Hype Cycle for Emerging Technologies in Finance, 2023

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By Analyst(s): Mark D. McDonald

Initiatives: Digital Technology in Finance

CFOs can use this Hype Cycle to identify the top emerging technologies shaping the future of finance. This 10-year outlook predicts the most relevant trends in technology, data and processes to prepare leaders for a finance organization collaboratively managed by people and machines.

Analysis

What You Need to Know

Continued market volatility pressures CFOs to increase flexibility and resiliency, but the cost of these objectives conflicts with the need to increase productivity and profitability. Fortunately, the growing maturity and prevalence of technologies such as AI and machine learning (ML) establish a foundation that can help navigate uncertainty while increasing efficiency. Recent advances in Generative AI demonstrate AI's potential and convince AI skeptics of AI's value in finance and accounting processes.

This year's Hype Cycle introduces the most finance-relevant emerging technologies that prepare CFOs to:

- Choose the trends best aligned to their organizations.
- Develop roadmaps that prepare finance teams for future trends.
- Introduce new skills and prepare the organizational culture for a future that includes human-machine collaboration.
- Outmaneuver competition by anticipating changes rather than reacting to them.

The innovations presented span a wide range of use cases, organization types and industries and address four themes:

- Decision Support
- Process Efficiency
- Dynamic Applications
- Data Integrity

The Hype Cycle

This Hype Cycle distills insights from nearly 2,000 innovations into a succinct set of must-know emerging technologies selected for their transformational potential and applicability to finance.

Although all these technologies are at an early stage, some are more mature than others. Early stage technologies present greater deployment risks but potentially greater benefits for early adopters. More mature technologies, further along the curve, have an evolving track record of demonstrated success, pose less risk and are often available as prepackaged solutions from software providers.

AI Is Transforming the Future of Finance

This year's Hype Cycle for Emerging Technologies in Finance is largely influenced by the use of AI across the entire scope of finance processes. CFOs are now less skeptical of AI and instead of questioning its value, are seeking out vendors and building skills to help them realize the benefits early AI adopters achieved. As finance leaders warm to the idea of enhancing their workforce with advanced AI technology, a new breed of AI-driven software providers is attracting customers by incorporating the emerging AI innovations featured in this Hype Cycle into their platforms.

Themes in Finance Emerging Technologies

Four distinct themes emerge from the collection of innovations featured in this year's Hype Cycle:

Decision Support: The following emerging innovations promise to help finance leaders combine human intuition with modern technology to evaluate scenarios and drive sound decisions:

- Digital twin in finance
- Digital twin of a customer
- Causal AI
- Decision intelligence
- Explainable AI in finance
- Multiexperience UI

Process Efficiency: The following solutions promise a long-overdue efficiency boost to teams struggling to deliver economies of scale. The rapid advancement of foundational models (which includes generative AI) is accelerating the efficiency of reviewing and creating written material, including contracts, policies and code.

- D&A governance platforms
- AI governance
- Internal talent marketplaces
- Foundation models (including generative AI)
- Hyperautomation in finance

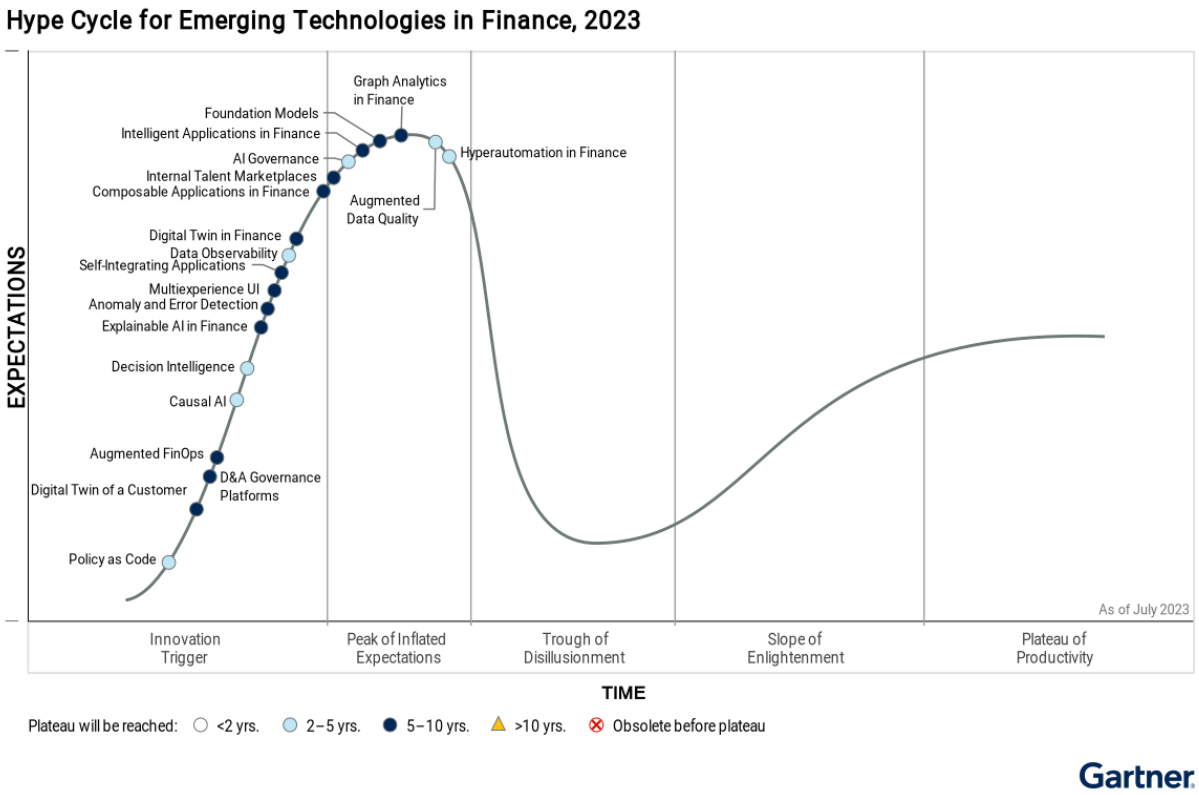
Dynamic Applications: A new era of applications hides the complexity of managing an interconnected application landscape and simplifies the effort of customizing platforms. These include:

- Policy as code
- Augmented FinOps
- Self-integrating applications
- Composable applications in finance
- Intelligent applications in finance

Data Integrity: AI relies on data, and better data leads to more reliable AI solutions. Without automated support, validating massive volumes of data is impossible. The following emerging innovations help finance teams increase the quality of data with minimal manual effort:

- Anomaly and error detection
- Augmented data quality
- Graph analytics in finance
- Data observability

Figure 1: Hype Cycle for Emerging Technologies in Finance, 2023



The Priority Matrix

The Priority Matrix maps the benefit rating for each innovation against the amount of time required to achieve mainstream adoption. The depicted placement of each technology and trend reflects an average assessment across all organizations and industries, so positions may vary for your company. CFOs should identify the technologies most relevant to their organization based on specific use cases and circumstances. Then, they can use the information in this Hype Cycle to guide roadmap content and investment decisions.

Innovations with a near-term adoption offer less-risky and tactical benefits with available vendors already supporting them. Innovations further out on the adoption horizon are considered strategic and have significant disruption potential. However, the advantages they offer and their likelihood of materializing are less certain.

Most innovations featured in this Hype Cycle have multiple use cases. Use the provided summaries for each technology to align each innovation with your specific objectives and circumstances. Validate the value of applicable innovations by adding proof-of-concept projects on your roadmap. Structure the roadmap to navigate obstacles and hurdles such as cultural resistance, skills and data before setting timelines.

Table 1: Priority Matrix for Emerging Technologies in Finance, 2023

(Enlarged table in Appendix)

Benefit	Years to Mainstream Adoption			
↓	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational		Augmented Data Quality Decision Intelligence	Augmented FinOps Digital Twin in Finance Digital Twin of a Customer Foundation Models Intelligent Applications in Finance Internal Talent Marketplaces Self-Integrating Applications	
High		AI Governance Causal AI Data Observability Hyperautomation in Finance Policy as Code	Anomaly and Error Detection Composable Applications in Finance D&A Governance Platforms Explainable AI in Finance Graph Analytics in Finance	
Moderate			Multiexperience UI	
Low				

Source: Gartner (August 2023)

Off the Hype Cycle

The Hype Cycle for Emerging Technologies in Finance is not a typical Gartner Hype Cycle. It draws from an extremely broad spectrum of topics, and we intend it to be dynamic. It features many technologies for only a year or two, after which it stops tracking them to make room for other emerging technologies. Most technologies that we remove from this Hype Cycle continue to be tracked on other Hype Cycles. Refer to Gartner's broader collection of Hype Cycles for items of ongoing interest.

The following were dropped in 2023:

- **Blockchain in finance** — This year's Hype Cycle excludes blockchain in finance to make room for other finance technologies that deliver a higher potential for transformative value.
- **Data literacy** — Although data literacy remains an imperative component of any technical plans in finance, the subject reached a level of maturity beyond the scope of emerging technologies in 2023.
- **Extended planning and analysis** — Gartner continues to track XP&A but the subject is not gaining traction with a diverse population of vendors, and demand from the finance community is low.
- **Democratized architecture** — This innovation remains a tracked item in Gartner's library. However, its applicability and adoption in finance is low. Alternatively, the composable architecture subject tracked in this Hype Cycle is more relevant for finance.
- **AGI** — Artificial general intelligence remains a future-oriented innovation and presents widespread implications for businesses and society. However, the subject is broad and its evolution is best represented in other items featured in the Hype Cycle.

On the Rise

Policy as Code

Analysis By: Paul Delory

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Policy as code (PaC) languages express governance and compliance rules as code, so they can be enforced programmatically by automation tools. PaC languages are often domain-specific and declarative. With PaC, policies are treated as software, making them subject to version control, code review and functional testing. The most mature PaC tools can render any business logic in code. You can use them today to enforce infrastructure compliance, authorization, Kubernetes admission control, and more.

Why This Is Important

In the most mature automation pipelines, infrastructure and operations (I&O) engineers mostly spend time on optimization, governance and compliance. They no longer build infrastructure; that work has been automated and turned over to others. Now, the I&O function builds the guardrails around the infrastructure services that their end users consume. I&O must align with security and compliance teams. PaC brings policy enforcement into their automation pipelines, while preserving a separation of duties that mirrors a typical IT org chart.

Business Impact

Policy as code improves:

- **Security, compliance and automation:** PaC combined with infrastructure automation implements policies automatically, with implicit compliance guarantees.
- **Alignment of security and operations teams:** PaC allows security and compliance teams to interface directly with automation pipelines to ensure conformance.
- **Visibility and auditability:** PaC provides both documentation of policies and evidence they are being enforced.

- **Time and effort spent:** PaC means less toil for operators.

Drivers

- **PaC tooling:** Several dedicated PaC tools are now on the market, many of them are open-source. The Open Policy Agent, a Cloud Native Computing Foundation project, has become the *de facto* standard for PaC. Indeed, even some other PaC tools now use Open Policy Agent policies alongside or instead of their own policy engines.
- **Increasing regulation:** New regulations such as GDPR have increased both the difficulty of compliance and the pressure on compliance teams. PaC allows compliance teams and auditors to document their policies in detail, and to verify that they are being enforced.
- **Security breaches:** Similarly, a spate of newsworthy security breaches at public companies — caused by infrastructure misconfigurations — has put every IT organization's security and compliance practices under increased scrutiny. No I&O team wants its security failures to be the reason for its company getting negative headlines.
- **Growth of DevOps and DevSecOps:** More and more companies are embracing DevOps and DevSecOps — which means more and more companies are encountering the hard governance problems of automation. Many teams that implement infrastructure as code quickly are finding that they need better policy enforcement, and PaC can help.
- **Cloud optimization and cost control:** Beside their benefits for security and compliance, PaC tools can also be used to enforce the build standards for infrastructure, including budgets. In the public cloud, where oversized or unnecessary infrastructure incurs direct out-of-pocket costs, programmatically enforced policies can help to control spending.

Obstacles

- **Scarcity of downloadable content:** PaC tools will not gain real traction until they have an extensive library of community-generated content. Ideally, users would simply download the policies they need from a free, public repository, rather than having to write their own policies. Over time, as the user base expands and commercial offerings see increased adoption, PaC tools will reach a critical mass of downloadable content that supports real-world use cases.

- **Skill set:** Many I&O professionals lack the skills to operate automation and PaC tools effectively. Gartner clients routinely report that their automation and policy management are hindered primarily by people, not tools. PaC will magnify these existing skills challenges.
- **Organizational inertia:** PaC promises improved collaboration between I&O and security or compliance teams. But in some organizations, this change would be unwanted. Internal resistance of this kind will slow the rate, scope and scale of PaC initiatives.

User Recommendations

- **Start small:** Choose a pilot use case where PaC is likely to provide real business benefits, expanding to others once PaC has proven its value.
- **Upskill staff:** PaC languages are not always intuitive. Technical staff will need practice to reach proficiency.
- **Prioritize existing templates:** Focus your PaC efforts on use cases that have ready-made implementation templates — ideally, publicly available downloadable content. For example, almost every PaC tool on the market has a canned implementation of the CIS benchmarks.
- **Break down team silos:** Use PaC to build a common workflow for automation and policy enforcement that spans I&O, security and compliance teams.
- **Integrate PaC into automation pipelines:** Use PaC to build guardrails for automation tools, so that they cannot take actions that are out of compliance.
- **Measure before and after:** Use observability tools and value stream mapping to define your starting state, then compare it to the end state. Collect real data to quantify the value of PaC.

Sample Vendors

HashiCorp; Palo Alto Networks; Progress; Pulumi; Styra

Gartner Recommended Reading

Using 'Policy as Code' to Secure Application Deployments and Enforce Compliance

How to Protect Your Clouds With CSPM, CWPP, CNAPP and CASB

Innovation Insight for Continuous Compliance Automation

Innovation Insight for Cloud-Native Application Protection Platforms

Magic Quadrant for DevOps Platforms

Digital Twin of a Customer

Analysis By: Melissa Hilbert, Michelle DeClue

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Definition:

A digital twin of a customer (DToC) is a dynamic virtual mirror representation of a customer that can be used to simulate and to emulate and anticipate behavior. Customers can be individuals, enterprise customer, personas, groups of people or machines.

Why This Is Important

DToCs help organizations of all sizes better understand their customers and anticipate their behavior. They increase efficiency and provide a personalized, empathetic service to customers, many of whose buying habits have changed during periods of disruption and change.

A DToC can be used to modify and enhance the customer experience (CX) and support new digitalization efforts, products, services and opportunities. It can be an engine of transformation and disruption.

Business Impact

Today, digital twins enable organizations to anticipate how a physical product will perform or need to be maintained in different conditions. Organizations can now use DToCs to simulate how a customer will react, given a specific set of ecosystem parameters, conditions, and control or input signals. DToCs help organizations selling products or services provide customers with better experiences, which results in increased revenue and lasting customer relationships.

Drivers

DToCs will help organizations drive revenue by:

- Gaining critical insights into customers
- Increasing revenue by enabling new ways to serve or capture customers, as well as by facilitating new data-driven business models
- Predicting and simulating behaviors with a view to making products, services, promotions and business campaigns more successful and reducing unnecessary costs of failure
- Improving customer engagement, customer retention, customer lifetime value and company growth
- Reducing churn, product failure and engagement abandonment

DToCs will help customers:

- Reduce friction in interactions with the supplier organization across their journey
- Increase positive outcomes, creating better value
- Engage in curated experiences and concierge-like experiences specifically tailored to drive value for them
- Protect privacy with the ability to change what personal data is collected and how organizations use it

Obstacles

- Privacy and cyber risk concerns may lengthen the time it takes DToCs to mature, and increase legal and regulatory risk.
- Organizations need competency in machine learning algorithms and some staff with data science skills to build or manage DToCs.
- Internal bias and concern exists about a DToC's ability to drive revenue or reduce costs. A strategy based on use cases of how to create value will be needed.
- The technology behind digital twins has focused on organizations and products. A customer focus is emerging, and lack of clear KPIs and other success measures limits the potential use of DToCs.
- Organizations need to establish trust with customers for customers to agree to share information. Customers will need transparency about what data is collected, how it will be used and the privacy and data controls that will be applied. For B2B, they need to know the benefits such as providing a more personalized experience, more relevant products or services, convenience and exclusive offers.

User Recommendations

- Align your activities with customers' privacy and cybersecurity concerns based on the availability of customer assets and establish a trust center to house these documents and expectations.
- Identify use cases for which DToCs could help deliver a better CX and for which suitable data is available by examining customer journeys and failure points.
- Define clearly KPIs and specific objectives that can be measured to validate improved business outcomes such as CX, demand forecastability or agility of responsiveness.
- Run a pilot, whether you build or buy a DToC, and compare results against a persona or C360 over a statistically significant period using significant data. Ensure your business and operating models are ready to support the endeavor.
- Encourage customers to share their data with you. Define benefits they can expect from a DToC, agree to the level of control they will have over their data including canceling the digital twin. Provide clear visibility into how their data will be used.

Sample Vendors

Absolutdata; Arrayworks; Fetch.ai; Infogain; Nstream; Salesforce; Tata Consultancy Services (TCS)

Gartner Recommended Reading

A Digital Twin of a Customer Predicts the Best Customer Experience

Quick Answer: Privacy Basics for a Digital Twin of a Customer

Innovation Insight: Demystifying Digital Twin of a Customer for B2B Sales

Quick Answer: Is a Digital Twin of a Customer the Future of a 360-Degree View of the Customer?

Supply Chain Executive Report: Drive Growth and Elevate Experiences With Digital Twin of the Customer

Augmented FinOps

Analysis By: Adam Ronthal, Dennis Smith

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

FinOps applies the traditional DevOps concepts of agility, continuous integration and deployment, and end-user feedback to financial governance, budgeting and cost optimization efforts. Augmented FinOps automates this process through the application of artificial intelligence (AI) and machine learning (ML) practices — predominantly in the cloud — to enable environments that automatically optimize cost based on defined business objectives expressed in natural language.

Why This Is Important

In the cloud, it is now possible to assess the cost of a specific workload or collection of workloads assigned to a project. However, price/performance — the primary measure of cloud efficiency — is difficult to assess due to the complexity and diversity of choice in underlying cloud infrastructure and service offerings and a lack of consistency in pricing models. Augmented FinOps can automate this process by applying AI/ML techniques.

Business Impact

The automation of cloud budget planning and financial operations will allow businesses to express their objectives — ideally in natural language — and allow their cloud ecosystems to automatically optimize the underlying cloud resources to meet those objectives. This will result in more efficient use of resources and, therefore, optimal spend by reducing/eliminating misaligned or poor use of cloud infrastructure and service offerings.

Drivers

- Practitioners are increasingly realizing that cloud is fundamentally a complex cost optimization exercise.
- Cloud adopters have a strong desire for transparency into cloud spending.
- Buyer inexperience is leading to either under-provisioning and associated resource contention or overprovisioning and spending more than is needed.
- Vendors are positioning cost-effectiveness as a competitive differentiator in their go-to-market strategies.
- Practitioners need to reduce the unpredictability of cloud spending when using cloud infrastructure and services for analytics, operational database management systems (DBMSs), data lakes and other applications, including custom IT infrastructure.
- Consumption-based usage remains common in earlier stages of cloud adoption, driving the need for augmented FinOps, although commit-based usage mitigates some unpredictability.
- Cost overruns are often obscured, downplayed, or dismissed by line of business implementers, requiring augmentation to achieve holistic and comprehensive cost optimization.
- Automation of financial governance controls in cloud environments provides increased predictability and cost optimization with less operational effort.
- Solid financial governance frameworks are positioning organizations to take advantage of FinOps.
- Emergence of specific roles — like FinOps practitioner or cloud economist — focused on FinOps practices and cost optimization means organizations have the expertise to address augmented FinOps.
- Owing to their complexity, cloud environments are ideally suited for the application of ML and AI methods to automate processes and track price and performance.
- Core FinOps capabilities are being delivered in three ways: Homegrown solutions, cloud service provider (CSP) instrumentation and third-party vendors. Increasingly practitioners are seeking out third-party or CSP tools to address their needs. All of these have a broad objective of adopting augmented capabilities as a means of competitive differentiation.

Obstacles

- Cloud service provider pricing models remain needlessly complex and diverse.
- Cloud ecosystems are (and will remain) open to third-party participants, which implies multiple commercial arrangements with multiple providers.
- Standards for cloud cost, usage and billing data like the FinOps Foundation's FOCUS proposal have yet to be broadly adopted. APIs for communicating performance data within the context of a broader ecosystem have yet to emerge. Both of these are required to assess the primary measure of success: price/performance.

User Recommendations

- Seek out service offerings to automate (via AI/ML) performance, consumption and pricing options. Increasingly, incorporate these capabilities into cloud data ecosystems that will learn from consumption patterns as they seek to optimize the underlying resources, and by extension, cloud spending through orchestration and optimization.
- Apply Gartner's FinOps Maturity Model to assess FinOps offerings in terms of their ability to address the following core capabilities: Observe, report, recommend, predict and optimize. The last three introduce augmented FinOps capabilities.
- Plan to use multiple tools to address the full scope of requirements. Many tools are broad in reach, but do not go deep into prescriptive recommendations. Others are tightly scoped and provide very targeted optimizations. Expect to spend time combining multiple tools to achieve broad and deep capabilities.

Sample Vendors

Acceldata; Anodot; Apptio; Capital One Software; Densify; Enteros; Finout; OtterTune; Sync Computing; Unravel Data

Gartner Recommended Reading

How to Identify Solutions for Managing Costs in Public Cloud IaaS

A Guidance Framework for Selecting Cloud Management Tools

Emerging Tech: Data Management Product Leaders Must Implement Augmented FinOps in Their Cloud Solutions

CDAOs and CFOs Must Drive Business Value in the Cloud Through Collaboration

Financial Governance Is Essential to Successful Cloud Data and Analytics

D&A Governance Platforms

Analysis By: Guido De Simoni

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

A data and analytics (D&A) governance platform represents a set of integrated technology capabilities that help govern and steward a range of policies spanning security, quality, access, retention, privacy and ethics. It exposes a user experience for policy setting and enforcement to all relevant participants (e.g., data stewards in business roles, business analysts, line of business [LOB] users, data scientists and governance board members).

Why This Is Important

The most complex governance challenges can no longer be met with siloed approaches. Convergence of capabilities is mandatory. Today, the execution of D&A governance is inconsistent, with different organizations using different types of technology. These disparities impede the success of digital business initiatives. Governance needs have grown more diverse and complex; all aspects of governance for all types of policies can benefit from cohesive technology support.

Business Impact

D&A leaders adopting D&A governance platforms will benefit from:

- An ability to mitigate risk from most complex, cross-organizational governance challenges
- Enhanced productivity and efficiency in governance processes, more rigor in enforcement of policies, and therefore more control and trust in data and analytics
- Emerging augmented data management capabilities that discover data and its relationships to seed and power various governance work efforts

- Converging long-term, discrete markets that will collide into one

Drivers

- Increasing complexity from data sovereignty requirements and digital strategies is forcing organizations to simplify and coordinate governance efforts globally across privacy, security, storage, access, use and sharing.
- Organizations want to have automated, synchronized, integrated, cost-effective and efficient D&A governance solutions with a central design, yet a distributed deployment. This requirement is driven by the growing recognition that the work of data and analytics governance is different from the work of data management, but that augmented data management supports the growth of these platforms of convergence.
- All of these aspects are operationalized, and more efficiency is gained when identification of data sources, curation of data, application of workflow, harmonization, reporting and visualization are provided in a coherent platform with automation. For example, you can address autogeneration of data quality rules using a number of methods. These include rule definitions and automated execution of data quality checks, AI-assisted data curation and association of business terms to technical artifacts, automated classification of sensitive data, and build subject registry.

Obstacles

- D&A governance today is served by discrete markets, each with its own solution. Inertia and sunk costs will slow down the emergence of this newer market.
- The current convergence within data management may not satisfy the needs of organizations across D&A governance.
- Incompatibility between what vendors can support and what different customer environments require will likely necessitate multiple metadata management solutions.
- Data management executes the policy that D&A covernance sets. The work — policy setting, enforcement and execution — is different, so the technology capacities, roles and value propositions of the platforms are different.
- Other obstacles reside in the cultural shift that many organizations must address in leveraging the inherent value of D&A governance. When organizations are committing to data and analytics initiatives aligned to mission-critical priorities, such obstacles can jeopardize the adoption of these platforms as enablers for continuous improvement. We estimate that this innovation will reach the Plateau of Productivity in more than 10 years.

User Recommendations

- Design proofs of concept that will capitalize on the required critical technology capabilities. Identify the relevance of these technologies and their connection to business outcomes as a first step. Then look into their ability to support specific use cases (such as risk management and compliance).
- Minimize the number of tools and solutions deployed by analyzing your strategic approach to D&A governance and by using available market technology capabilities in end-to-end scenarios supported by emerging D&A governance platforms.

Sample Vendors

Alex Solutions; Collibra; data.world; Global Data Excellence; IBM; Informatica; OvalEdge

Gartner Recommended Reading

The Role of Technology in Data and Analytics Governance Policy Management

Market Guide for Data and Analytics Governance Platforms

Causal AI

Analysis By: Pieter den Hamer, Leinar Ramos, Ben Yan

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Causal artificial intelligence (AI) identifies and utilizes cause-and-effect relationships to go beyond correlation-based predictive models and toward AI systems that can prescribe actions more effectively and act more autonomously. It includes different techniques, such as causal graphs and simulation, that help uncover causal relationships to improve decision making.

Why This Is Important

AI's ultimate value comes from helping people take better actions. Machine learning (ML) makes predictions based on statistical relationships (correlations), regardless of whether these are causal. This approach is fine for prediction, but predicting an outcome is not the same as understanding what causes it and how to improve it. Causal AI is crucial when we need to be more prescriptive to determine the best actions to influence specific outcomes. Causal AI techniques help make AI more autonomous, explainable, robust and efficient.

Business Impact

Causal AI leads to:

- Greater decision augmentation and autonomy in AI systems by estimating intervention effects
- Greater efficiency by adding domain knowledge to bootstrap AI models with smaller datasets
- Better explainability by capturing easy-to-interpret cause-and-effect relationships
- More robustness and adaptabilty by leveraging causal relationships that remain valid in changing environments

- The ability to extract causal knowledge with less costly and time-consuming experiments
- Reduced bias in AI systems by making causal links more explicit

Drivers

- **Analytics demand is shifting from predictive (what is likely to happen) to more prescriptive (what should be done) capabilities.** Making accurate predictions will remain key, but a causal understanding of how to affect predicted outcomes will be increasingly important.
- **AI systems increasingly need to act autonomously to generate business value,** particularly for time-sensitive and complex use cases, where human intervention is not feasible. This autonomy will only be possible by AI understanding what impact actions will have and how to make effective interventions.
- **Limited data availability for certain use cases is pushing organizations toward more data-efficient techniques like causal AI.** Causal AI leverages human domain knowledge of cause-and-effect relationships to bootstrap AI models in small-data situations.
- **The growing complexity of use cases and environments where AI is applied requires more robust AI techniques.** Causal structure changes much more slowly than statistical correlations, making causal AI more robust and adaptable in fast-changing environments. The volatility of the last few years has exposed the brittleness of correlation-based AI models across industries. These models have struggled to adapt because they were trained under a very different context.
- **The need for greater AI trust and explainability is driving interest in models that are more intuitive to humans.** Causal AI techniques, such as causal graphs, make it possible to be explicit about causes and explain models in terms that humans understand.
- **The next step in AI requires causal AI.** Current deep learning models and, in particular, generative AI have limitations in terms of their reliability and ability to reason. A composite AI approach that complements generative AI with causal AI — in particular, causal knowledge graphs — offers a promising avenue to bring AI to a higher level.

Obstacles

- **Causality is not trivial.** Not every phenomenon is easy to model in terms of its causes and effects. Causality might be unknown, regardless of AI use.
- **The quality of a causal AI model depends on its causal assumptions and on the data used to build it.** This data is susceptible to bias and imbalance. Just because a model is causal doesn't mean that it will outperform correlation-based ones.
- **Causal AI requires technical and domain expertise to properly estimate causal effects.** Building causal AI models is often more difficult than building correlation-based predictive models, requiring active collaboration between domain experts and AI experts.
- **AI experts might be unaware of causality methods.** If AI experts are overly reliant on data-driven models like ML, organizations could get pushback when looking to implement causal AI.
- **The vendor landscape is nascent, and enterprise adoption is currently low.** Clearly, this represents a challenge when organizations are running initial causal AI pilots and identifying specific use cases where causal AI is most relevant.

User Recommendations

- Acknowledge the limitations of correlation-based AI and ML approaches, which focus on leveraging correlations and mostly ignore causality. These limitations also apply to most generative AI techniques, including foundation models such as GPT-4.
- Use causal AI when you require more augmentation and automation in decision intelligence — i.e., when AI is needed not only to generate predictions, but also to understand how to affect the predicted outcomes. Examples include customer retention programs, marketing campaign allocation and financial portfolio optimization, as well as smart robotics and autonomous systems.
- Select different causal AI techniques depending on the complexity of the specific use case. These include causal rules, causal graphs and Bayesian networks, simulation, and ML for causal learning.
- Educate your data science teams on causal AI. Explain the difference between causal and correlation-based AI, and cover the range of techniques available to incorporate causality.

Sample Vendors

Actable AI; causaLens; Causality Link; CML Insight; Geminos Software; IBM; Lucid.AI; Qualcomm; SCALNYX; Xplain Data

Gartner Recommended Reading

Innovation Insight: Causal AI

Innovation Insight for Composite AI

Innovation Insight for Decision Intelligence Platforms

Building a Digital Future: Autonomic Business Operations

Case Study: Causal AI to Maximize the Efficiency of Business Investments (HDFC Bank)

Decision Intelligence

Analysis By: Erick Brethenoux

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Decision intelligence (DI) is a practical discipline that advances decision making by explicitly understanding and engineering how decisions are made and how outcomes are evaluated, managed and improved via feedback.

Why This Is Important

The current hype around automated decision making and augmented intelligence, fueled by AI techniques in decision making (including generative AI), is pushing DI toward the Peak of Inflated Expectations. Recent crises have revealed the brittleness of business processes. Reengineering those processes to be resilient, adaptable and flexible will require the discipline brought by DI methods and techniques. A fast-emerging market (DI platforms) is starting to provide resilient solutions for decision makers.

Business Impact

Decision intelligence helps:

- **Reduce technical debt and increase visibility.** It improves the impact of business processes by materially enhancing the sustainability of organizations' decision models based on the power of their relevance and the quality of their transparency, making decisions more transparent and auditable.
- **Reduce the unpredictability of decision outcomes.** It does so by properly capturing and accounting for the uncertain factors in the business context and making decision models more resilient.

Drivers

- **A dynamic and complex business environment, with an increasingly unpredictable and uncertain pace of business.** Two forces are creating a new market around decision intelligence platforms (DIPs). The first is the combination of AI techniques such as natural language processing, knowledge graphs and machine learning. The second is the confluence of several technology clusters around composite AI, smart business processes, insight engines, decision management and advanced personalization platforms.
- **The need to curtail unstructured, ad hoc decisions that are siloed and disjointed.** Often uncoordinated, such decisions promote local optimizations at the expense of global efficiency. This phenomenon happens from both an IT and a business perspective.
- **Expanding collaboration between humans and machines.** This collaboration, supplemented by a lack of trust in technologies (such as AI), is increasingly replacing tasks and promoting uneasiness from a human perspective. DI practices promote transparency, interpretability, fairness, reliability and accountability of decision models critical for the adoption of business-differentiating techniques.
- **Tighter regulations that are making risk management more prevalent.** From privacy and ethical guidelines to new laws and government mandates, it is becoming difficult for organizations to fully understand the risk impacts of their decisions. DI enables an explicit representation of decision models, reducing this risk.
- **Uncertainty regarding decision consistency across the organization.** Lack of explicit representation of decisions prevents proper harmonization of collective decision outcomes. DI remedies this issue.
- **Emergence of software tools in the form of decision intelligence platforms.** DIPs will enable organizations to practically implement DI projects and strategies.
- **Generative AI.** The advent of generative AI is accelerating the research and adoption of composite AI models, which are the foundation of DIPs.

Obstacles

- **Fragmentation:** Decision-making silos have created data, competencies and technology clusters that are difficult to reconcile and that could slow down the implementation of decision models.
- **Subpar operational structure:** An inadequate organizational structure around advanced techniques, such as the lack of an AI center of excellence, could impair DI progress.
- **Lack of proper coordination between business units:** The inability to impartially reconsider critical decision flows within and across departments (also because of fragmentation) diminishes the effectiveness of early DI efforts.
- **Lack of modeling in a wider context:** In organizations that have focused almost exclusively on technical skills, the other critical parts of human decision making — psychological, social, economic and organizational factors — have gone unaddressed.
- **Lack of AI literacy:** Many organizations still suffer from a lack of understanding when it comes to AI techniques. This AI illiteracy could slow down the development of DI projects.

User Recommendations

- **Promote the resiliency and sustainability of cross-organizational decisions** by building models using principles aimed at enhancing traceability, replicability, pertinence and trustworthiness.
- **Improve the predictability and alignment of decision agents** by simulating their collective behavior while also estimating their global contribution versus local optimization.
- **Develop staff expertise** in traditional and emerging decision augmentation and decision automation techniques, including predictive and prescriptive (optimization, business rules) analytics. Upskill business analysts, and develop new roles, such as decision engineer and decision steward.
- **Tailor the choice of decision-making technique** to the particular requirements of each decision situation by collaborating with subject matter experts, AI experts and business process analysts.
- **Accelerate the development of DI projects** by encouraging experimentation with generative AI and expediting the deployment of composite AI solutions.

Gartner Recommended Reading

Innovation Insight for Decision Intelligence Platforms

Reengineer Your Decision-Making Processes for More Relevant, Transparent and Resilient Outcomes

How to Choose Your Best-Fit Decision Management Suite Vendor

AI Security: How to Make AI Trustworthy

Top Strategic Technology Trends for 2023: Adaptive AI

Anomaly and Error Detection

Analysis By: Mark D. McDonald

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Anomaly and error detection in finance leverages AI and ML to identify errors, mistakes or unusual activity, as well as violations of internal policies, compliance rules and accounting standards. Such tools may be on-premises or cloud-based, and may be stand-alone solutions or integrated with accounting and reporting systems (e.g., ERP). Solutions report anomalies and errors in real time or via periodic batch processing, allowing users to take investigative or corrective actions on findings.

Why This Is Important

Finding and correcting errors grows increasingly difficult for finance departments as data volume and complexity grow. New rules, regulations and accounting policies make compliance challenging and increase the chances of embarrassing violations and restatements. By leveraging AI and automating anomaly and error identification, finance teams spend time supporting business objectives rather than fixing problems and responding to audit findings.

Business Impact

Anomaly and error detection offers:

- **Early detection of problems** before they become time-consuming, frustrating, costly and embarrassing to correct
- **Error-free and compliant financial results** that build stakeholder trust and a solid company reputation
- **"Finding-free" audit reports** that require no punch list of time-consuming follow-up actions
- **Increased leadership confidence in the finance function** and an assurance that published financial statements are consistently and reliably accurate

Drivers

- **Increased complexity:** Consistent increases in data volume increase the complexity of managing that data. Increased volume and complexity lead to more errors that are difficult to uncover.
- **Cost and productivity pressure:** Increased pressure to reduce costs forces financial leaders to look for cost-cutting measures across all financial processes. By using AI-driven tools to detect errors early, fewer resources are needed to find and correct mistakes, allowing finance staff to spend more time on business support. Additionally, consistent adherence to statutory accounting guidelines and policies reduces the hourly cost of audit support.
- **Reputation:** Stakeholders demand financial integrity and financial statements they can rely on. By ensuring that results are integral, companies avoid reputation-damaging restatements.
- **Advancements in AI and machine learning (ML):** Increased accessibility of AI and ML is motivating vendors to leverage these techniques and develop effective and easy-to-use platforms that require minimal user training and implementation effort.
- **AI and ML curiosity:** CFOs are actively exploring the benefits of AI and ML in the finance workflow. Using anomaly and error detection software allows leaders to observe the benefits of AI without a large project or disrupting workflows.
- **Increasing effectiveness of external auditors:** Some larger audit firms are using AI to lower costs and find a larger number of detailed anomalies and errors. This forces audit clients to implement commensurate tools to keep up.

Obstacles

- **AI skepticism:** Negative AI media coverage prevents widespread acceptance of AI-driven tools and processes.
- **Establishment resistance:** Tools that impact the revenue stream of large audit firms will encounter certain resistance. Regulatory agencies will also challenge changes to established control processes.
- **Lack of AI experience:** Without AI experience, leaders struggle to relate AI's advantages with business benefits and to integrate these tools into legacy workflows.
- **Immature market:** A lack of clear market segments and benchmarked capabilities leaves this new era of AI-driven solutions off company radars.
- **Legacy system investment:** Years of sunk capital in tailored, rules-driven systems drive a falsely optimistic sense of security that these systems will adequately handle growing data volumes and complexity.
- **Lack of ROI commitment:** An inability to promise ROI for AI-driven software solutions drives hesitation when making investments.

User Recommendations

- Isolate the areas of finance processes with the largest number of and most costly errors to identify where anomaly and error detection has the largest potential impact.
- Use the cost of errors as a baseline for potential savings. Choose recent examples and assess their cost. Consider costs like late delivery penalties and lost revenue from internal mistakes. Other direct costs may include the time charged by external auditors to follow up on audit findings.
- Search for external vendors that can help. Consult a Gartner analyst to help narrow your search.
- Engage a shortlist of possible vendors in a live demonstration of their tools to evaluate them on the efforts needed to provide the tool with sufficient data and whether the tool addresses your process needs. Include an assessment of whether the software's output provides actionable information.
- If no vendors can help with your specific use case, engage your internal advanced analytics department to build custom solutions.

Sample Vendors

Ai XPRT; AppZen; AuditMap; MindBridge; Oversight

Explainable AI in Finance

Analysis By: Mark D. McDonald

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Gartner defines explainable AI (XAI) as a set of capabilities that describes how an algorithmic model determines its outcome. In finance, explainability helps develop the story behind the values predicted by AI models. Financial leaders suffer enormous risks from presenting misleading facts, including prosecution, increasing the importance of explainability. XAI lowers this risk by adding transparency to model outcomes, which builds trust and avoids biases in algorithmic decision making.

Why This Is Important

XAI gives visibility into how a model arrived at a particular decision. This helps build trust, confidence and understanding in AI-driven outputs. As AI adoption grows, internal users demand explanations before relying on model outcomes. As AI replaces human decision making, regulators across various business sectors, particularly banking and insurance, require evidence that models used in regulated decisions are free of bias and adhere to the same decision-making criteria as humans.

Business Impact

Both developers and end users are responsible for XAI. Stakeholders at all levels must ensure sufficient explainability before relying on model outcomes. Without explainability, a business risks making decisions that can damage its reputation, violate laws or lead to poor decisions. This underscores the importance of AI governance that addresses the interpretability needs of direct and indirect stakeholders from inside and outside of the organization.

Drivers

- The lack of model output explainability limits an organization's ability to manage AI risk. Without explainability, an organization cannot justify the actions or decisions suggested by AI models.
- Relying on algorithmic decisions without explainability introduces a level of AI risk that can lead to a damaged reputation, financial loss, unethical behavior, legal violations and poor decisions.
- Explainable AI models used in financial forecasting help describe the story behind the forecast values.
- Business stakeholders and users have different interpretability needs. Developers, users, managers, leaders, consumers, customers and regulators all require a different burden of proof that models are behaving responsibly.
- Organizations hold the same level of decision-making responsibility for AI as they do for decisions made by people. XAI enables users to validate that models are behaving as responsibly as people.
- The growing emphasis on ethical and moral corporate behavior drives an increased need for XAI as companies rely on algorithms to influence their behavior.
- New regulations and legal actions increase the demand for explainable AI methodologies.
- Explainable models help finance leaders build trust and consequently increase AI adoption.

Obstacles

- Building an effective XAI that financial leaders can trust requires a mix of technical and financial management skills that are predominantly found in citizen data scientists.
- Explainable models are harder to build, and they require more time and cross-functional participation in development.
- Building explainability into models is often addressed near the end of the project; however, effective explainability is achieved during the upfront design.
- Without understanding that explainable models are possible, finance users are likely to reject the use of AI due to the perception that all AI is subject to the black-box effect.
- Organizations that focus on the models' accuracy, rather than the explainability, stall their efforts to expand the use of AI by creating models that fail to earn financial leadership's trust.
- Explainability is often confused with machine learning (ML) interpretability. ML interpretability serves data scientists, while explainability serves nondeveloper business users.

User Recommendations

- Include the need for explainability during initial model design. Modify project management guidelines to include an explainability requirement, and add explainability to the conditions for end-user approval.
- Consider a “provability” approach when explainability is not possible, which requires postprediction steps to prove that a model’s output is reasonable.
- Flag outputs with inconclusive or insufficient explainability for review before they are released for use.
- Use finance citizen data scientists during development so finance explainability requirements are included in model design.
- Engage cross-functional teams early in the model design effort to ensure business users include their explainability requirements and will be confident in model outputs.
- Document explainability limitations and ensure results are only used where their level of explainability is sufficient.

Sample Vendors

Dataiku; EazyML; Fiddler; Google; H2O.ai; IBM; Microsoft; Modzy; Superwise; TruEra

Gartner Recommended Reading

How a Coin Flip Can Build Trust in AI: Lessons From Chevron

Market Guide for AI Trust, Risk and Security Management

Incorporate Explainability and Fairness Within the AI Platform

Multiexperience UI

Analysis By: David Pidsley

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

A multiexperience user interface (UI) for analytics and business intelligence (ABI) aligns modes of interaction and analytics capabilities, which optimize a user's experience of analytics development and consumption of content for a given decision-making process. The increase in possible combinations of approaches is due to advancements in technologies such as augmented analytics, generative AI, data storytelling, natural language query, virtual reality (VR) and augmented reality (AR).

Why This Is Important

Much like the customized user experiences we are used to in our day-to-day interactions with technology, consumer-oriented analytics experiences are needed to drive adoption of data-driven decisions. Organizations must be able to deliver the most relevant, contextualized and consumable analytics outputs possible. This requires tapping into the unique intersection of various devices, interaction modalities and analytics capabilities that can augment users' ability to consume insights.

Business Impact

Transitioning from static analytics outputs to dynamic contextualized insights, embedded or automated, means analytics are delivered with increased relevance closer to the point of decision. Aligning analytics with an optimal interface and consumption modality will impact the approach to measuring ABI adoption. Quantifying adoption must shift from counting how many users leverage a tool to how many people consult data in making a decision and what pathway of capabilities they use.

Drivers

- Multiexperience is closely coupled to advancements in both hardware, in the form of interfaces such as desktops, mobile devices, wearable devices, virtual reality simulators or smart speakers; and software, in the form of augmented analytics, data storytelling and natural language query capabilities.
- The various modalities in which users can interact with data (chat, click, touch, voice, etc.) are generally accepted, yet organizations are only scratching the surface when it comes to maximizing the cross-section of these interfaces and capabilities. Many organizations are already using embedded forms of analytics as a starting point for multiexperience.
- Because capabilities, such as augmented and automated data storytelling, are almost entirely enabled by cloud-based architectures, adoption will be accelerated proportionate to organizations' movement to cloud-based data and analytics tools.
- AI-powered assistants enabled by generative AI (similar to ChatGPT, Copilot) that vendors make available within (or connect to) ABI platforms have changed the way analytics developers and consumers experience their work. This shifts the focus from drag-and-drop to prompt-and-refine.

Obstacles

- While there is a wide variety of multiexperience UIs available to users, the roles and skills needed to compose these remains a challenge.
- Data and analytics (D&A) resources must learn how to maximize the combination of new interaction modalities and analytics capabilities. The time needed for this will be in direct competition with the time needed for day-to-day analytics requests that many D&A teams are already inundated with.
- While unique best-of-breed user experiences may be ideal, potential buyers may default to using existing ABI platforms that will add augmented capabilities without time-consuming migration, consolidation or additional new investments.
- Automation of decisions, accelerated by the adoption of AI, may lessen the need for humans to create analytic content for decision support. Data literacy may decline as business users transition from analytics consumers to a role where their input simply validates recommended decisions.

User Recommendations

- Account for multiexperience approaches to consuming data by aligning the right analytic capability to the right user interface and experience.
- Evaluate where new consumption mechanisms could add value to decision-making processes, rather than simply lifting and shifting the same traditional analytics outputs to a modern cloud platform.
- Evaluate, on a regular basis, your existing ABI tools and innovative startups to offer new augmented user experiences beyond the predefined dashboard, such as AI-powered coding assistants.
- Place analytics capabilities as close to relevant business decision makers as possible, by evaluating when ABI platform capabilities are best embedded in line with other business applications or workflows.
- Take a data-driven approach to analytics adoption by leveraging the usage data available within today's ABI platforms. If not prebuilt, discuss with vendors the options available to tap into such data.

Sample Vendors

BadVR; D6 VR; Google; SAS; TIBCO Software; Virtualitics

Gartner Recommended Reading

Market Guide for Augmented Analytics

Top Trends in Data and Analytics, 2023

Emerging Technologies: Find Success With Head-Mounted Displays Despite Modest Market Growth Expectations

Cool Vendors in Analytics and Data Science

Multiexperience Will Be the New Normal for Consuming Analytics Content in the Augmented Era

Self-Integrating Applications

Analysis By: Keith Guttridge

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Self-integrating applications will use a combination of automated service discovery, metadata extraction and mapping, automated process definition, and automated dependency mapping to enable applications and services to integrate themselves into an existing application portfolio with minimal human interaction.

Why This Is Important

Integrating new applications and services into an application portfolio is complex and expensive. Gartner research shows that up to 65% of the cost of implementing a new ERP or CRM system is attributable to integration. The technology for enabling applications to self-integrate exists in pockets, but no vendor has yet combined all the elements successfully. As applications develop the ability to discover and connect to each other, the amount of basic integration work will dramatically reduce.

Business Impact

Self-integrating applications can:

- Improve agility, as the time to onboard applications and services is massively shortened.
- Cut costs by up to 65% when onboarding new applications and services.
- Reduce vendor lock-in, as platform migration becomes simpler.
- Improve the ability to focus on differentiation and transformational initiatives, as the “keeping-the-lights-on” burden is dramatically reduced.

Drivers

- Cloud hyperscalers provide features such as service discovery, metadata extraction, intelligent document processing and natural language processing.
- Automation or integration vendors provide features such as intelligent data mapping, metadata extraction, next-best-action recommendations, process discovery and automated decision making.
- SaaS vendors provide features such as process automation, packaged integration processes, portfolio discovery and platform composability.
- In the new era, intelligent application portfolio management is placed on top of augmented integration platforms in order to properly address the challenge.
- Generative AI simplifies the build process to create integration processes.

Obstacles

- Embedded integration features within SaaS are good enough to enable organizations to get started quickly, thus stalling investment in improving self-integration capabilities.
- Generally, organizations are not well aware of the availability of augmented integration technologies for enabling self-integrating applications. Many organizations still view integration as a complex issue requiring specialist tools.
- There is not a clear market leader that is looking to push this technology forward as the major application vendors look to protect their customer bases.
- Complex scenarios across multiple datasets and service interfaces are too challenging for the current technology. Organizations place too much trust in the solution to do the right thing. Ownership and visibility of the integrations might become contentions within the organizations.

User Recommendations

Software engineering leaders responsible for integration should:

- Ask your major application vendors about the interoperability of applications within their portfolios. This is the area where self-integrating applications are most likely to emerge first.

- Investigate integration vendors that have augmented artificial intelligence features to automate the process of onboarding applications and services into a portfolio.
- Manage your expectations for ease of integration. Self-integrating applications will provide just enough integration with the rest of the application portfolio to enable a new application to work efficiently.
- Keep track of governance capabilities. Who can authorize access? Has the appropriate observability been established? Is everything fully audited? Does something need to change? An organization's integration landscape is an ever-evolving environment, and each integration has a life cycle that needs to be maintained.

Sample Vendors

Boomi; IBM; Microsoft; Oracle; Salesforce; SAP; SnapLogic; Tray.io; Workato

Data Observability

Analysis By: Melody Chien, Ankush Jain

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Data observability is a technology that supports an organizations' ability to understand the health of an organization's data, data pipelines, data landscape, and data infrastructure by continuously monitoring, tracking, alerting and troubleshooting issues to reduce and prevent data errors or system downtime. It tells us what went wrong based on agreed upon SLAs for data quality and usage; reasons; assesses the impacts; and recommends solutions. Data observability improves reliability of data by increasing our ability to observe changes, discover unknowns and take appropriate actions.

Why This Is Important

Data observability uses data profiling, AI/ML, lineage and active metadata to provide the following benefits:

- **Monitor & Detect:** Provide a holistic view to determine how components of data pipelines are operating, evaluate whether data quality meets expectations, and detect data related issues.
- **Alert & Troubleshoot:** Send right alerts to the right people at the right time and perform root cause analysis.
- **Resolve & Prevent:** Provide recommendations to fix the issues or optimize data pipelines to meet business requirements with the goal to prevent downtime or critical data issues before affecting business.

Business Impact

- Data observability allows technical teams to gain visibility of the health of data pipelines and infrastructure. They can identify possible drifts in various areas, and minimize the time to investigate and solve issues, preventing unplanned outages or critical data errors.
- Business users will also gain visibility of data quality and associated financial impacts. This will ensure appropriate use and management of data to meet governance requirements.
- Data observability allows facilitation and improvement of the data fabric with continuous observations and evaluations of the data and analytics ecosystem.

Drivers

- Data and analytics leaders face a growing number of mixed data stacks, diversity of datasets, unexpected data drifts such as change in schema or business context, high demand for data quality and near zero tolerance of downtime. All these add to the challenges in data management. They need a holistic view of the state of data quality and data pipelines within interconnected systems.
- Data pipelines move data from point to point and deliver data to consumers. This journey can be disrupted by unexpected events such as data quality issues or a lack of infrastructure resources. The data that flows through these pipelines needs to be monitored for loss of quality, performance or efficiency. Organizations need to be able to identify points of failure before they have a chance to propagate. Data observability automatically detects important events and analyzes various signals to troubleshoot the issues, and provides actionable insights of what to do next.
- Data observability goes beyond traditional monitoring. It provides a multidimensional view of data including performance, quality, usage and financial impacts to the downstream applications. Leveraging active metadata, lineage of data and AI/ML, data observability generates real-time insight by monitoring the business context and analyzing data pattern, comparing history, and developing a semantic understanding of the data. It provides an end-to-end observability to help organizations be better equipped to handle critical events and prevent business disruptions.
- This capability is essential to the data fabric design concept and becomes an important building block to further automation in data management practices.

Obstacles

- There is no standard definition of what constitutes a data observability solution. Vendors offer a range of different capabilities often branded as data observability which is causing confusion in the market and leading to issues adopting the tools.
- The current vendor landscapes are very fragmented based on coverage areas and data environments supported. Most vendors focus on observability of the data quality and data pipelines, and are less concerned about data usages and financial impacts. The full end-to-end observations are not quite there yet from individual vendors.
- Most data observability tools only support the modern data stack. This limits their application in large enterprise environments with more complex data environments in many cases using legacy data management tools.
- Most data observability tools target the data engineer persona and are positioned as IT tools. Though business users receive important insights from data observability tools, they may find them less user-friendly.
- Organizations are embracing the concept of “observability.” But the actual adoption of the tools is not straightforward. The consideration of how they connect to the overall ecosystem and connecting this to data governance strategy is still a concern.

User Recommendations

- Identify the data elements or data pipelines which require high standards or SLA in quality, uptime, latency and performance. Pinpoint the gap of current monitoring capabilities vs. desired capabilities to support the requirements.
- Evaluate data observability tools available in the market that can enhance your observability based on priority of business requirements, primary users and interoperability with the enterprise data ecosystems.
- Pilot data observability program by building a monitoring mechanism as a starting point to increase visibility over the health of data. Invest in observability capabilities in a cloud environment first, as it's commonly supported by vendors and is faster and easier to demonstrate value.
- Include both business and IT perspectives when evaluating data observability tools by engaging with both personas early on in the evaluation process.
- Partner with business stakeholders to evaluate and demonstrate business value of data observation practices by tracking improvement of data quality, reduction in downtime and ability to meet SLAs to show tangible benefits.

Sample Vendors

Acceldata; Ataccama; Bigeye; Collibra; IBM; Kensu; Monte Carlo; Soda; Unravel

Gartner Recommended Reading

Data and Analytics Essentials: Data Observability

Quick Answer: What Is Data Observability?

The State of Data Quality Solutions: Augment, Automate and Simplify

Market Guide for DataOps Tools

Digital Twin in Finance

Analysis By: Mark D. McDonald

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

A digital twin is a virtual representation of a real entity that can be a physical object, a process, an organization or a person. It relies on sensors or other monitoring technologies to collect the state of an object to build a digital representation. Using a digital twin adds value by testing changes to the twin before implementing them on their real-world counterpart. Finance can use digital twins to represent business processes and assess the impact of changes before implementing them.

Why This Is Important

Enterprises are using digital twins to create virtual representations of entities or activities for process, cost, revenue or other business objectives. Examples include improving operational efficiency of a power plant, or identifying opportunities for supply chain improvement or areas to model and improve business processes. Technology providers are developing new revenue streams and customer engagement by developing and selling digital-twin-enabling products and services.

Business Impact

Finance is exploring digital twins to:

- Identify the impact of decisions before executing them. For example, a digital twin of the supply chain can quantify the financial impact of alternative decisions.
- Drive new revenue models by reselling data collected by the digital twin.
- Identify hyperautomation opportunities by simulating process changes on a digital twin.
- Reduce risk of fraud and noncompliance by monitoring and flagging live transactions that do not match the behavior of the digital twin.

Drivers

- Digital twins' capabilities are more accessible to organizations due to rapidly evolving simulation and modeling capabilities, better interoperability and access to IoT sensors, and availability of tools and computing infrastructure to access and support large datasets.
- In Gartner's 2022 Finance Technology Bullseye Survey, 21% of respondents report deploying, piloting or exploring digital twins. Finance is accelerating the adoption of digital twins to support a variety of business outcomes: increasing process efficiency, optimizing supply chain costs, supporting new business models, identifying risk, supporting new investments, and driving faster and more effective decision making.
- Finance is exploring digital twins in multiple use cases: supporting investment decisions, screening risk, modeling new processes and exploring scenarios.
- Specific asset-intensive industries, such as oil and gas, manufacturing, automotive, and utilities have demonstrated effective use of digital twins to improve business operations through remote monitoring of assets.
- Finance institutions, banks and fintech companies are also among the early adopters of digital twins within customer support, fraud detection, lending decision making, credit risk assessment, stress tests and wealth management functions.

Obstacles

- Few enterprises have the skilled cross-functional teams — business, finance and technology — required to develop digital twins. These teams conceive, create and maintain digital twins, including the models that are synchronized to the real entities.
- Digital twins require a blend of sensors and machine learning (ML) algorithms, which challenges most finance teams. The difficulty in finding the skills to develop and maintain these solutions prevents many organizations from starting.
- Loosely defined business objectives, rapidly changing circumstances and difficulty setting a digital twin's scope prevent finance from launching digital twin projects.
- Lack of data quality across business and operational data drives skepticism in the digital twins results, driving lower adoption of the technology within finance.
- Digital twins require a cohesive regulatory, compliance and legal framework, which is a concern for CFOs and others in the C-suite when planning large-scale digital twin deployments.

User Recommendations

- Work with IT and business leaders to establish realistic expectations for how digital twins can support organization objectives, and define KPIs to measure success.
- Engage the business unit to identify champions, get budget support and co-create the digital twin strategy. Avoid digital twin projects that lack a business sponsor and objective, as they will waste resources and undermine adoption.
- Isolate the areas of finance processes by applying simulation on the digital twin to identify the largest opportunity for hyperautomation.
- Identify operational technology (sensors) and information technology (ML) gaps and build a roadmap to either procure or internally build the skill sets needed to close the gap.
- Prepare a long-term governance strategy that covers data, regulatory and compliance framework to complete digital twin deployments.

Sample Vendors

Alibaba Cloud; Altair; Ansys; Element; e-Magic; Google; KONGSBERG; TADA

Gartner Recommended Reading

2023 Finance Technology Bullseye Report

Quick Answer: What Is a Digital Twin?

Market Guide for Technologies Supporting a Digital Twin of an Organization

At the Peak

Composable Applications in Finance

Analysis By: Irmina Melarkode, Nisha Bhandare

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Composable applications are built, in part or in whole, as flexible assemblies (compositions) of software components that represent well-defined business capabilities, packaged for programmatic access (PBCs). The intent of the modularity is increased flexibility in the application's own delivery, business-driven evolution and extension, plus the components' availability for composition across applications.

Why This Is Important

As business environments become increasingly dynamic, finance teams struggle to adapt with complex and siloed technologies. Composability organizes finance technologies into modular application building blocks that deliver well-defined finance capabilities in support of specified business outcomes. By embracing composable technologies, finance can improve speed and agility while enabling innovation within the function.

Business Impact

Introducing composability in technology strategy enables finance organizations to make decisions about where and how to invest in technology, which will generate a faster and agile response to emerging business needs. Technology investments, when paired with composable thinking, will provide a notable improvement in the function's resilience, adaptability and readiness to change.

Drivers

- In a continuously changing business context, demand for business adaptability directs organizations toward technology architecture that supports fast, safe and efficient application change.
- The demand for active participation of business decision makers like finance in the design of their digital experiences promotes technology adoption.

- The emerging business model of industry clouds promotes the architecture of modularity and financial processes composition inside and across the composable technology ecosystem.
- The increasing number of vendors offering API-centric SaaS builds up a portfolio of available finance capability-centric packaged application — promoting their use as building blocks of composable business applications.
- Rapid innovations in technology, such as native AI applications, are rendering traditional technology selection and implementation practices inflexible, outdated and difficult to adapt to business disruptions.
- With rapid disruptions within the business environment and technology industry, finance is leaning in on technology to drive two outcomes: (1) innovate finance processes to adapt quickly to the accelerating pace of business change and (2) standardize finance processes to enable cost optimization.

Obstacles

- With limited experience of composable thinking, finance gravitates toward selecting large and complex technologies that drive rigidity in the technology environment and slow down the transition toward composability.
- Finance's technological conservatism leads to an outdated, one-size-fits-all approach in governing all composable technologies, which impedes agility and innovation in the function.
- Limited practice of business-IT collaboration for application design delays the effective composable design that depends on the complementary expert talents in multidisciplinary fusion teams.
- Most legacy applications can participate in composition via APIs and/or event streams, but their architecture provides only minimal autonomy, delaying the full positive effect of composable architecture.
- Without a modern application integration strategy, organizations will struggle to maintain and evolve multiple composable applications in their environment, delaying the benefits of autonomy and agility.

User Recommendations

- Break down business strategy into key outcomes and identify the specific finance capabilities needed to support these outcomes.

- Reorganize the technology landscape into an ecosystem of modular building blocks that support each finance capability by using a composable finance technology strategy.
- Align finance technology within the three layers of the composable technology architecture — core, differentiated or innovative — to ensure decisions around technology strategy, investment and deployment support the right objective.
- Gradually modernize (or replace) existing applications toward the architecture of business-centric modularity.
- Promote modular thinking as the means to great flexibility in business and software innovation.
- Prioritize forming business-IT fusion teams to support faster and more effective adaptive change of business applications.
- Use cases include: procure-to-pay suites, cash management solutions, integrated invoice-to-cash applications, accounting engines.

Gartner Recommended Reading

Drive Agility by Deploying a Composable Finance Technology Strategy

Build a Finance Capability Roadmap as the First Step in Your Composable Technology Journey

Design an Ecosystem of Composable Finance Technologies to Accelerate Your Digital Transformation

Internal Talent Marketplaces

Analysis By: Emi Chiba

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Internal talent marketplaces (ITMs) are intelligent platforms that match internal or contingent workers to work opportunities without recruiter involvement. They provide personalized recommendations aligned to workers' unique skills and experiences. Opportunities include gigs, time-boxed projects, stretch assignments, mentoring or full-time roles. ITMs offer marketing features, matching algorithms and feedback functionality, while aligning with adaptive organizational design principles.

Why This Is Important

Continued market uncertainty and demand for new skills have made adaptability and resilience critical. Volatility combined with worker demands for increased mobility and development opportunities has led to the adoption of ITMs. ITMs provide organizations with valuable insight into skills and workers equitable insight into available growth opportunities. They are key to enabling adaptability, resilience and experiential learning.

Business Impact

Adopters of ITMs use them to:

- Understand workforces through a different lens — focused on the skills needed, rather than the role.
- Gather skills data and support talent through experiential learning and hands-on opportunities.
- Encourage and track employee development and collaboration in new ways, with a focus on skills.
- Address rapidly changing business priorities, and redeploy or reskill existing employees in order to improve organizational sustainability, while increasing employer brand appeal.

Drivers

- **Business agility and composability:** Agile and composable organizations require more flexible deployment of workers across projects, products and other initiatives. Composable businesses are architected for real-time adaptability and resilience in the face of uncertainty. They need people with learning agility to adapt to changing skills demands. They also need to be able to align a highly networked workforce to the work that needs to get done in a dynamic way.
- **Talent visibility:** HR and other organizational leaders benefit from the data and insights from ITMs to support workforce planning and other talent processes. Team, project and product leaders within organizations benefit from more flexible staffing and improved visibility into talent.
- **Worker demand for growth opportunities:** Deployed correctly, ITMs provide employees and contingent workers with better visibility into work opportunities. They can stretch and build up their skills and experiences in order to grow their portfolio of work and careers.
- **Technology availability:** Hype around the ITM has increased. The market for these platforms consists of human capital management (HCM) suite providers, talent acquisition vendors, learning platforms and specialist point solutions. Maturity in applying AI to detect, infer and map relationships between skills has increased, as has the use of AI techniques to automatically match talent to work opportunities.

Obstacles

Organizational challenges impeding adoption include:

- Lack of cultural readiness for more dynamic and adaptive organizational models and project- or gig-based work.
- Talent hoarding due to fear of lack of resources. Managers may discourage team members from seeking outside opportunities as they only see talent engaging in work for other teams, and fear not having enough talent to get assigned work done on their own team.
- Lack of psychological safety. Workers may not be confident enough to bid on projects or gigs for fear that they will not be selected. Uncertainty can also exist around how performance on projects will impact annual performance reviews.

Data-related challenges include:

- Access to data regarding worker and worker experiences, knowledge and skills.
- Use of organization-specific and more granular skills to enable better matching.
- Difficulties in balancing privacy and the need for a significant amount of talent data to enable better user experiences through more relevant matching.

User Recommendations

- Pilot ITMs within business units that use adaptive or agile organization models, or work with progressive talent management leaders who want to deliver agile skills development.
- Invest in design thinking, work design and workplace ethnography. Allowing workers to bid for projects and gigs, represents a significant change to management practices.
- Inventory current skills ecosystem and data sources to decide what may feed into matches and recommendations in the ITM prior to vendor evaluation.
- Evaluate vendors by assessing user experience, ability to incorporate diverse sources of data and skills ontologies. When evaluating vendors with similar capabilities, prioritize user experience as user adoption is critical to the adoption and success of an ITM.
- Market the ITM, as it gets adopted within your organization, as an essential, growth-focused part of your differentiated employer brand.

Sample Vendors

365Talents; Degreed; Eightfold AI; Fuel50; Gloat; Oracle; ProFinda; SAP; Workday

Gartner Recommended Reading

Market Guide for (Internal) Talent Marketplaces

Innovation Insight for AI-Enabled Skills Management

Market Guide for Talent Acquisition (Recruiting) Technologies

Future of Work Reinvented: Shifting Talent and Skills

AI Governance

Analysis By: Svetlana Sicular

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

AI governance is the process of creating policies, assigning decision rights, and ensuring organizational accountability for risks and investment decisions for the application and use of artificial intelligence techniques. AI governance is part of adaptive data and analytics governance, addressing the predictive and generative nature of AI.

Why This Is Important

With AI now delivering value in the enterprise, data and analytics leaders observe that scaling AI without governance is ineffective and dangerous. Generative AI and applications, like OpenAI's ChatGPT, make AI governance a necessity, as using pretrained AI models billions of times sharpens risk concerns. The leaders want to balance AI's business value and the need for appropriate oversight. AI draws the attention of legislators worldwide, who mandate actions by clarifying AI governance priorities.

Business Impact

AI governance, as part of the organizational governance structure, enacts responsible AI, and provides common implementation and adherence mechanisms across the business ecosystem when it comes to:

- Ethics, fairness, and safety to protect the business and its reputation,
- Trust and transparency to support AI adoption via explainability, bias mitigation, model governance, operationalization, and collaboration norms and capabilities.
- Diversity to ensure the right technology and roles for each AI project.

Drivers

- AI governance is in the peak area of the Hype Cycle. Enterprise practitioners are taking steps toward establishing AI governance. Leading organizations in various industries establish AI governance by addressing standards for AI development and operations, providing best practices, guidelines for model management and monitoring, data labeling and interpretation, explainability, fairness, bias mitigation, security, and legal.

- Regulations around the globe target AI directly and affect AI practices indirectly, making AI governance goals more concrete. The U.S. Blueprint for an AI Bill of Rights provides governance pathways, from principles to practice. The objective of the EU AI Act is to "enhance governance and effective enforcement of existing law on fundamental rights and safety requirements applicable to AI systems." The Algorithmic Impact Assessment is a mandatory risk assessment tool intended to support the Treasury Board of Canada. Singapore's Model AI Governance Framework guides organizations in developing appropriate governance structures and mechanisms.

- Trust and transparency of AI solutions are crucial for AI adoption. The probabilistic and opaque nature of AI is new to audiences familiar with deterministic outcomes. AI governance can minimize misinterpretations of AI results by scrutinizing trust in data sources and the explainability of AI decisions. It provides specific testing and validation guidelines, differentiating "life-critical AI."

- AI governance is necessary to establish AI accountability. It is difficult to achieve because use cases differ in terms of their data, solution and outcome requirements. It outlines reactive responsibilities, actions and procedures in the case of unanticipated and unintended consequences. It ensures that ethics are considered for each use case.

Obstacles

- Often, AI governance is stand-alone from mainstream governance initiatives, which stalls its progress. The best method is to extend existing governance mechanisms to take advantage of recognizable policies and methods, such as in data governance. AI governance benefits from a conversation with the security, legal and customer experience functions.
- Many governance initiatives assume command and control. Instead, adaptive governance supports freedom and creativity in AI teams but also protects the organization from reputational and regulatory risks. Little or no governance in AI teams to facilitate freedom and creativity is an acceptable approach if this is a conscious governance decision.
- AI value assurance and model risk management are new in AI. While methods exist — for example, in the financial industry — they are largely unknown to others, and every governance organization is inventing its own.
- Technologies to support AI governance are fragmented and are often designed for a single industry.

User Recommendations

- Extend to AI your existing governance mechanisms, such as risk management or data and analytics governance.
- Establish and refine processes for handling AI-related business decisions. Blend processes, people and technology to succeed.
- Aim to align your AI governance framework with the laws and regulations in your jurisdiction(s) to directionally assure your efforts amid evolving AI-specific considerations. Gain agreement on AI risk guidelines that are driven by the business risk appetite and regulations.
- Decide on the organizational structure and accountability for propagating responsible AI — for example, what to centralize and what to do locally.
- Implement tools for AI review and validation. For each AI use case, require an independent AI model validator, a data scientist whose job is to assure model explainability and robustness. Have all parties in the process defend their decisions in front of their peers and validators.
- Ensure that humans are in the loop to mitigate AI deficiencies.

Sample Vendors

Arthur; Chatterbox Labs; Credo AI; DarwinAI; FICO; Google; IBM; Prodago; SAS; Weights & Biases

Gartner Recommended Reading

Applying AI — Governance and Risk Management

4 AI Governance Actions to Make a Swift Business Impact

Artificial Intelligence Primer for 2023

Intelligent Applications in Finance

Analysis By: Mark D. McDonald

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Intelligent applications are augmented with AI and connected data, from transaction and external sources, to generate a system that provides contextualized features, experiences and processes. Intelligent applications can continually learn, improve and adapt themselves to the business and technical landscape in which they operate.

Why This Is Important

As the complexity of data grows and business volatility increases, finance departments look to leverage new technology to keep up. A new breed of software vendors is introducing compelling AI-driven financial applications that solve the common problems finance organizations face using new approaches including AI. Buying these platforms allows finance to spend more time on business support and frees up their limited in-house AI resources to build business-specific AI-driven solutions.

Business Impact

Intelligent applications serve three tiers of the finance organization:

- Front-office applications assist with forecasting and analysis, uncovering hidden trends that provide early warning.
- Middle-office platforms focus on data quality and connectivity. This includes processes like anomaly detection and data pipeline automation.
- Back-office systems (primarily accounts receivable and accounts payable [AR/AP]) automate processes and use decision-making algorithms to route, categorize and schedule actions.

Drivers

- ERP rollouts of the last decades focused on collecting transactional data. Now, finance organizations are burdened by the quantity of information collected and don't know how to analyze or utilize it.
- A lack of new finance talent entering the workplace is requiring finance to dramatically increase productivity to keep up with growing demands and increased volatility.
- A desperation to do more work with dwindling resources is driving financial leaders to find new ways to increase productivity.
- Limited internal resources to build AI-driven applications is pushing financial leaders to leverage AI's advantages by purchasing the capabilities from software vendors.
- ERP configurations that are slow and expensive to change are driving a composable application landscape where financial technical architectures include several specialized applications rather than a single monolithic ERP system. Software vendors building these specialized applications are differentiating themselves with productivity improvements and feature enhancements that rely on AI.
- The complexity of integrating applications into corporate technical landscapes restricts the number of applications that organizations introduce, but new intelligent applications include self-integrating features that speed the implementation and lower the cost of implementation and maintenance.
- Vendors are recognizing an unserved niche in the finance landscape and beginning to serve the untapped market with new and compelling features that large ERP vendors struggle to match.
- The 2021 Gartner End-User Emerging Technology Survey found that the strongest driver of intelligent application investment is the organization's need to automate business processes (see Emerging Technologies: Capitalize on Opportunities With Intelligent Business Applications — Adopter Survey Findings). This was a stronger driver than the desire to improve existing products and services, or to improve competitive differentiation.

Obstacles

- **Trust in system-generated insights** — Without an adequate explanation of how AI-driven decisions are derived, finance leaders will be skeptical of intelligent applications.
- **Reliance on the ERP monolith** — In an effort to avoid increasing technical debt and complexity, finance organizations favor leveraging their ERP investments and resist replacing them with new software.
- **Benefits limited to common processes** — Applications built to serve a broad section of companies will only address the use cases common to all companies. Using AI to solve company-specific problems will still require in-house development efforts.
- **Overuse of AI in marketing** — Vendors have a tendency to overuse the term "AI" in marketing and neglect the focus on business impact, which leads to inflated expectations that are often unmet.
- **Reliance on continuously updated data** — A reliance on continuous access to reliable data from disparate systems increases the complexity of developing intelligent applications.

User Recommendations

- Include a composable application architecture in your roadmap. Review the benefits that new finance software vendors are delivering, and replace ERP subledger functionality with intelligent applications.
- Start your intelligent application review in back-office processes like AR and AP. With large volumes of manual work, these areas have the most to gain from AI-driven automation.
- Review middle-office intelligent applications that help detect, correct and avoid errors. In particular, AI-driven audit support software can help keep ledgers continually "audit-ready."
- Evaluate financial planning and analysis solutions that introduce AI-driven predictive analytics to the planning process. Be aware that these front-office solutions may require enhancements from internal data scientists to reflect the specific nature of your business.
- Challenge your current software providers to outline where AI is represented in their product roadmaps and how it adds business value.

Sample Vendors

Auditoria.AI; Billtrust; DecisionNext; Emagia; Esker; FIS; HighRadius; Prevedere; Sidetrade; Sievo

Gartner Recommended Reading

Magic Quadrant for Integrated Invoice-to-Cash Applications

Emerging Technologies: Capitalize on Opportunities With Intelligent Business Applications — Adopter Survey Findings

Quick Answer: How Do Intelligent Applications Go Beyond Analytic Applications?

Top Tech Provider Trend for 2023: Intelligent Applications

Foundation Models

Analysis By: Arun Chandrasekaran

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Foundation models are large-parameter models that are trained on a broad gamut of datasets in a self-supervised manner. They are mostly based on transformer or diffusion deep neural network architectures and will potentially be multimodal in the near future. They are called foundation models because of their critical importance and applicability to a wide variety of downstream use cases. This broad applicability is due to the pretraining and versatility of the models.

Why This Is Important

Foundation models are an important step forward for AI due to their massive pretraining and wide use-case applicability. They can deliver state-of-the-art capabilities with higher efficacy than their predecessors. They've become the go-to architecture for NLP, and have also been applied to computer vision, audio and video processing, software engineering, chemistry, finance, and legal use cases. Primarily text-based, large language models (LLMs) are a popular subset of foundation models. ChatGPT is based on one (GPT-4).

Business Impact

With their potential to enhance applications across a broad range of natural language use cases, foundation models will have a wide impact across vertical industries and business functions. Their impact has accelerated, with a growing ecosystem of startups building enterprise applications on top of them. Foundation models will advance digital transformation within the enterprise by improving workforce productivity, automating and enhancing CX, and enabling rapid, cost-effective creation of new products and services.

Drivers

Foundation models:

- **Require only limited model customization to deliver effective results.** Foundation models can effectively deliver value through prebuilt APIs, prompt engineering or further fine-tuning. While fine-tuning may deliver the best value because of customization possibilities, the other two options are less complex.
- **Deliver superior natural language processing.** The difference between these models and prior neural network solutions is stark. The large pretrained models can produce coherent text, code, images, speech and video at a scale and accuracy not possible before.
- **Enable low-friction experimentation.** The past year has seen an influx of foundation models, along with smaller, pretrained domain-specific models built from them. Most of these are available as cloud APIs or open-source projects, further reducing the time and cost to experiment.
- **Have accelerated AI innovation with massive model sizes.** Examples include OpenAI's GPT-4; Google's AI's PaLM; Google DeepMind's Gopher and Chinchilla; Meta AI's LLaMA; and Alibaba's M6. In addition, companies such as Hugging Face, Stability AI and EleutherAI have open-sourced their models.

Obstacles

Foundation models:

- **Do not deliver perfect results.** Although a significant advance, foundation models still require careful training and guardrails. Because of their training methods and black-box nature, they can deliver unacceptable results or hallucinations. They also can propagate downstream any bias or copyright issues in the datasets.

- **Require appropriate skills and talent.** As with all AI solutions, the end result depends on the skills, knowledge and talent of the trainers, particularly for prompt engineering and fine-tuning.
- **Expand to impractical sizes.** Large models are up to billions or trillions of parameters. They are impractically large to train for most organizations because of the necessary compute resources, which can make them expensive and ecologically unfriendly.
- **Concentrate power.** These models have been mostly built by the largest technology companies with huge R&D investments and significant AI talent, resulting in a concentration of power among a few large, deep-pocketed entities. This situation may create a significant imbalance in the future.

User Recommendations

- **Create a strategy document** that outlines the benefits, risks, opportunities and execution plans for these models in a collaborative effort.
- **Plan to introduce foundation models into existing speech, text or coding programs.** If you have any older language processing systems, moving to a transformer-based model could significantly improve performance. One example might be a text interpretation, where transformers can interpret multiple ideas in a single utterance. This shift in approach can significantly advance language interfaces by reducing the number of interactions.
- **Start with models that have superior ecosystem support,** have adequate enterprise guardrails around security and privacy, and are more widely deployed.
- **Explore new use cases,** such as natural language inference, sentiment analysis or natural-language-based enterprise search, where the models can significantly improve both accuracy and time to market.
- **Designate an incubation team** to monitor industry developments, communicate the art of the possible, experiment with BUs and share valuable lessons learned companywide.

Sample Vendors

Alibaba Group; Amazon; Baidu; Cohere; Google; Hugging Face; IBM; Microsoft; OpenAI; Stability AI

Graph Analytics in Finance

Analysis By: Clement Christensen, Mark D. McDonald

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Graph analytics comprises a series of techniques and database technologies that enable the exploration of relationships between entities, such as organizations, people or transactions. It uses nodes and vertices to analyze the relationship between such entities (commonly termed “objects”). It uncovers, with relatively low complexity, linkages between seemingly disparate data points and enables analysis in users’ natural language without the need for burdensome SQL queries.

Why This Is Important

Exploring interconnected data relationships among multiple sources daunts many financial planning and analysis (FP&A) leaders. Legacy, relational (SQL) query works well when data is known, but falters in environments when data is unfamiliar and evolving. Graph analytics recognizes that most data is connected, simplifies interfaces and evaluates its most relevant linkages without changing its underlying structure. This enables exploration of new and previously hidden relationships within data.

Business Impact

Graph analytics enable analysis of underleveraged data for insights that address evolving demand for insights, assess risk and suggest proactive resolutions. Now possible at scale, graph techniques have proven effective as recommendation engines, market basket analysis, merchandising decisions, fraud analysis, route optimization, clustering analysis, outlier detection, and more. When combined with business process models, graph analytics successfully identifies patterns to exploit or optimize.

Drivers

- A steady increase in data volume increases the complexity of data and makes finding relevant relationships between data points more difficult.
- As the number and diversity of data sources grows, graph analytics adds the ability to quickly link disparate sources into a logically cohesive data structure.
- Data relationship insights are often lost when using traditional data storage. Since graph analytics does not modify data's underlying structure, it preserves data's richness. It enables data's relationships to be explored, discovered and analyzed — especially when relationships are complex and there is no existing data model.
- Use cases requiring analysis across highly complex models are developed and used within machine learning (ML), with the output stored in graph databases. Graph analytics can traverse millions of relationships in a matter of seconds, whereas traditional relational database management systems (RDBMSs) take minutes or hours (potentially crashing systems).
- Graph databases are ideal for linking internal and external data for storage, manipulation, and analysis. Graph-specific processing languages such as graph query, capabilities and computational power enable storage, manipulation, and analysis across a wide variety of perspectives. For example, graph analytics might be used to compare financial ERP trade data with social, geographical or other data to detect fraud or cyberattacks.
- Some vendors have developed graph solutions (such as SPARQL or GQL) that enable graph analytics to use more commonly available SQL.
- Established AI techniques (such as Bayesian networks) increase the power of knowledge graphs and the usefulness of graph analytics.
- Use cases that span many industry verticals in a horizontal fashion are seeing early-to-moderate levels of adoption (such as route optimization, market basket analysis, fraud detection, social network analysis or location intelligence).

Obstacles

- Many FP&A leaders are still evolving their team's data and analytics (D&A) and query skills. Graph analytics requires new skills related to graph-specific knowledge (such as Resource Description Framework [RDF], property graphs, SPARQL Protocol, RDF Query Language, Python or R). Low availability of graph skills gaps have slowed adoption and limited growth, within FP&A and finance.
- Graph analytics complements RDBMSs, but will not replace them. Where there is a need to record parallel or serial business process data (such as transactional detail), traditional RDBMSs remain highly valuable for certain use cases (especially for compliance and audit purposes).
- Despite the healthy startup market of vendors pushing to integrate graph analytics in multimodel platforms, much of the technology is developed either in-house or integrated via resale agreements with specialist vendors.

User Recommendations

- Test graph analytics where overly complex, traditional SQL-based coding, queries and visualizations inhibit insight development.
- Use graph analytics to complement and enhance traditional pattern analysis, focusing on the use cases noted above.
- Transition metadata analytics from simple catalog search and discovery into a graph analysis model.
- Implement interactive user interfaces from vendors that use graph elements to find insights and analytic results, and the store outputs for reuse in a graph database.
- Train FP&A staff how to align data assets, develop statistical processes or author algorithms to create training datasets and build identification processes that detect data changes to evolve analytical models.
- Prioritize efforts to clean metadata across the landscape since graph analytics leverages metadata. This includes having a consistent definition of metadata elements across systems.

Sample Vendors

Cambridge Semantics; Elastic; Neo4j; Siren; Smarsh; SparkCognition (Maana)

Gartner Recommended Reading

Understanding When Graph Analytics Are Best for Your Business Use Case

Quick Answer: When to Use Graph Analytics in Finance

Quick Answer: What Is Graph Analytics in Finance?

CFO Podcast: Graph, the Future of Databases With Grant Nelson

Augmented Data Quality

Analysis By: Ankush Jain

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Augmented data quality (ADQ) solutions provide the capabilities for enhanced experience aimed at improved insight discovery; next-best-action suggestions; and automation by leveraging artificial intelligence (AI)/machine learning (ML) features, graph analysis and metadata analytics. Each technology can work both independently and cooperatively to create network effects, which can then be used to increase data quality automation and effectiveness across a wide range of data quality use cases.

Why This Is Important

Ensuring high-quality data is important to data and analytics endeavors. Based on rapid expansion of contemporary data environments, a multitude of data types and pressing demands of businesses, organizations are searching for innovative approaches that are fast, affordable, scalable and easy to implement to tackle data quality issues. ADQ technologies revolutionize conventional and time-consuming manual procedures by increasing automation and enhancing insights.

Business Impact

- Automation/augmentation enhance data quality, reduce manual effort and improve efficiency.
- Multipersona usability enables nontechnical users to run processes via natural language, eliminating skill barriers.
- AI/ML techniques and metadata analytics enhance multiple data quality processes.
- Semantic connections, lineage tracing and domain data mapping enable impacts/solutions to be identified by knowledge graphs.
- Support for data engineers includes monitoring/observability across complex landscapes.

Drivers

- Traditional data quality practices that rely on manual efforts and subject matter experts struggle to address complex and exception-prone data quality problems.
- Data quality across various use cases offers accelerated time to value, reduced risk and increased competitive advantage across all business activities and user groups.
- Augmented data quality solutions are essential for emerging and future data ecosystems, integrating seamlessly with cohesive designs, such as data fabrics, supporting operational excellence and enhancing financial governance.
- Organizations need seamless integration, agile deployments and bidirectional exchange of intelligence with adjacent data management functions, which is core to ADQ.
- ADQ enables organizations to scale and unify data quality efforts for enterprisewide success, which is often a challenge, due to limited internal capabilities and strategies.
- ADQ makes use of advanced techniques including ML, natural language processing (NLP), large language models and GenAI, active metadata and knowledge graphs. This enables augmentation across several data quality capabilities, such as profiling and monitoring/observability; data transformation; rule discovery and creation; matching, linking and merging; data quality remediation; and role-based usability.
- Embracing augmented data quality solutions and leveraging emerging technologies is crucial to improve data integrity, governance and overall success in the data ecosystem.

Obstacles

- **Limited awareness and understanding of benefits** of ADQ solutions can impede adoption. Organizations should actively educate their teams about the value and potential impact of these tools, fostering a culture that embraces and leverages advanced data quality technologies.
- **Lack of scalability and integration with existing data infrastructure** can be an obstacle to the adoption of ADQ tools.
- **The lack of explainability and traceability of AI/ML algorithms** could lead to reluctance to adopt these tools.
- **The inclusion of data and analytics governance is crucial** when implementing ADQ tools. AI-driven automation provides users with independence, but it is essential to embed governance requirements into the AI models to mitigate data-related risks.

User Recommendations

- **Evaluate data quality capabilities:** Assess manual efforts/complexity needed to support use cases. Identify improvement areas ADQ can address. This will help determine requirements for adopting ADQ.
- **Explore ADQ capabilities:** Investigate the features, setup process, required skills and constraints associated with ADQ solutions. Assess offerings from incumbent data quality vendors and explore product roadmaps for enhancement.
- **Establish data cataloging:** Implement practices to collect/analyze metadata for automation and efficient data quality processes. Enhance management of data assets and facilitate ADQ integration.
- **Align with data governance:** Partner with stakeholders to monitor ADQ solutions. Ensure to governance requirements and framework adherence. Establish metrics to show benefits/business value.
- **Collaborate with solution providers:** Provide feedback, share experiences and suggest enhancements. Engage in user forums, contribute to improvements and shape development roadmap to meet needs.

Sample Vendors

Ataccama; Collibra; DQLabs; Experian; IBM; Informatica; Precisely; Syniti; Talend

Gartner Recommended Reading

The State of Data Quality Solutions: Augment, Automate and Simplify

Augmented Data Quality Represents a New Option for Upscaling Data Quality Capabilities

Building Automation Into Your Data Quality Initiatives

Magic Quadrant for Data Quality Solutions

Critical Capabilities for Data Quality Solutions

Hyperautomation in Finance

Analysis By: Mark D. McDonald

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Business-driven hyperautomation is a disciplined approach that organizations use to rapidly identify, vet and automate as many business and IT processes as possible. Hyperautomation involves the orchestrated use of multiple technologies, tools or platforms (inclusive of, but not limited to, AI, machine learning, event-driven software architecture, RPA, iPaaS, packaged software and other types of decisions, and process and/or task automation tools).

Why This Is Important

Hyperautomation in finance is a step toward autonomous finance that links a series of manual and semiautomated processes into a fully automated workflow. CFOs looking for greater workforce efficiencies use vendors that combine traditional automation solutions, such as business process automation and RPA, with a modern set of automation technologies (like AI and machine learning) to support a modern finance transformation.

Business Impact

Hyperautomation in finance enables organizations to increase productivity by automating workflow execution and decision making. Hyperautomation tools provide integrated solutions to support complex decision processing, improve resilience and efficiency, and add agility to finance processes. They create the opportunity to accelerate processing times, reduce error rates and drive down process costs with the goal of improving productivity and having an immediate business impact.

Drivers

- Finance organizations are maturing their adoption of hyperautomation. In Gartner's 2022 Finance Technology Bullseye Survey, over 56% respondents reported an average of four or more hyperautomation initiatives underway that aim to improve efficiency, speed, agility and employee productivity.
- The hyperautomation market continues to mature. Vendors that originated in RPA, BPA, low-code application platform (LCAP) and iPaaS sectors, as well as startups, technology giants and systems integrators, are procuring, building and enhancing their toolboxes of automation technologies.
- Hyperautomation solution capabilities have evolved due to consolidation among existing players, and acquisitions and entries by larger IT companies. This evolution is extending the capabilities of traditional RPA platforms by including AI and ML.
- By incorporating nonintelligent tools such as LCAPs and intelligent document processing (IDP) solutions and workflows alongside intelligent automation technologies like AI and ML, finance organizations can augment and orchestrate more complex and decision-based tasks across the full range of finance processes.

Obstacles

- Finance often uses a single tool or technology, such as RPA, to achieve its automation goals, which may not be the best way to automate all use cases, especially those that are exception-heavy or judgment-based. This drives decreased optimism about hyperautomation capabilities.
- As AI improves and further emulates human decision making, the temptation to delegate human responsibilities to machines can lead to unintended consequences if processes are not built with transparency and the ability for people to intervene.
- As finance engagement with hyperautomation increases, the need for strong, centralized governance grows to ensure that accountability is assigned correctly and that the focus is on managing rules and processes rather than tasks.
- Hyperautomation capabilities are still evolving. Vendors that started out as RPA and BPA providers are adapting to a hyperautomation landscape, but with different mixes of tools and varying levels of maturity and integration.

User Recommendations

- Take a diversified approach to automation to avoid dependency on a single technology. Build a portfolio of platforms in which each component specializes on the processes and outcomes it supports.
- Avoid automation projects that focus on technology or a specific use case. Instead, identify the capabilities needed from your use cases and look for the most suitable set of technologies to meet the majority of your capability needs.
- Prioritize use cases by assessing the readiness for automation initiatives in order to avoid working on processes that are not ready for automation.
- Develop automation skills, governance and structure within your organization.
- Overcome resistance and skepticism by demonstrating successful prototypes of smaller and simpler projects, before moving on to more complex and impactful efforts.
- Establish a comprehensive set of metrics aligned with business outcomes to measure the success of your automation initiatives.

Sample Vendors

Automation Anywhere; Microsoft; NICE; SS&C Blue Prism; UiPath

Gartner Recommended Reading

Succeed With Hyperautomation by Simplifying Your Start to RPA

2023 Finance Technology Bullseye Report

Market Guide for Intelligent Document Processing Solutions

Appendixes

See the previous Hype Cycle: Hype Cycle for Emerging Technologies in Finance, 2023 (September 2022)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	*Definition* ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2023)

Table 4: Maturity Levels

(Enlarged table in Appendix)

Maturity Levels	Status	Products/Vendors
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source: Gartner (July 2023)

Document Revision History

Hype Cycle for Emerging Technologies in Finance, 2023 - 21 September 2022

Recommended by the Author

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Understanding Gartner's Hype Cycles

Tool: Create Your Own Hype Cycle With Gartner's Hype Cycle Builder

How Leading Finance Organizations Achieve AI Success

Use Artificial Intelligence to Supercharge Your Finance Staff

Magic Quadrant for Integrated Invoice-to-Cash Applications

Infographic: Artificial Intelligence Use-Case Prism for Finance

Table 1: Priority Matrix for Emerging Technologies in Finance, 2023

Benefit ↓	*Years to Mainstream Adoption*			
	Less Than 2 Years ↓	***2 - 5 Years*** ↓	***5 - 10 Years*** ↓	***More Than 10 Years*** ↓
Transformational		Augmented Data Quality Decision Intelligence	Augmented FinOps Digital Twin in Finance Digital Twin of a Customer Foundation Models Intelligent Applications in Finance Internal Talent Marketplaces Self-Integrating Applications	
High		AI Governance Causal AI Data Observability Hyperautomation in Finance Policy as Code	Anomaly and Error Detection Composable Applications in Finance D&A Governance Platforms Explainable AI in Finance Graph Analytics in Finance	
Moderate			Multiexperience UI	
Low				

Source: Gartner (August 2023)

Table 2: Hype Cycle Phases

Phase	*Definition*
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Phase ↓	Definition ↓

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	Definition ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2023)

Table 4: Maturity Levels

Maturity Levels ↓	*Status* ↓	*Products/Vendors* ↓
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source: Gartner (July 2023)