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Top Trends in Data and Analytics for 2021

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Initiatives: Data and Analytics Strategies; Analytics, BI and Data Science Solutions; Artificial Intelligence; Data Management Solutions

The D&A trends covered in this research can help organizations respond to change, uncertainty and the opportunities they bring over the next three years. D&A leaders must examine how to turn these trends into mission-critical investments that accelerate their capabilities to anticipate, shift and respond.

Overview

Opportunities

- The COVID-19 pandemic, while devastating, has proven that society and even the most conservative organizations can make dramatic changes, previously thought impossible, to survive and thrive. The top data and analytics (D&A) trends highlighted in this report will accelerate and scale D&A-based transformations to help organizations and society build their best future.

- Digital and AI acceleration have been byproducts of disruption. However, the difficulties of moving AI from pilot to production at scale impedes the business impact of AI. New AI tools and techniques can enable complex and data-scarce use cases, while investments in XOps can operationalize them using DevOps best practices.

- Change acceleration has become necessary for survival. The ability to rapidly design composable D&A and transparent decision flows using a common data fabric represents a critical competency for a disruption-ready and resilient organization.

- Distributed everything — data, people and devices — is accelerating. Using graph techniques to uncover connections in combinations of diverse data at scale enriches data management, analytics, AI and machine learning (ML), and enables innovation. Leveraging distributed D&A that resides in edge computing environments, while giving every distributed user dynamic insights, represents new opportunities for competitive differentiation and operationalizing business value.

■ Establishing D&A as a core business function with critical capabilities in business-domain-led D&A, data literacy, data monetization, smarter data sharing and adaptive governance accelerates the achievement of intended value from D&A investments.

Recommendations

D&A and other business leaders responsible for D&A strategies should:

■ Accelerate change by extending the AI competencies to support complex and scarce data use cases, including those that use small and wide data, and by designing composable D&A and transparent decision flows that use a common data fabric.

■ Operationalize the business value of data and analytics by unifying DevOps practices (XOps) across data, ML, models and platforms, and by building D&A into a core business function.

■ Harness "distributed everything" to transform, optimize and scale analytics-centric processes and business models by augmenting consumers with dynamic data stories, leveraging D&A at the edge, and using graph analytics as a foundation for modern D&A.

■ Encourage innovation by putting in place success metrics and incentives that emphasize learning and reward innovation.

■ Proactively monitor, experiment with or exploit key trends to respond to disruption and uncertainty, innovate and rebuild. Don't just react to trends as they mature.

What You Need to Know

A fundamental truth throughout history is that the most significant innovations, societal advances and game-changing companies are born in downturns and times of crisis. As disruptive and destructive as the COVID-19 pandemic has been, it has served as an engine of innovation and has proved that even the most conservative organizations (and people) can make radical changes quickly. Necessity has enabled unprecedented shifts in how we work, how we live, what we buy and what we value. It has forced most enterprises to respond in new ways to previously unimaginable demands to reimagine customer engagement, optimize resources, reinvent processes and rethink products, business models and even their very purpose — almost overnight — transformations that would otherwise have taken years to implement, if ever.

D&A has never been more critical. It's harder to make sense of a world with ever more interdependencies and unintended consequences. A small change here leads to a big change there, etc. (think of the butterfly effect). This requires better D&A, as humans have a harder time making sense of it all, and therefore require assistance to make decisions while taking ever more factors, stakeholders and data sources into account. In addition, in the face of more competition, digitization and more emancipated consumers, decisions must be made more quickly and more accurately, and must be personalized, again requiring D&A to play a pivotal role.

The top D&A trends covered in this research (and summarized in Figure 1 with links to individual trends in Table 1) represent business, market and technology dynamics that you cannot afford to ignore. They have the potential to transform your enterprise, and will accelerate in their adoption over the next one to three years. The accelerated speed at which disruption is occurring requires D&A leaders to have structured and proactive mechanisms in place to identify technology trends and prioritize those with the biggest potential impact on their competitive advantage (maybe even their survival in these uncertain times). They are in no particular order of importance. Your ranking of them and whether you proactively monitor them, conduct a proof of concept or deploy the capabilities represented by the trends will depend on your mission-critical priorities, both urgent and longer-term, and how these trends can enable them.

The global pandemic has been a major disruptive force of change. However, there are additional dynamics driving our top D&A trends that predated the pandemic, but were accelerated by it. These include the rate of AI, digital and overall innovation, cloud, and the convergence of D&A capabilities. These dynamics underline the mission-critical role of D&A and the need to further improve its effectiveness for all organizations and society at large. Implementing success metrics and incentives that put an emphasis on learning and reward innovation when experimenting will further contribute to success.

While the trends are divided into three categories, they may straddle two or all three categories. Given this urgency, D&A leaders must address:

- **Accelerating change** in D&A, leveraging innovations in AI, improved composability and more agile and efficient integration of more diverse data sources.

- **Operationalizing business value** through more effective XOps, better decision making and making D&A an integral part of business.

- **Distributed everything,** requiring the flexible connection of data and insights to empower an ever wider audience of people and objects.

This report covers trends that are expected to enter the mainstream over the next three years.

For a current or immediate budget cycle view of trends and actionable advice, see Leadership Vision for 2021: Data and Analytics Leader.

Figure 1. Top Trends in Data and Analytics For 2021

Top Trends in Data and Analytics For 2021

Accelerating Change	Operationalizing Business Value	Distributed Everything
1 Smarter, Responsible, Scalable AI	**5** XOps	**8** Graph Relates Everything
2 Composable Data and Analytics	**6** Engineering Decision Intelligence	**9** The Rise of the Augmented Consumer
3 Data Fabric is The Foundation	**7** D&A as a Core Business Function	**10** D&A At the Edge
4 From Big to Small and Wide Data		

Source: Gartner

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Trend Profiles: Click Links to Jump to Profiles

Accelerating Change	Operationalizing Business Value	Distributed Everything
Smarter, More Responsible, Scalable AI	XOps	Graph Relates Everything
Composable Data and Analytics	Engineering Decision Intelligence	The Rise of the Augmented Consumer
Data Fabric is the Foundation	Data and Analytics as a Core Business Function	Data and Analytics at the Edge
From Big to Small and Wide Data		

Accelerating Change

Trend 1: Smarter, Responsible, Scalable AI

Analysis by: Pieter den Hamer, Erick Brethenoux, Sumit Agarwal

SPA: By 2023, 60% of organizations with more than 20 data scientists will require a professional code of conduct incorporating ethical use of data and AI.

Description:

Smarter, more responsible and scalable AI disruptions are needed to support more complex and data scarce use cases, while protecting privacy and embedding AI models more effectively. Scaling and operationalizing machine learning (ML) and AI for business impact will require extending the AI toolbox with new techniques, including synthetic data, active learning and adaptive learning. New approaches to building interpretable systems and operationalizing AI models into production are also an imperative.

Why Trending:

- AI benefits are currently hard to take advantage of when data availability is limited, particularly in a post pandemic world where many models requiring large amounts of historical data may no longer be relevant. Current data-intensive approaches are also compute- and energy-intensive and inflexible.

- Bias and discrimination in decision making are amplified when automated with AI. Gartner inquiries suggest that as AI becomes more central to all aspects of society and business, there is a growing urgency around its ethical use and privacy.

- Many organizations struggle to scale their AI prototypes and pilots to full production and wider usage, and often underestimate the challenge of deploying and integrating AI with other systems. According to the 2020 Gartner AI in Organizations Survey, only 53% of prototypes are eventually deployed. Once in production, AI models require frequent monitoring to maintain accuracy and actual value creation.

Implications:

- The current trends of smarter, more responsible and more scalable AI enable better learning algorithms, interpretable systems and shorter time to value.

- Better learning algorithms enable AI solution development with less data or "small data." These include composite AI, small data techniques and adaptive, federated, generative adversarial and self-supervised machine learning.

- Interpretable systems support the validation of AI decision automation or augmentation to build trust and provide lineage and reproducibility, for example in augmented diagnosis in healthcare. They also support the ethical use of AI while minimizing bias, protecting privacy and complying with regulations and corporate policies, for example in loan application processing.

- Shorter time to value helps to apply AI more broadly and quickly to support business innovation and agility, as well as to make AI more accessible to a wider audience without technical assistance.

Actions:

- Invest in techniques such as composite AI, which is the synergy of data-driven techniques such as deep learning with expertise-driven techniques such as knowledge graphs and rules, agent-based systems and other simulation techniques. Use adaptive, federated/collaborative and transfer learning, allowing model improvement after initial deployment, enabling AI to become more adaptive and robust. Overcome a lack of representative or labeled data by reinforcement, active, self-supervised or zero/one-shot learning, or by generating synthetic data.

- Build interpretable systems through explainable ML models and explicit decision models, which help to build trust in AI. They also help to improve the accuracy, risk management and governance of decision automation and the augmentation of human and artificial intelligence. Reduce bias by improving the representativeness and diversity in data and the protection of data against poisoning. Also put in place ethics guidelines and privacy by design, or techniques such as data masking and differential privacy.

- Leverage advances in the automation and augmentation of development and deployment activities, as well as in model operations. Augmentation and automation improve productivity of AI experts and make AI more accessible to a less technical audience. Explore new infrastructure, such as neuromorphic hardware, to accelerate AI computations and workloads. Implement advanced model operations, enabling easier deployment, lineage and more automated detection and replacement of models with degrading performance.

Further Reading:

Link to Trend Profile

Key Actions to Prevent Machine Learning Failure Due to COVID-19-Related Data Drift

Preserving Privacy While Using Personal Data for AI Training

Innovation Insight for ModelOps

Trend 2: Composable Data and Analytics

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Analysis by: Julian Sun, Yefim Natis, Carlie Idoine, Rita Sallam, Joseph Antelmi

SPA: By 2023, 60% of organizations will compose components from three or more analytics solutions to build decision-oriented applications infused with analytics that connect insights to actions.

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Description:

Composable D&A utilizes container- or microservices-based architecture and data fabric to assemble flexible, modular, reusable and consumer-friendly D&A capabilities from existing assets. This transforms monolithic data management and analytics applications into assemblies of data, analytics or other application building blocks (known as packaged business capabilities or PBCs) through the use of composition technologies such as low- and no-code capabilities, supporting adaptive and intelligent decision making.

Why Trending:

- Gartner inquiries suggest that most large organizations have more than one "enterprise standard" analytics and BI tool. Composing new applications from the PBCs of each (in combination with others) will promote productivity and agility.

- Container- or microservices-based analytics and business intelligence (ABI) and data science and machine learning (DS/ML) platforms with improved APIs allow for the rapid and flexible assembly of analytics applications.

- Organizations often struggle to operationalize AI. Organizations can use composition to extend established BI production systems to new AI capabilities.

- Cloud-based marketplaces are becoming an effective channel for organizations to distribute and share modular analytics capabilities.

Implications:

- **Alignment of data, analytics and application development and collaboration between D&A and application teams**: Organizations can use extension APIs from the D&A world to engage with the application world, while application developers can contribute integration kits and new composed PBCs to the D&A marketplaces.

- **Improvement of analytics capabilities**: Organizations can create advanced analytics capabilities by composing the best capabilities from different vendors together, rather than using them separately on different platforms.

- **Agile citizen development**: Embedded analytics focused on dashboards and reporting are usually implemented by IT. Less skilled business power users can use the low- or no-code capabilities to compose more advanced analytics capabilities and workflows.

- **Democratization of analytics capabilities**: Cloud-based marketplaces are becoming an effective channel for organizations to distribute, share and find analytics applications and the required components and add value to their applications.

Actions:

- Improve decision making by incorporating and assembling modular, reusable D&A capabilities with a common data fabric.

- Leverage composable analytics to drive innovation by incorporating advanced DS/ML capabilities into analytics applications.

- Exploit opportunities to add analytics capabilities to applications by building a joint team of application developers and business analysts with ongoing collaboration. Rethink organization, processes and skills.

- Pilot composable analytics in the cloud, establishing an analytics marketplace to drive and support collaboration and sharing.

Further Reading:

Link to Trend Profile

Composable Analytics Shapes the Future of Analytics Applications

The Future of Data and Analytics: Reengineering the Decision, 2025

Use Gartner's Reference Model to Deliver Intelligent Composable Business Applications

Trend 3: Data Fabric Is the Foundation

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Analysis by: Mark Beyer, Ehtisham Zaidi, Henry Cook and Jacob Lund

SPA: By 2023, artificial intelligence in the data fabric will be capable of reducing data quality and data mastering ongoing operations costs up to 65%.

Description:

A data fabric utilizes continuous analytics over existing, discoverable and inferenced metadata assets to support the design, deployment and utilization of integrated and reusable data objects regardless of deployment platform and architectural approach. It can include automated orchestration for data access, data integration, data quality, use of knowledge graphs, and even data utilization and usage recommendations.

Why Trending:

- Siloed integration initiatives lead to poor customer experience — poor processes, integration errors, missing or inaccurate data, or any combination of these.

- Core data management functionalities currently appear in many different data management tools, increasing cost, time to deployment and skills requirements, and causing delays in data utilization.

- The data fabric is a single architecture that can address the levels of diversity, distribution, scale and complexity in an organization's data assets.

Implications:

- Reduces time for integration design by 30%, deployment by 30% and maintenance by 70%, because data fabric designs draw upon the ability to use, reuse and combine different data integration styles.

- Automated data and metadata discovery, data quality and integration drive augmented data management. Automating repetitive tasks that exist in most data quality, mastering and integration solutions will lower the overall costs for these solutions (by 35-65% depending on the existing approach).

- Data fabrics leverage existing skills and technologies, such as existing data hubs, data lakes, data warehouses, operational data stores, master data repositories and other traditional architecture and design solutions, while introducing new approaches, tools and platforms.

Actions:

- Ensure that your data fabric supports the combination of different data delivery styles dynamically (through metadata-driven design) to support specific use cases.

- Operationalize a data fabric by implementing continuous and evolving data engineering practices for the data management ecosystem.

- Build your data fabric by leveraging existing, well-understood and established integration technologies and standards, but educate your team on new approaches and practices such as DataOps and data engineering, including in edge environments.

Further Reading:

Link to Trend Profile

Infographic: An Intelligent Composable Business Demands a Data Fabric

Demystifying the Data Fabric

Data Engineering Is Critical to Driving Data and Analytics Success

Trend 4: From Big to Small and Wide Data

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Analysis by: Farhan Choudhary, Shubhangi Vashisth, Pieter den Hamer, Lydia Clougherty Jones and Jim Hare

SPA: By 2025, 70% of organizations will be compelled to shift their focus from big to small and wide data, providing more context for analytics and making AI less data hungry.

Description:

As companies experience the limitations of big data as a critical enabler of analytics and AI, new approaches known as "small data" and "wide data" are emerging. The wide data approach, applying X analytics techniques, enables the analysis and synergy of a variety of small and large, unstructured and structured data sources. The small data approach is about the application of analytical techniques that require less data but still offer useful insights. This includes the tailored use of less data hungry models, rather than using more data hungry deep learning techniques in a one-size-fits-all approach.

Why Trending:

- Decision making by humans and AI has become more complex and demanding, requiring a greater variety of data for better situational awareness.

- Small and large disruptions — such as the COVID-19 pandemic — cause historical data to become obsolete more quickly. Techniques are needed to build analytics and AI with less data. In addition, collecting sufficiently large volumes of historical or labeled data for analytics and AI is a challenge for many organizations.

- Data sourcing, data quality, bias and privacy protection are common challenges. However, the cost of addressing these challenges in large datasets for conventional supervised ML can be prohibitive.

- New analytics techniques are needed, capable of using available data more effectively, either by reducing the required volume or by extracting more value from unstructured, diverse data sources.

Implications:

- Small and wide data approaches enable more robust analytics and AI, reducing organizations' dependency on big data and helping them attain a richer, more complete situational awareness or 360-degree view to support better decision making.

- The wide data approach enables the analysis and synergy of a variety of small and large, unstructured and structured data sources for more context and better situational awareness for both human decision makers and AI applications.

- X analytics derives insights from single or combined data sources in a variety of formats. These include tabular, text, image, video, audio, voice, temperature or even smell and vibration. The data itself comes from an increasing range of internal and external data sources such as data marketplaces and brokers, social media, Internet of Things (IoT) sensors and digital twins.

- The small data approach applies techniques such as certain time-series analysis techniques, few-shot learning, synthetic data and self-supervised learning, as well as collaborative or federated, adaptive, reinforcement and transfer learning.

- Potential areas for innovation with small and wide data include, but are not limited to, demand forecasting in retail, behavioral and emotional intelligence in (real-time) customer service applied to hyperpersonalization and customer experience improvement. Other areas include physical security or fraud detection and adaptive autonomous systems, such as robots, which constantly learn by the analysis of correlations in time and space of events in different sensory channels.

Actions:

- Lower the barrier to entry for advanced analytics and AI by considering small and wide data approaches to mitigate the real or perceived lack of data.

- Provide a richer context for more accurate business decision making by extending the AI toolbox with small and wide data techniques, taking advantage of the growing availability of external data sources through data sharing and marketplaces.

- Improve the predictive power of data and the accuracy of models by considering alternative modeling techniques, rather than overly relying on data hungry deep learning approaches.

Further Reading:

Link to Trend Profile

How to Use AI to Fight COVID-19 and Beyond

Boost Your Training Data for Better Machine Learning

Predicts 2021: Artificial Intelligence Core Technologies

Operationalizing Business Value

Trend 5: XOps

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Analysis by: Erick Brethenoux, Ankush Jain, Afraz Jaffri, Soyeb Barot, Donald Feinberg

SPA: By 2025, 50% of enterprises will have devised artificial intelligence (AI) orchestration platforms to operationalize AI, from less than 10% in 2021.

Description:

The goal of XOps (DataOps, MLOps, ModelOps, PlatformOps, etc.) is to achieve efficiencies and economies of scale using DevOps best practices and ensure reliability, reusability and repeatability while reducing duplication of technology and processes and enabling automation.

Why Trending:

■ Analytics and AI solutions have struggled to keep pace with the growing complexity, implementation diversity (hybrid, on-premises, multicloud) and the need for access and delivery of datasets, data science, and ML artifacts and AI-based solutions.

■ Most analytics and AI projects fail because operationalization is only addressed as an afterthought. The extra time taken to hand off models and analytics artifacts causes significant delays and lost productivity in operationalization, lack of ownership and frustration among engineers.

■ Complexity around integrating the solution with existing enterprise applications and infrastructure is the top barrier to scaling analytics and AI implementations and achieving business value.

■ The multiplication of Ops disciplines stemming out of DevOps best practices has caused significant confusion in the marketplace. Yet, their reconciliation can bring significant advantages to organizations that are able to harmonize those disciplines.

Implications:

■ Scaling prototypes that leverage analytics and AI assets can be achieved through the continuous and sustainable operationalization of those assets. Operationalizing at scale will also address the reproducibility, traceability, integrity and integrability of analytics and AI assets.

■ A unified XOps strategy provides the necessary transparency and visibility to track business value throughout analytics and AI assets' life cycles.

■ The flexible design and agile orchestration of governed decision-making systems that can adapt continuously are the promises of a purposefully crafted XOps strategy. Additional benefits include the ability to simulate entire decision processes to anticipate changes, reduce uncertainty, reduce systems' vulnerability to threats and attacks, and prepare for unexpected environmental changes.

■ Analytical modeling assets that are deployed across hybrid, edge and Internet of Things (IoT) contexts require orchestration platforms that integrate capabilities and simplify access across contexts.

■ An integrated XOps strategy will make it possible to align and integrate the tasks needed to combine different techniques (composite AI) to solve a problem within a single solution.

Actions:

- Create an integrated XOps practice that blends disparate functions, teams and processes to support data processing, model training, model management and model monitoring, allowing for continuous delivery of AI-based systems. Establish clear lines of cooperation between DevOps practices and analytics and AI labs or centers of excellence.

- Establish a strong DevOps practice across the various stages — data pipeline, data science, ML, AI and underlying infrastructure — to radically improve the delivery pipeline and operationalize your analytics and AI architectures.

- Build a new set of competencies above the traditional roles, including systems thinking, the emphasis on feedback loops, and the promotion of experimentation and learning.

- Nurture production AI mindsets even for AI pilots. This means utilizing standardized data and model pipeline infrastructure stacks to maximize reusability, reproducibility, reliability and rate of success, all the while minimizing AI time to production.

- Enable a unified foundation for XOps, where DataOps, MLOps and ModelOps can be orchestrated. Enable the customization of data and model pipelines across hybrid multicloud, edge and IoT context by building talent around the operations of analytics and AI platforms.

Further Reading:

Link to Trend Profile

Innovation Insight for ModelOps

Innovation Insight for DataOps

Demystifying XOps: DataOps, MLOps, ModelOps, AIOps and PlatformOps for AI

Trend 6: Engineering Decision Intelligence

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Analysis by: Anthony Mullen, Erick Brethenoux, Rita Sallam

SPA: By 2023, composable decisions that leverage a data fabric will reduce operational costs and accelerate time to insight by 20%, while improving explainability.

Description:

Decision intelligence is a practical discipline framing a wide range of decision-making techniques. These range from conventional analytics to AI and complex adaptive system applications, depending on the

decision context, to design, model, align, execute, monitor and tune decision models. Engineering decision intelligence applies to not just individual decisions, but sequences of decisions, grouping them into business processes and even networks of emergent decision making.

Why Trending:

- Decision making has become more complex as business and society have become more uncertain. According to a Gartner Research Circle Survey, "65% of decisions made are more complex (involving more stakeholders or choices) than they were two years ago."

- An organization's business results, both positive and negative, are the sum total of the quality, timeliness and accuracy of its decisions, as well as its ability to execute on those decisions.

- There is more uncertainty about the direction of the market, whether decisions will be questioned, and the durability of a decision.

- To deal with unprecedented levels of business complexity and uncertainty, organizations must improve their ability to accelerate accurate and highly contextualized decisions.

- It is possible to design decision solutions and examine their consequences individually. However, it becomes exponentially harder to determine and track the consequences at the aggregate scale, particularly if they are networked and complex.

Implications:

- Creating an organizational competency in engineering decision intelligence with a reusable, composable decision framework enables data-driven organizations to accelerate turning data into insights and actions that optimize business performance and achieve mission-critical priorities.

- Engineering decision intelligence supports improved decisions both individually and collectively, by modeling and optimizing their interactions, measuring business impact, learning and adjusting.

- As decisions become increasingly automated and augmented, engineering decisions for precision, transparency, traceability, flexibility reusability and explainability will improve trust and adoption.

- Decisions have a human emotional component or impact with trade-offs. Changing how decisions are made can have a significant impact on the role of decision makers. These shifts must be anticipated and proactively managed.

Actions:

- Create new decision-making habits by training decision makers to apply best practices such as critical thinking, trade-off analysis, recognizing bias and listening to opposing views.

- Increase data literacy skills throughout the organization as a step toward building a data-driven, decision-centric organization. Establish D&A communities to encourage collaboration and community-shared learning.

- Consider creating a role for decision engineers by hiring or upskilling experts that are able to work with decision makers to identify critical decisions that would benefit from the rigor of engineering decision intelligence practices.

Further Reading:

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Improve Decision Making Using Decision Intelligence Models

When to Automate or Augment Decision Making

How to Manage the Risks of Decision Automation

Trend 7: Data and Analytics as a Core Business Function

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Analysis by: Saul Judah, Melissa Davis, Alan Duncan, Lydia Clougherty Jones

SPA: By 2022, over 75% of centrally organized analytics programs will be replaced by a hybrid organizational model that shares power with local domain data and analytics leaders.

Description:

D&A is shifting to become a core business function. Rather than it being a secondary activity done by IT to support business outcomes, business leaders increasingly think in terms of D&A as one of their key business capabilities to drive their business results. As organizations accelerate their digital business transformation efforts, business-domain-led D&A, data literacy, data monetization, smarter data sharing and adaptive governance increasingly play key business roles.

Why Trending:

- Business domain leaders are taking control, ownership and responsibility of their D&A functions in order to accelerate their digital business initiatives. However, they often underestimate the associated complexity and risks, missing strategic business opportunities. Chief data officers (CDOs) who are fully involved in setting business direction and goals, serving as executive decision makers, increase the consistent production of business value by a factor of 2.6x.

- To be competitive using D&A, organizations need to leverage a broad range of data assets both internal and external to the enterprise. They must share that data, build trust and adoption through D&A governance and ensure impactful use of D&A by building data literacy skills. However, most D&A strategies and the data, technology and organizational competencies required to enable them are not aligned to business outcomes or mission-critical priorities.

- To respond to disruptive change, organizations must be able to deliver innovation quickly and adapt applications dynamically, reassembling capabilities from inside and outside the enterprise.

Implications:

- With D&A as a core business function, it becomes a shared business asset aligned to business results. D&A silos break down because of better collaboration between central and federated D&A teams.

- Operating D&A as a business function enables better business agility, responsiveness, resilience, saleability and sustainability in support of a composable enterprise.

- Data sharing collaboration as a core competency, even with competitors, could yield both organizational competitive advantage and digital business acceleration.

- Upgrading and coordinating the portfolio of D&A skills across business domains and central teams is becoming a critical action for D&A leaders.

Actions:

- Build balanced, collaborative organizational models for D&A that enable both enterprise and business domain outcomes to be achieved through effective, trust-based governance.

- Actively curate business area datasets that could be monetized or exchanged, building a business function to maintain an inventory of possible information assets in an intelligent data catalog.

- Give business leaders access to the right data at the right time to maximize business impact by adopting a "must share data unless" approach to D&A. Enable this by recalibrating risk, establishing trust-based mechanisms and engaging with augmented data ecosystems.

- Identify quantifiable success criteria for key business outcomes and directly connect these with the D&A assets that enable them.

Further Reading:

Link to Trend Profile

Roadmap for Data Literacy and Data-Driven Business Transformation: A Gartner Trend Insight Report

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Data and Analytics Leaders Must Use Adaptive Governance to Succeed in Digital Business

Data Sharing Is a Business Necessity to Accelerate Digital Business

Distributed Everything

Trend 8: Graph Relates Everything

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Analysis by: Afraz Jaffri, Ankush Jain, Jim Hare, Pieter den Hamer

SPA: By 2025, graph technologies will be used in 80% of data and analytics innovations, up from 10% in 2021, facilitating rapid decision making across the enterprise.

Description:

Graph technologies encompass a wide variety of solutions that work with data represented as a set of nodes and edges instead of tables, rows and columns. It allows us to find relationships between people, places, things, events, locations etc. across diverse data. This structure intuitively models relationships between entities and can capture business knowledge, making it easier to perform queries and answer questions. In addition, modeling data as a graph opens up new analytical insights through the use of graph algorithms.

Graphs are forming the foundation of many modern data and analytics capabilities. Increased understanding and collaboration with business users, organizing and preparing data for downstream processes, uncovering hidden insights, improving ML model creation and providing explainable AI are just some of the uses driven by different graph technologies and techniques.

Why Trending:

- Complex business problems require contextual awareness and understanding the variable nature of connections and strengths across multiple entities, such as organizations, people or transactions. Critical business questions that used to take months to answer can now be solved in minutes.

- Graphs form the foundation of modern D&A, with capabilities to enhance and improve user collaboration, ML models and explainable AI. The recent Gartner AI in Organizations Survey demonstrates that graph techniques are increasingly prevalent as AI maturity grows, going from 13% adoption when AI maturity is lowest to 48% when maturity is highest.

- No- and low-code tools that enable visual exploration and interaction with a graph are enabling insights to be found without the need for graph query languages.

- Improved, scalable and lower-cost processing options, including cloud-based services and dedicated hardware, are making graph analytics and databases prime candidates for accelerated adoption.

- Knowledge graphs can form a key component of data fabrics and give structure to images, audio, video and natural languages. They do so by exposing metadata and business rules, enabling data scientists to quickly identify and use the data they need while preserving context and representing all forms of data in a standard queryable format.

Implications:

- A change in thinking and development of a "graph mindset" are taking place as more organizations identify use cases that graph techniques can solve. Up to 50% of Gartner inquiries on the topic of AI involve discussion of the use of graph technology.

- The number of products that incorporate graph technology will increase. Within these products, the use of graphs may or may not be visible to end users, resulting in duplication and redundancy. There needs to be an understanding of when an underlying graph model can be exposed, and how multiple graphs can be combined.

- AI solutions will evolve from being based on one type of model, or ensemble of models, to being made of composite models, with graph techniques playing a prominent role. The use of graph techniques will require a broader and deeper set of data science and AI skills with specialist roles, such as graph engineer and ontology manager, appearing, as well as existing roles in data science teams becoming proficient in graph techniques.

- Graph technology underpins the creation of richer semantic models that can enhance augmented analytics models, as well as the richness of conversational analytics. Organizations that use graphs and semantic approaches for natural language technology projects will have less technical debt than those that do not.

Actions:

- Complement traditional analytics with graph technology when the primary business questions are about the relationships between data rather than data values themselves.

- Deduce actual relationships among data in multiple data stores and identify enforced and implied relationships in the data across the organizational silos by taking advantage of graph-enabled data and metadata management capabilities..

- Examine business processes that have a high potential for optimization through the use of graph techniques and algorithms by creating a conceptual graph domain model for the process and testing scenarios that graph algorithms could solve.

- Identify potential use cases that can be simplified or accelerated with graphs for ML by evaluating existing models that require intensive data preparation and feature selection workflows.

Further Reading:

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How to Build Knowledge Graphs That Enable AI-Driven Enterprise Applications

Understanding When Graph Technologies are Best for Your Business Use Case

Case Study: Answering Critical Business Questions With Graph Analytics (Jaguar Land Rover)

Trend 9: The Rise of the Augmented Consumer

Analysis by: James Richardson, Rita Sallam, Kurt Schlegel

SPA: By 2025, augmented consumerization functionality will drive adoption of analytics and business intelligence capabilities beyond 50% for the first time, influencing more business processes and decisions.

Description:

The percentage of time users spend in predefined dashboards, which largely require manual exploration and some degree of analyst skill, will be displaced by automated, conversational, mobile and dynamically generated insights that are customized to a user's context and delivered to their point of consumption in dynamic, autogenerated and personalized data stories and embedded in applications. This will shift advanced analytical power to the information consumer — the augmented consumer — giving them capabilities previously only available to analysts and citizen data scientists.

Why Trending:

- Visual-based exploration approaches and predefined dashboards in modern analytics and BI platforms have expanded access to data exploration. However, these experiences are too difficult for use by less skilled business or operations people, who need to ask their own questions or to know which insights are the most important and actionable.

- Predefined dashboards often overwhelm users with data, and users need to have the skills and time to explore what happened, why and what to do about it manually. This can lead to incorrect conclusions and flawed decisions and actions.

Implications:

- Surfacing the most important insights for specific business and operational users at their point of consumption and action, without the need for an analyst intermediary, will further expand adoption and improve the impact of analytics on the organization.

- New user experiences with ABI platforms range from extending existing predefined dashboards and manual point-and-click exploration with augmented and conversational capabilities, to autogenerated domain- and industry-specific insights and conversational capabilities. These capabilities are embedded in enterprise applications and extensions of NLP-based interfaces. There are also completely new dynamic user experiences, where the dashboard plays a minimal role. Dynamic data stories highlight for each user the most meaningful changes in the business for them.

- Technological immaturity, organizational immaturity, low levels of data literacy, resistance to change, lack of trust in perceived "black box" approaches and concerns about the availability of data will inhibit adoption and must be proactively managed.

Actions:

- Evaluate your existing ABI tools, as well as innovative startups offering new augmented and NLP-driven user experiences.

- Prioritize consumer capabilities, including: embedded analytics to push personalized content directly to the consumer's natural workflow; natural language query to make it easy to find the right information; analytics catalog to describe analytics content available and show the usage of that content; automated insights to use machines to find insights; and dynamic storytelling to displace use of predefined dashboards and manual exploration.

- Accelerate adoption of analytics and increase their impact by teaching users how to use the newly found analytical power to impact their specific business problems, opportunities and processes, as well as by expanding the organization's data literacy.

- Build trust in autogenerated insights and models by back testing and offering users scenario planning and "what-if analysis," and by prioritizing explainability features in selected platforms.

Further Reading:

Link to Trend Profile

How Augmented Analytics Will Transform Your Organization: A Gartner Trend Insight Report

Magic Quadrant for Analytics and Business Intelligence Platforms

Augmented Analytics: Teaching Machines to Tell Data Stories to Humans

Trend 10: Data and Analytics at the Edge

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Analysis by: Ted Friedman, Roy Schulte, Pieter den Hamer, Paul Debeasi

SPA: By 2023, over 50% of the primary responsibility of data and analytics leaders will comprise data created, managed and analyzed in edge environments.

Description:

Increasingly, data, analytics and the technologies supporting them reside outside traditional data centers and cloud environments. This is where edge comes in — computing environments residing closer to assets in the physical world and outside IT's typical purview. As this trend continues, there is both a requirement and a huge opportunity for organizations to enable greater flexibility in how and where data management and analytics are carried out. These changes will significantly impact D&A leaders and their teams, requiring new capabilities and skills while also opening up new opportunities to deliver value.

Why Trending:

- By distributing D&A capabilities to edge environments, data-centric solutions can enable more real-time value. For scenarios that require extremely low latency, the ability to capture and analyze data close to the place and time of origin reduces latency issues.

- More D&A solutions, such as those supporting IoT use cases, need to operate in disconnected (or intermittently connected) scenarios. By bringing more powerful D&A capabilities to edge environments, these solutions need not rely on centralized data centers or cloud resources.

- By provisioning advanced analytics and AI capabilities to edge environments, the assets driven by those environments can behave in an autonomous manner, with no support from external data sources or processing capabilities. As demand grows for "smarter" physical assets in many industries, supporting autonomous behavior will be a common requirement.

- Governance issues related to sensitive or regulated data can constrain D&A teams from adopting centralized or cloud-based environments — moving data outside its originating geography can violate sovereignty regulations. By enabling data to be managed and processed in edge environments, or by applying federated ML, the enterprise can remain in compliance.

Implications:

- **Speed and agility:** By placing data, analytic workloads and AI capabilities at optimal points ranging all the way out to endpoint devices, D&A teams can enable more real-time use cases. In addition, the flexibility to move D&A workloads up and down the continuum from centralized data centers or the cloud to edge devices will enable greater optimization of resources.

- **Scale and reach:** By using distributed computing resources and spreading the load across the ecosystem, D&A teams can more broadly scale their capabilities and extend their impact into more areas of the business. This includes use cases and outcomes traditionally managed only via

operational technology teams, such as those managing equipment in industrial settings. Dedicated hardware for edge processing of data will continue to amplify these benefits.

- **Resiliency:** Pushing D&A capabilities toward edge environments can also bring benefits in the form of greater fault tolerance and autonomous behavior. If edge environments do not require centralized resources, then issues with connectivity to or unplanned downtime of those centralized resources don't disrupt processes that rely on local edge capabilities.

- **Governance:** With the distribution and complexity of edge environments comes a great challenge from a D&A governance perspective. It will be critical for D&A teams to extend the reach of their governance practices to include edge-resident D&A workloads in scope.

Actions:

- Identify use cases where AI capabilities in edge environments can enable differentiated products and services by collaborating with engineers, operations managers and satellite office managers working in edge locations.

- Plan to augment existing data management and analytics infrastructure to support edge deployment by partnering with product teams that are implementing IoT platforms and similar distributed computing architectures.

- Identify opportunities for leverage and shared outcomes by establishing communication and collaboration with operational technology (OT) teams.

- Place a greater emphasis on end-to-end system design. Understanding the dependencies between all components of distributed data pipelines, analytic workloads and AI models will be crucial to success.

- Ensure safety and control by extending existing D&A governance capabilities to apply to edge environments where appropriate.

Further Reading:

Link to Trend Profile

How to Overcome Four Major Challenges in Edge Computing

Emerging Technologies: Edge AI Adoption Patterns Deliver Business Value

How to Enable Edge Data in Support of IoT Analytics

Changes Since Last Year

Trend 1: Smarter, More Responsible and Scalable AI — This trend is an update and evolution of Top 10 Trends in Data and Analytics, 2020, where we highlighted smarter, faster and more responsible

disruptions in AI such as reinforcement, transfer, adaptive, federated/collaborative and generative adversarial learning techniques. It also explored efficient infrastructures such as trends in distributed processing and embedded AI models and trends in new compute infrastructure, such as neuromorphic hardware.

Trend 3: Data Fabric Is the Foundation — The data fabric has been an evolving top 10 D&A trend for the past three years. This year, we focus on its market evolution and its foundational role in the D&A architecture and intelligent composable business.

Trend 4: From Big to Small and Wide Data — This trend is related to a number of trends from the Top 10 Trends in Data and Analytics, 2020. This includes X analytics, data exchanges and sharing, and smarter, faster, more responsible AI. It is also related to graph analytics as a foundational technology for related diverse data in knowledge graphs and for finding patterns across diverse data using graph analytics technologies.

Trend 6: Engineering Decision Intelligence — The Top 10 Trends in Data and Analytics, 2020 highlighted the importance of decision intelligence. Engineering decision intelligence focuses on the need to use composability and design approaches for decision intelligence systems as core components of an organizational decision competency.

Trend 8: Graph Relates Everything — Graph analytics has been an emerging top D&A trend for the past three years. We continue to evolve our analysis and recommendations as potential high-impact use cases, vendor solutions, customer deployments and processing capabilities expand. Graphs relate to and enable many of our current and past trends, including data fabric, natural language processing, the rise of the augmented consumer, X analytics, and smarter, more responsible and more scalable AI.

Trend 9: The Rise of the Augmented Consumer — We identified the decline of the dashboard as a top data and analytics trend in Top 10 Trends in Data and Analytics, 2020. The rise of the augmented consumer is an evolution of this important market trend, which is growing in importance, to ensure the realization of business value from data and analytics as business complexity and uncertainty increase.

Evidence

Composable Data and Analytics:

Gartner's 2020 Magic Quadrant customer reference survey indicates that many large organizations have more than one "enterprise standard" analytics and BI tool, with 41% stating they have multiple standards in place.

Data Fabric:

Interactive briefings in which vendors provided Gartner with updates on their strategy, market positioning, recent key developments and product roadmaps.

Feedback about tools and vendors captured during conversations with users of Gartner's client inquiry service.

Client inquiries to Gartner's data and analytics team — more than 500 aggregated conversations with users of Gartner's client inquiry service from January 2018 through September 2019

Engineering Decision Intelligence:

Gartner primary and secondary research into decision intelligence, composable applications and composable data and analytics and AI.

The Future of Data and Analytics: Reengineering the Decision, 2025

Data and Analytics as a Core Business Function:

Survey Analysis: Board of Directors Say Pandemic Drives Increased Investments in IT

 Survey Analysis: Fifth Annual CDO Survey — Growth Must Continue in Order to Achieve Real Impact

Recommended by the Authors

A Guidance Framework for Operationalizing Machine Learning

Use 3 MLOps Organizational Practices to Successfully Deliver Machine Learning Results

Use Gartner's 3-Stage MLOps Framework to Successfully Operationalize Machine Learning Projects

Assessing DevOps in Artificial Intelligence Initiatives

Using Platform Ops to Scale and Accelerate DevOps Adoption

Predicts 2021: Operational AI Infrastructure and Enabling AI Orchestration Platforms

Data Fabrics Add Augmented Intelligence to Modernize Your Data Integration

How to Activate Metadata to Enable a Composable Data Fabric

Emerging Technologies: Data Fabric Is the Future of Data Management