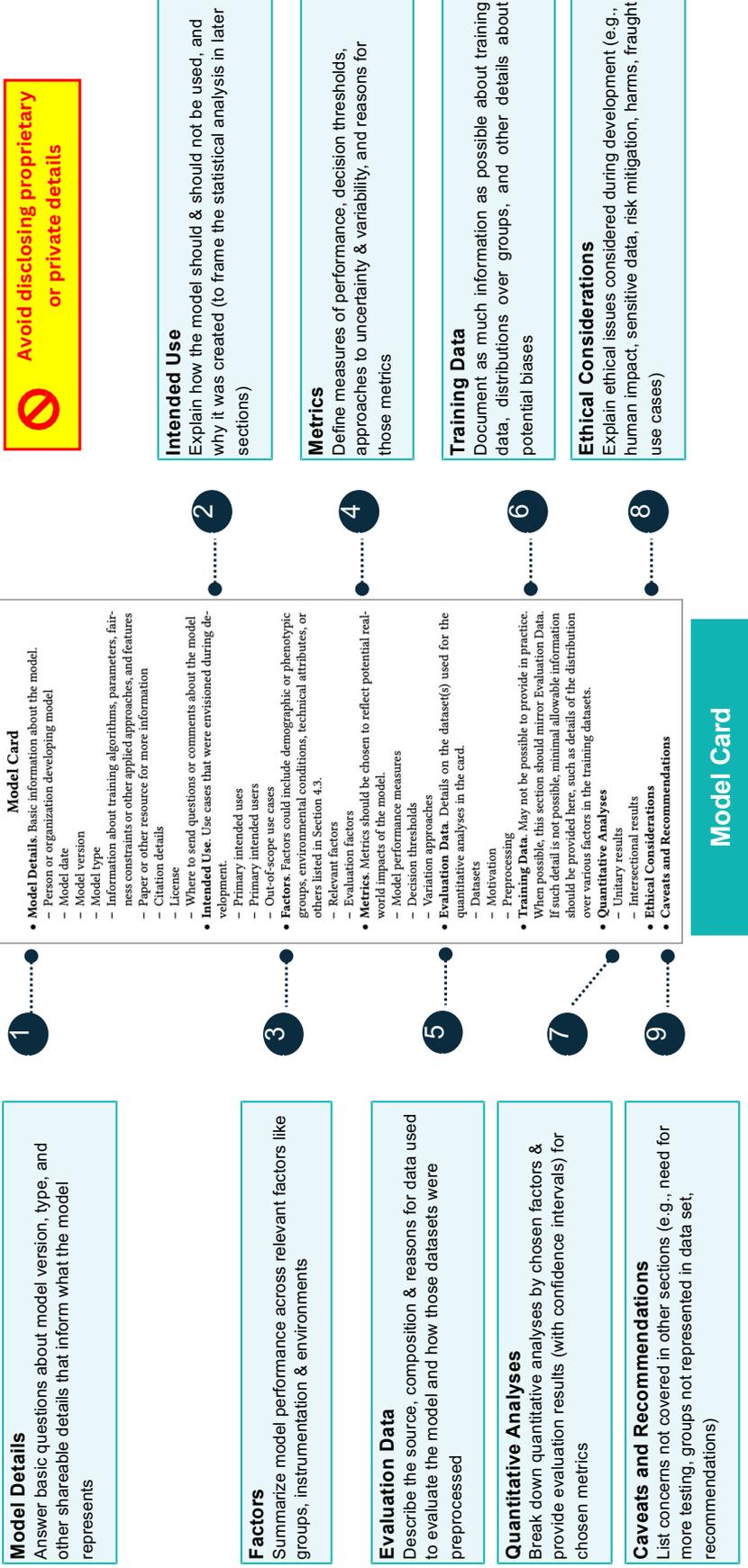
AI Framework Example: Map AI activities and deliverables to formal responsibilities to roles.

AI Deliverable	BOD	AI Steward	Data Arch	Audit	Compl	Privacy	Risk	HR	Other AI Ethics Board	AI Exec Leader	AI PM	AI/ML Engineer	Data Scientist	Domain Owner	DGO
Define AI vision & strategy	A	C	C	C	C	C	C	I	C	R	I	I	C	I	C
Establish AI guiding principles	A	C	C	C	C	C	C	I	C	R	I	I	C	I	C
Establish AI ethics guidelines	A	C	C	C	C	C	C	I	R	C	I	I	C	I	C
Promote ethical & responsible AI	A	C	C	C	C	C	C	R	R	C	I	I	R	R	C
Ensure AI strategic alignment	C	C	C	C	C	C	C	I	C	A	I	I	R	R	C
Prioritize use cases	I	C	C	C	C	C	C	I	I	A	C	C	C	R	C
Manage AI projects, resources & timelines	I	C	C	I	I	C	C	I	I	I	R	C	C	C	C
Define AI design & testing requirements	I	R	C	I	I	C	C	I	I	A	R	R	R	R	C
Identify & mitigate AI risks	I	R	C	I	I	R	R	I	I	A	R	R	R	R	C
Identify data privacy & protection needs	I	R	C	I	I	R	R	I	I	A	C	C	C	I	C
Build & maintain AI solutions	I	R	C	I	I	C	C	I	I	A	C	C	C	I	C
Deploy & monitor AI solutions	I	R	C	I	I	C	C	I	I	A	C	R	R	I	C
Fix, improve & update AI solutions	I	R	C	I	I	C	C	I	I	A	C	R	R	R	C
Assess regulatory & policy compliance	I	C	C	C	R	C	C	I	I	A	C	C	C	I	C
Audit AI processes, solutions & risks	I	R	C	R	C	C	R	I	I	A	C	C	C	I	C
Develop & deliver AI training programs	I	C	C	C	C	C	C	R	I	A	C	C	C	I	C
Follow AI guidelines, standards & policies	C	R	R	R	R	R	R	R	C	A	R	R	R	R	R

KEY: **R** Responsible **A** Accountable **C** Consulted **I** Informed

# Implement a standard for DOCUMENTING AI models

AI Framework Example: Leverage a template to standardize requirements and content for documentation.



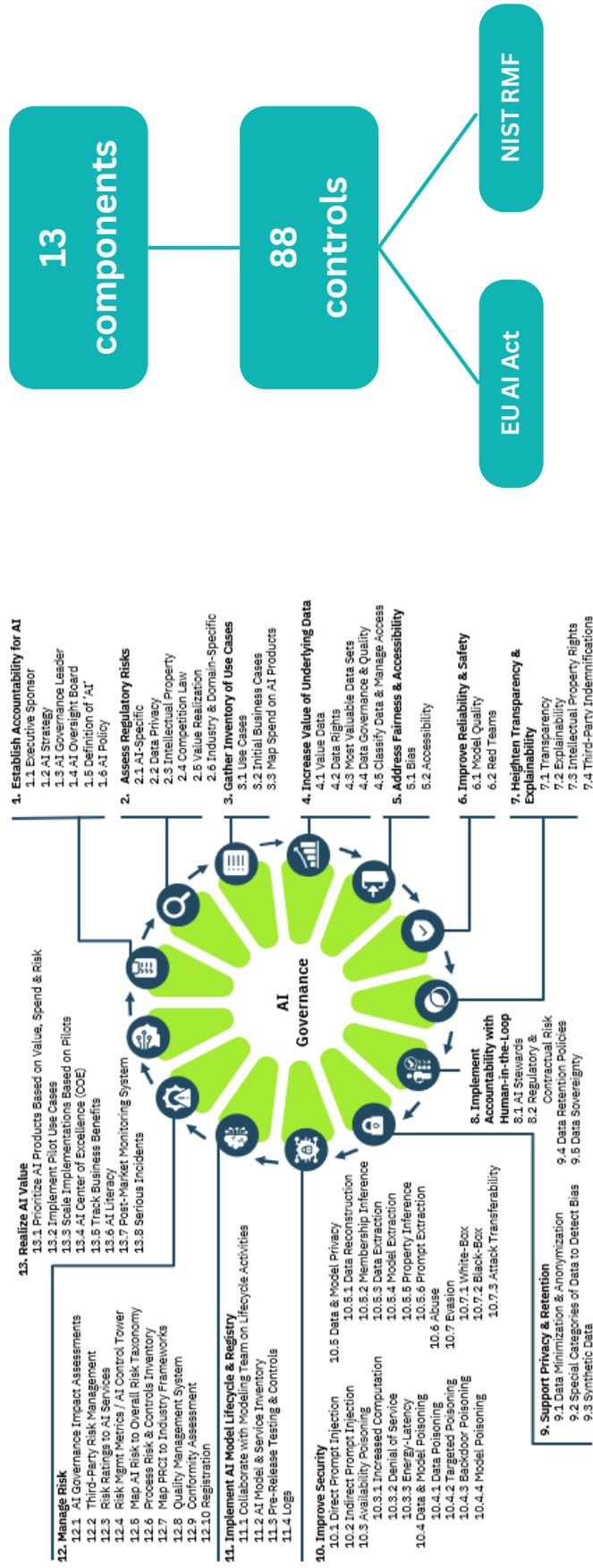
Source: Mitchell, M., Wu, S., Zaldivar, A., Barnes, P., Vasserman, L., Hutchinson, B., Spitzer, E., Raj, L. D., & Gebru, T. (2019, January 14). Model cards for model reporting. In FAT\*19: Conference on Fairness, Accountability, and Transparency (pp. 220-229). <https://doi.org/10.48550/arXiv.1810.03893>.

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# Map AI governance framework to REGULATORY controls

AI Compliance Example: Continuous loop framework mapped to requirements in the EU AI Act and NIST RMF.

YourDataConnect.com



Source: Soares, S. (2024). AI governance: A controls playbook with mappings to the European Union AI Act and the NIST AI Risk Management Framework. YourDataConnect, LLC (DBA YDC). <https://yourdataconnect.com/>



# Identify **TOLLGATES** across the AI lifecycle

AI Measures Example: Define and document required outcomes/deliverables for each AI initiative.

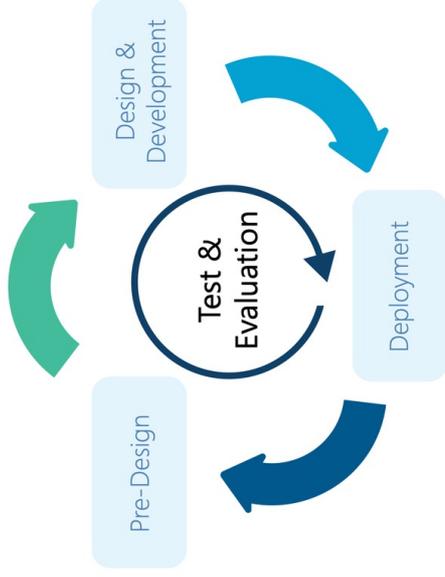
- 1 Value**
  - Define a clear value proposition + assess strategic alignment for each AI effort
  - Determine what the data & model will predict + how it will achieve or contribute to business goals
- 2 Goals**
  - Translate business objectives into clear technical actions + measurable & achievable goals
  - Establish realistic expectations for precision + what's predicted + how to use predictions
- 3 Metrics**
  - Measure model performance objectively using agreed-upon metrics (e.g., accuracy, lift, cost, etc.)
  - Include measures for assessing ethical issues + training + operationalizing the model
- 4 Data**
  - Resolve data issues before ingestion (i.e., good data is the foundation of predictive strength)
  - Identify relevant data privacy & data usage issues + address them
- 5 Training**
  - Clarify what can vs. cannot be learned from the data + what are expected vs. unexpected outcomes
  - Validate model sensitivity + debug it before learning from the data + track model versions
- 6 Deployment**
  - Ensure buy-in from all levels + needed business units (include customer service + tech support)
  - Communicate the impact on roles & responsibilities, daily routines, workflows & decision making

Source: Siegel, E. (2024). The AI playbook. MIT Press.

# Manage potential **BIAS** across the AI lifecycle

AI Measures Example: Define stages and formal processes and multi-stakeholder support to mitigate potential harms.

## NIST Bias Management Framework



### Pre-Design

- Document data lineage (forward, backward, end-to-end)
- Maintain data provenance records & risk assessments
- Measure & ensure data quality as well as data privacy requirements
- Specify problem, purpose and benefits; conduct research; identify available data
- Assess organizational biases, individual & group heuristics, limited points of views
- Consider biases reflected in the selected datasets

### Design & Development

- Analyze requirements and available data; select/design model
- Perform compatibility analysis; identify sources of bias; implement mitigation plans
- Evaluate/adjust bias mitigation efforts until model stays within pre-specified limits

### Deployment

- Release and use the model; monitor system outputs after human interaction
- Ensure deployed solutions do not cause unintended effects or harms
- Assess/retrain model as needed; correct adverse events or decommission model

### Test & Evaluation (*throughout*)

- Perform continuous testing and evaluation of all components and features
- Verify model performance against agreed-upon metrics and bias mitigation efforts
- Identify and resolve data quality, data privacy and data usage issues

Source: National Institute of Standards and Technology. (2022). *Towards a standard for identifying and managing bias in artificial intelligence*. NIST Special Publication 1270. <https://doi.org/10.6028/NIST.SP.1270>

# Audit for **BIAS** across the AI lifecycle

AI Measures Example: Assess the fairness and efficacy of AI models across all stages to lessen or eradicate harmful effects.

## Purpose, Process & Monitoring Framework

Credit Scoring • Insurance Scoring • Automated Underwriting Risk-Based Pricing • Digital Advertising • Tenant Screening Selection Tools

### Purpose

#### Business Understanding:

- Assess project goals and the expectations, requirements, and objectives of stakeholders (collectively referred to as the "business problem")
- Assess risks the business problem may pose to consumers, institutions, and society

#### Data Understanding:

- Assess how well data is used to accurately capture and reflect the business problem
- Determine what if any techniques were used to mitigate risks associated with data paucity or data quality

### Process

#### Staff Profile:

- Ensure teams are diverse, inclusive, and educated to spot challenges and prevent issues that lead to unfavorable outcomes

#### Data Assessment:

- Determine if the data sources and data fields used to develop the model are appropriate, representative, fair, and accurate

#### Model Assessment:

- Evaluate training algorithms, parameters, hyper-parameters, fairness constraints used during both development and post-modeling, and the selection of less discriminatory alternatives

#### Outcome Assessment:

- Evaluate performance of the final model in line with scope and metrics defined in the business problem to determine if the model meets its objectives, including minimization of risks

#### Model Use and Limitation:

- Review and document known model limitations and assumptions, and circumstances where the model may or may not be used outside the scope of its intended uses

### Monitoring

#### Product Model Validation:

- Compare missingness patterns of the data used to develop the training model with those of the production version
- Assess model evaluation metrics and fairness metrics across both environments and protected class categories (before and after model deployment) to confirm model stability and reliability
- Decide whether about retraining, patching, or retiring production models

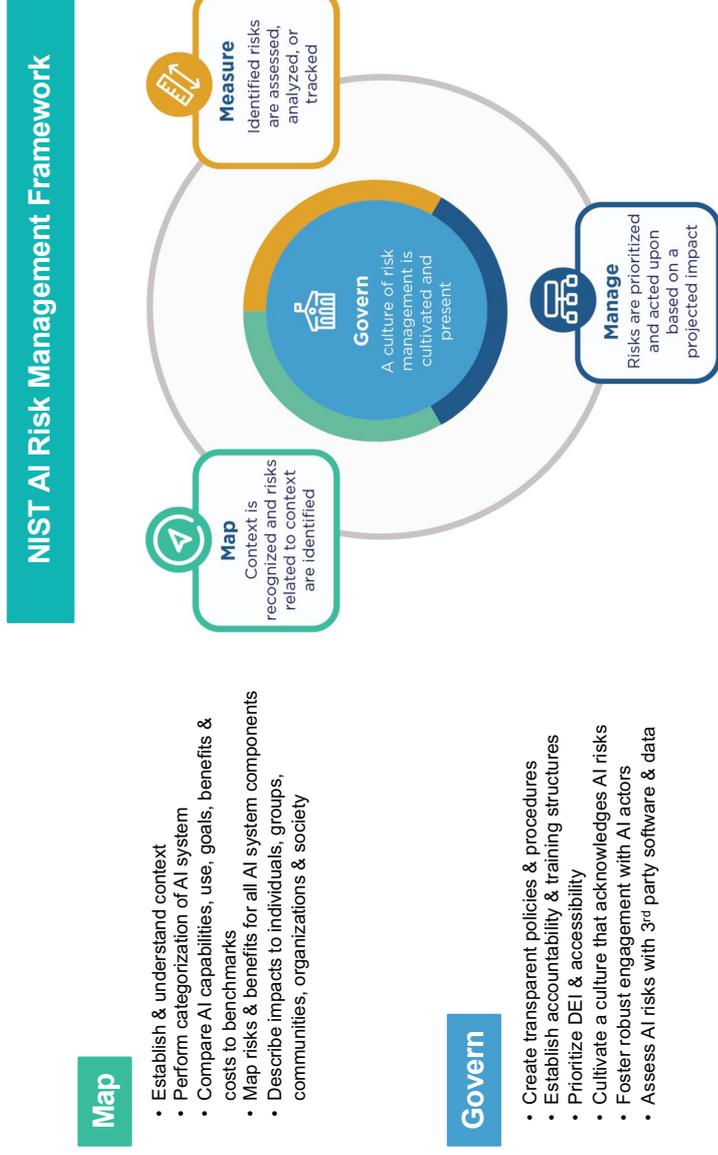
#### Protection from Confidentiality and Integrity Attacks:

- Evaluate defenses that protect the privacy of records used to train the model or score the model in production
- Ensure the model incorporates defenses that assure fairness and accountability.

Source: Akinwumi, M., Rice, L., & Sharma, S. (2022). Purpose, process, and monitoring: A new framework for auditing algorithmic bias in housing and lending. [https://nationalfairhousing.org/wp-content/uploads/2022/02/PPM\\_Framework\\_02\\_17\\_2022.pdf](https://nationalfairhousing.org/wp-content/uploads/2022/02/PPM_Framework_02_17_2022.pdf).

# Formalize **RISK MANAGEMENT** across the AI lifecycle

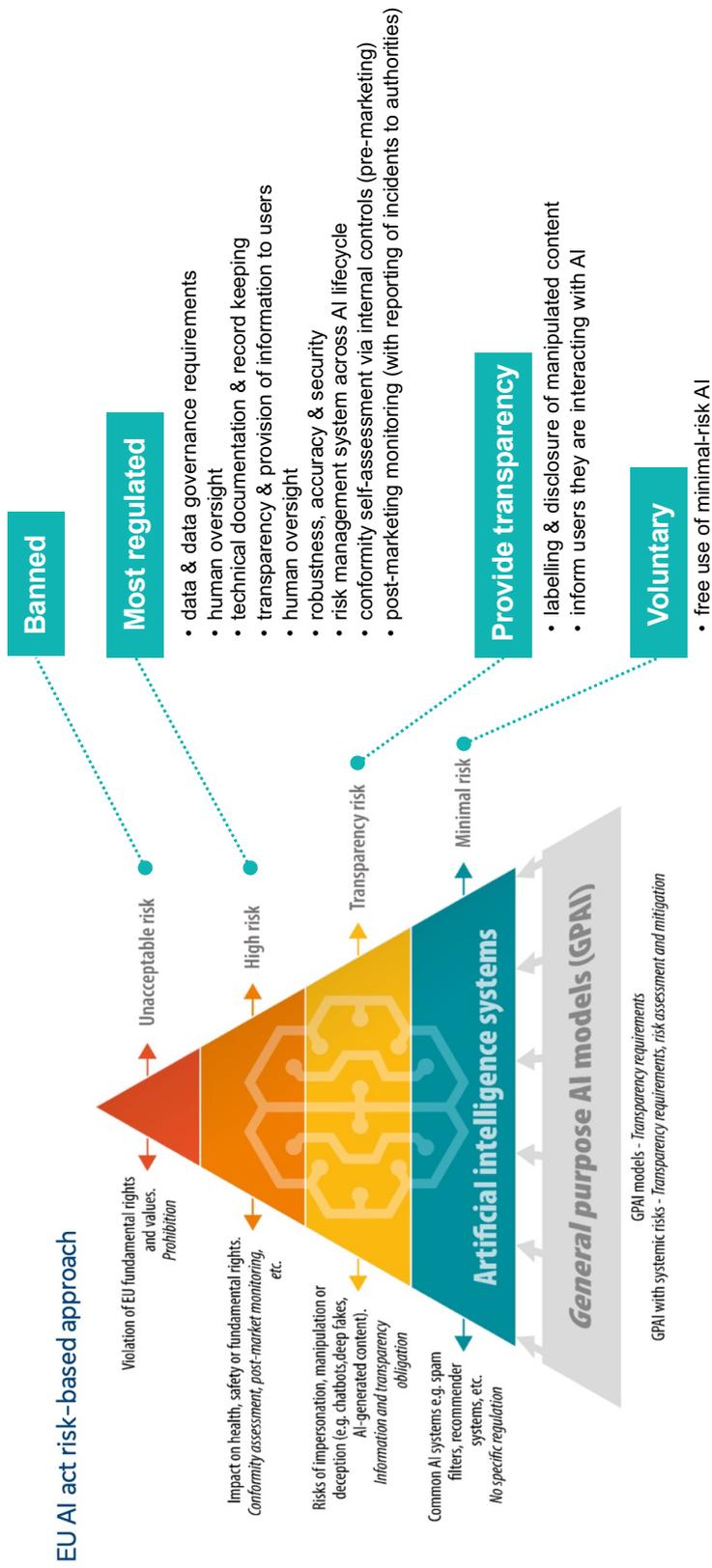
AI Measures Example: The NIST AI RMF helps minimize anticipated negative impacts & identify opportunities for positive impacts.



Source: National Institute of Standards and Technology. (2023). Artificial Intelligence Risk Management Framework (AI RMF 1.0). NIST AI 100-1.1. U.S. Department of Commerce. <https://doi.org/10.6028/NIST.AI.100-1>

# Set RISK TOLERANCE LEVELS for AI risk

AI Measures Management Example: The draft [EU AI Act](#) defines levels of risk based on the intended use of an AI system.



Source: Madiea, I. (2024). Artificial Intelligence Act: EU legislation in progress (Briefing 688792). European Parliament. [https://www.europarl.europa.eu/RegData/etudes/BRIEF/2024/1688792/EPRS\\_BRI\(2024\)1688792\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIEF/2024/1688792/EPRS_BRI(2024)1688792_EN.pdf)

# Define an AI risk SCORING RUBRIC

AI Measures Example: Use an objective rubric to rate and prioritize risks and inform risk mitigation approaches.

## RISK MATRIX

### Likelihood

	Probable Likely to occur during standard AI operations	Occasional Likely to occur sometime during standard AI operations	Improbable Unlikely but possible to occur during standard AI operations	Impact
High	Red	Red	Yellow	High Impact of decisions is widespread and/or their severity is serious
Medium	Red	Yellow	Green	Medium Impact of decisions reaches a moderate amount of people and/or their severity is moderate
Low	Yellow	Green	Green	Low Impact of decisions is isolated and/or their severity is not serious

### Additional measurement challenges:

- Availability of reliable metrics
- Risks at different stages of the AI lifecycle
- Risks in real-world settings (vs. pre- deployment environments)
- Inscrutability (limited explainability and/or interpretability)
- Reliable human baselines
- Third-party software, hardware & data risks

## RISK RATING

LOW Risk Less rigor / More autonomy Could apply risk mitigation efforts	MEDIUM Risk Balanced rigor / autonomy Should apply risk mitigation efforts	HIGH Risk More rigor / Less autonomy Must apply risk mitigation efforts
-------------------------------------------------------------------------------	----------------------------------------------------------------------------------	-------------------------------------------------------------------------------

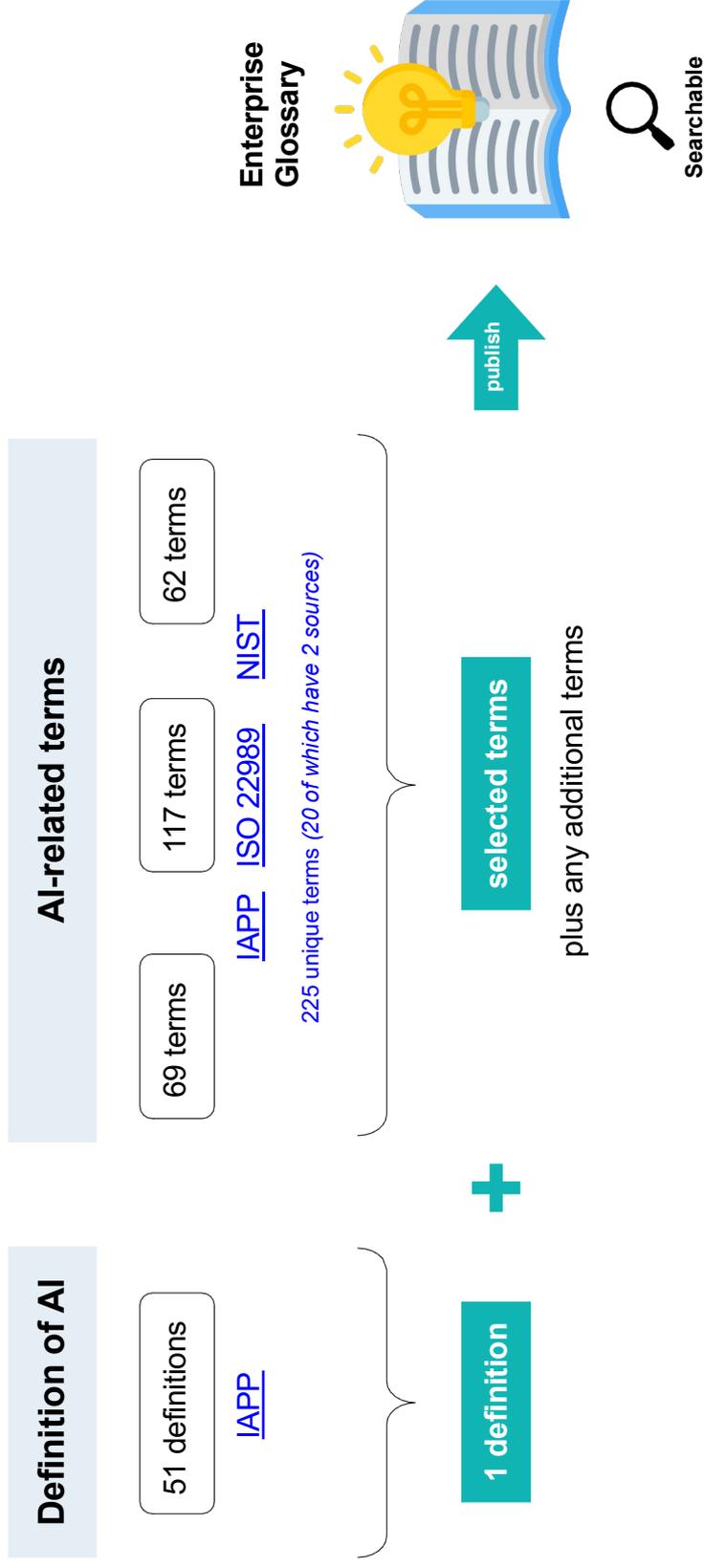


Source: Info-communications Media Development Authority & Personal Data Protection Commission. (2020). Artificial Intelligence Governance Framework Model. Second edition. <https://www.adpa.gov.sg/media/files/pdpc/pdpc/files/resource-for-organisation/ai/governanceframework2.pdf>

Source: National Institute of Standards and Technology. (2023). Artificial Intelligence Risk Management Framework (AI RM 1.0). NIST AI 100-1. U.S. Department of Commerce. <https://doi.org/10.6028/NIST.AI.100-1>

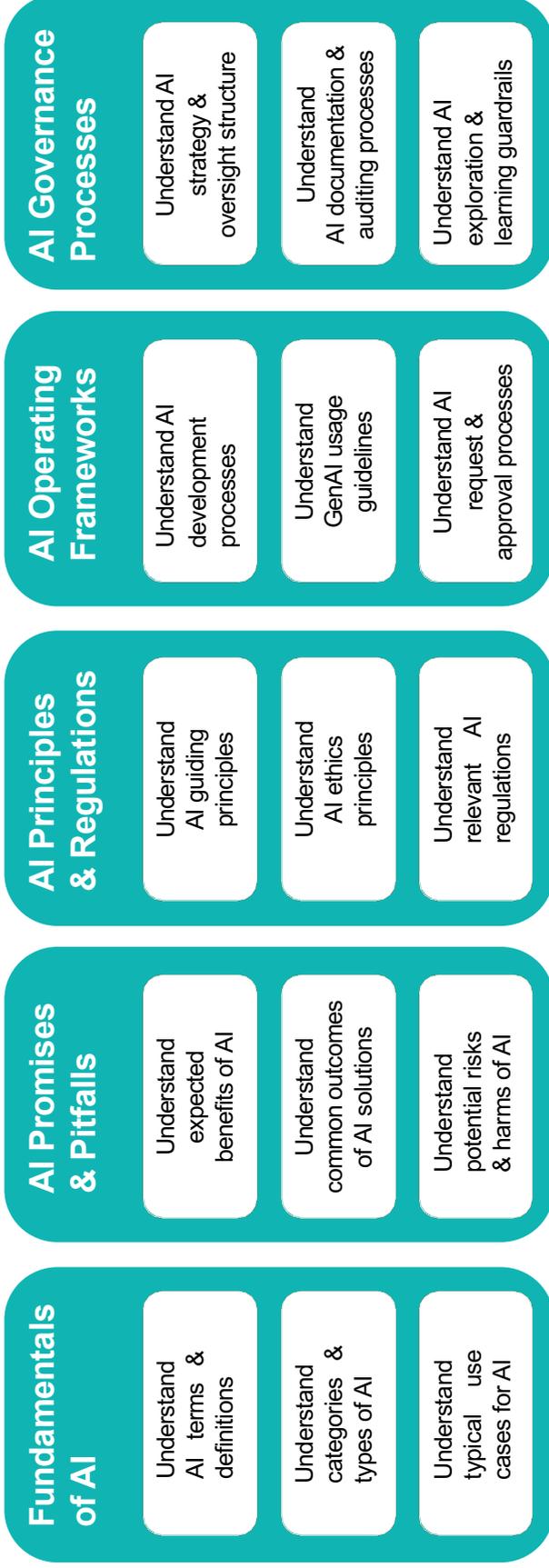
# Publish a GLOSSARY of AI terminology

Socialize official AI-related terms & definitions so everyone is on the same page (and can find that page!)



# Launch widespread AI LITERACY training

A formal training program will help upskill AI awareness and capabilities and help mitigate risk.



Consider launching an AI Center of Excellence for enterprise-wide AI-related learning & discovery

# Consider AI certifications for the ORGANIZATION

Aligning development efforts with AMS certification can generate competitive advantage.



## 5259-1:2024 Data Quality

O/IEC 5259-1:2024(en) Artificial intelligence — Data quality for analytics and machine learning (ML) — Part 1: Overview, terminology, and examples

**Table of contents**

- 1 Scope
- 2 Normative references
- 3 Terms and definitions
- 4 Context of the organization
- 4.1 Understanding the organization
- 4.2 Understanding the needs and expectations
- 4.3 Determining the scope of the AI management system
- 4.4 AI management system
- 5 Leadership
- 5.1 Leadership and commitment
- 5.2 AI policy
- 5.3 Roles, responsibilities and authorities
- 6 Planning
- 6.1 Actions to address risks and opportunities
- 6.2 AI objectives and planning to achieve them
- 6.3 Planning of changes
- 7 Support
- 7.1 Resources
- 7.2 Competence
- 7.3 Awareness
- 7.4 Communication
- 7.5 Documented information
- 8 Operation
- 8.1 Operational planning and control
- 8.2 AI risk assessment
- 8.3 AI risk treatment
- 8.4 AI system impact assessment
- 9 Performance evaluation
- 9.1 Monitoring, measurement, analysis and improvement
- 9.2 Internal audit
- 9.3 Management review

**Foreword**

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of international standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives) or [www.iec.ch/members\\_beyond\\_members](http://www.iec.ch/members_beyond_members)).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

**Source:** International Organization for Standardization. (2024). Information technology — Artificial intelligence — Artificial intelligence concepts and terminology (ISO/IEC 22889:2022). <https://www.iso.org/obp/ui/en/#iso:std:iso-iec:22889:ed-1:1:en>.

**Source:** SGS. (2023). ISO/IEC 42001 certification: Artificial intelligence (AI) management system. <https://www.sgs.com/en/services/iso-iec/42001-certification-artificial-intelligence-ai-management-system>.

## 42001:2023 Model Management

Management system

**Table of contents**

- 1 Scope
- 2 Normative references
- 3 Terms and definitions
- 4 Context of the organization
- 4.1 Understanding the organization
- 4.2 Understanding the needs and expectations
- 4.3 Determining the scope of the AI management system
- 4.4 AI management system
- 5 Leadership
- 5.1 Leadership and commitment
- 5.2 AI policy
- 5.3 Roles, responsibilities and authorities
- 6 Planning
- 6.1 Actions to address risks and opportunities
- 6.2 AI objectives and planning to achieve them
- 6.3 Planning of changes
- 7 Support
- 7.1 Resources
- 7.2 Competence
- 7.3 Awareness
- 7.4 Communication
- 7.5 Documented information
- 8 Operation
- 8.1 Operational planning and control
- 8.2 AI risk assessment
- 8.3 AI risk treatment
- 8.4 AI system impact assessment
- 9 Performance evaluation
- 9.1 Monitoring, measurement, analysis and improvement
- 9.2 Internal audit
- 9.3 Management review

**Introduction**

Artificial intelligence (AI) is increasingly applied across all sectors, utilizing information technology, and is expected to be one of the main economic drivers. A consequence of this trend is that certain applications can give rise to societal challenges over the coming years.

This document intends to help organizations responsibly perform their role with respect to AI systems (e.g. to use, develop, monitor or provide products or services that utilize AI). AI potentially raises specific considerations such as:

- The use of AI for automatic decision-making, sometimes in a non-transparent and non-explainable way, can require specific management beyond the management of classical IT systems.
- The use of data analysis, insight and machine learning, rather than human-coded logic to design systems, both increases the application opportunities for AI systems and changes the way that such systems are developed, justified and deployed.
- AI systems that perform continuous learning change their behaviour during use. They require special consideration to ensure their responsible use continues with changing behaviour.

This document provides requirements for establishing, implementing, maintaining and continually improving an AI management system within the context of an organization. Organizations are expected to focus their application of requirements on features that are unique to AI. Certain features of AI, such as the ability to continuously learn and improve or a lack of transparency or explainability, can warrant different safeguards if they raise additional concerns compared to how the task would traditionally be performed. The adoption of an AI management system to extend the existing management structures is a strategic decision for an organization.

The organization's needs and objectives, processes, size and structure as well as the expectations of various interested parties influence the establishment and implementation of the AI management system. Another set of factors that influence the establishment and implementation of the AI management system are the many use cases for AI and the need to strike the appropriate balance between governance mechanisms and innovation. Organizations can elect to apply these requirements using a risk-based approach to ensure that the appropriate level of control is applied for the particular AI use cases, services or products within the organization's scope. All these influencing factors are expected to change and be reviewed from time to time.

**Source:** International Organization for Standardization. (2023). Information technology — Artificial intelligence — Management system (ISO/IEC 42001:2023). <https://www.iso.org/obp/ui/en/#iso:std:iso-iec:42001:ed-1:1:en>.

# Consider AI certifications for **STAFF**

IAPP launched their AI Governance Professional (AIGP) certification in 2024.



[iapp.org](https://iapp.org)

## Candidates:

- AI/ML
- Auditing
- Compliance
- Data Governance
- Data Science
- GRC
- Info Sec
- Legal
- Privacy



[Source: International Association of Privacy Professionals. \(n.d.\). Artificial Intelligence Governance Professional \(AIGP\) certification. IAPP. Retrieved April 18, 2024, from https://iapp.org/certif/aigp/](https://iapp.org/certif/aigp/)

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# Questions? Feel free to contact me

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