

**BIG IDEA**

# Next-Generation Embedded Analytics Spark Digital Transformation

**Embedding Is Not Just for Software Companies—  
Drive Action and Innovation with In-Context Analytics**



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## EXECUTIVE SUMMARY

The practice of embedding analytics into applications is not new, but until recently it has been associated predominantly with independent software vendors intent on quickly adding reporting and analytical capabilities to their software and software-as-a-service offerings. This style of embedding remains a popular tactic for software and cloud services vendors, but “end-user” organizations (those in all other industries that are not in the business of selling software) are also getting in on the act. Not only does embedding address time and ease-of-use constraints, it also helps companies to innovate and transform interactions with employees, partners and customers. Digital leaders and fast followers recognize that data-driven insights delivered in the context of decisions and transactions can vastly improve the user experience. The approach can also be used to speed decision-making, monetize potentially valuable data and unleash new business models.

This report examines the evolution of embedded analytics as a route to digital transformation and emerging, data-driven business models. It explores rising preferences for fast, concise decision support and recommendations delivered within applications in place of traditional BI reports and analytic dashboards consumed as separate, purely analytical interfaces. The report also explores opportunities to harness edge analytics from connected devices and advanced data science and prediction to automate workflows, thereby speeding action while improving productivity and saving money. Finally, the report looks at the emerging technologies and licensing approaches that make embedding more affordable, and it closes with recommendations for questions that organizations should answer internally before moving on to the technology-selection process.

### Business Themes



Data to Decisions



Next-Generation  
Customer Experience



Technology Optimization

# WHY AND HOW EMBEDDED ANALYTICS ARE EVOLVING

Embedded analytics have long been associated with the independent software vendor (ISV) practice of licensing core reporting, dashboarding and exploratory analysis technologies from well-known business intelligence (BI) and analytics vendors and building these capabilities into their applications. Heretofore, these ISVs—companies in the business of selling software and software-as-a-service (SaaS) applications—have been responsible for the majority of embedding, but that’s now changing.

Innovative “end-user” organizations across every industry are increasingly recognizing the value of embedded analytics, and it’s a trend that’s growing for three reasons: rising demand for easier and faster decision-making; the pursuit of innovation and new business models; and emerging opportunities to harness prediction, machine learning (ML) and automation. Here’s a closer look at each of these three trends.

## Self-Service Analytics and Conventional BI Have Limits

So-called “self-service” BI and analytics has been a hugely positive development in the evolution of data-driven decision-making. Unfortunately, this trend has carried most organizations only so far. The truth is that most self-service capabilities are aimed at analysts. Yes, these analysts are now far more capable of quickly generating more dashboards and reports for actual business users. But the reports and exploratory dashboards aimed at business users have at least two drawbacks.

- **Analysis paralysis.** Before the self-service era, the common complaint was that there was too much data and too little insight. Many organizations now lament that there are too many insights and too few well-informed actions. Businesspeople often encounter overlapping or, worse, conflicting reports and dashboards. These multiple versions of the truth leave users confused about which insights are trustworthy and relevant to specific questions and potential actions.

BI and analytics teams and center-of-excellence leaders can address these problems, to an extent, by standardizing key metrics, certifying data sources and consolidating overlapping reports and dashboards. BI and analytics vendors have also helped

by adding governance features that can be used to certify datasets and approved, company-standard metrics and measures. Nonetheless, report and dashboard sprawl and inconsistencies in interpretation remain challenges in the broad use of BI and analytics among business users.

- **Time-to-insight.** A second drawback of conventional reports and dashboards is the gap they can leave between insight and action. Reports, for example, tend to be point-in-time analyses published and distributed on a weekly or daily basis. Years ago, users thought of “the latest report” as fresh insight, but these days, reports are increasingly perceived as rearview-mirror history produced for the record.

Dashboards are now the default source for daily, interday and near-real-time insight. But here, too, the requirement to switch between dashboards and the transactional and productivity apps where people do their day-to-day work can impede productivity. It may seem like a simple matter to toggle between interfaces, but add in the tasks of logging in and then finding and interpreting the right key performance indicators (KPIs) and visualizations, and users may forget the question they were trying to answer by the time they get back to the transactional interface.

## Embedding Evolves Toward In-Context Insight and Action

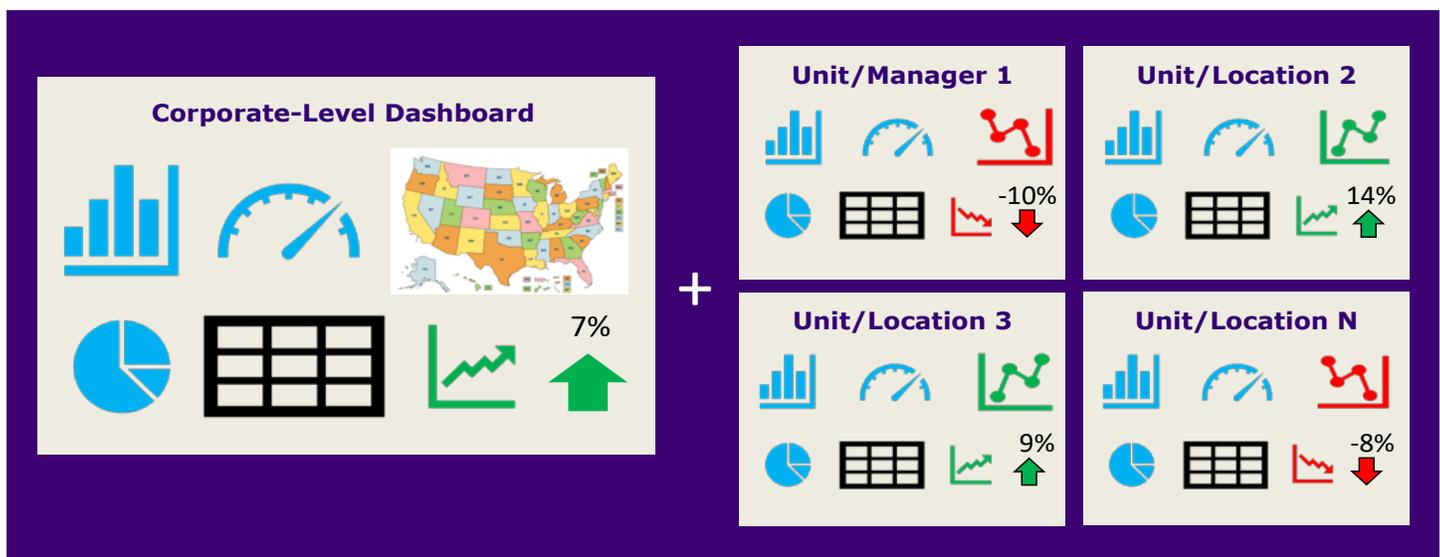
Embedded analytics approaches not only save time, they ensure that curated analytics based on known, reliable data sources and relevant analyses are presented where they are needed. Rather than navigating to separate analytical interfaces, finding and interpreting the right content, and then toggling back to a transactional app, users are presented with precisely the insights they need embedded within the applications in which they make decisions and act.

The embedded analytics concept is not entirely new to end-user organizations, but it’s evolving in sophistication, as described below.

- **Level 1: Web embedding.** The most basic approach to embedding analytics is to publish conventional reports, data visualizations or dashboards to web pages. In this approach, static assets are shared using iFrames or other simple HTML or JavaScript embed codes.
- **Level 2: Secure custom portals.** The next step up in sophistication—and the prevailing approach used by end-user organizations to date—is to publish analytic assets to internal-, partner- and/or customer-facing portals. These portals consolidate access to myriad reports and dashboards, typically with group- and user-level security access controls, scheduling, personalized alerts and notifications and, in some cases, customized interface styling and branding.

In a half-step up in sophistication, this style of embedding can be done within business/ transactional application landing pages—portal-like pages within the context of an app. A bank, restaurant or retail chain, for example, could securely deliver branch- or location-specific performance dashboards within the branch-, store- or restaurant-management application (see Figure 1). This approach offers the advantages of a

**Figure 1. Business-Unit or Manager-Specific Dashboards Can Be Embedded Within Portals or Business Applications**

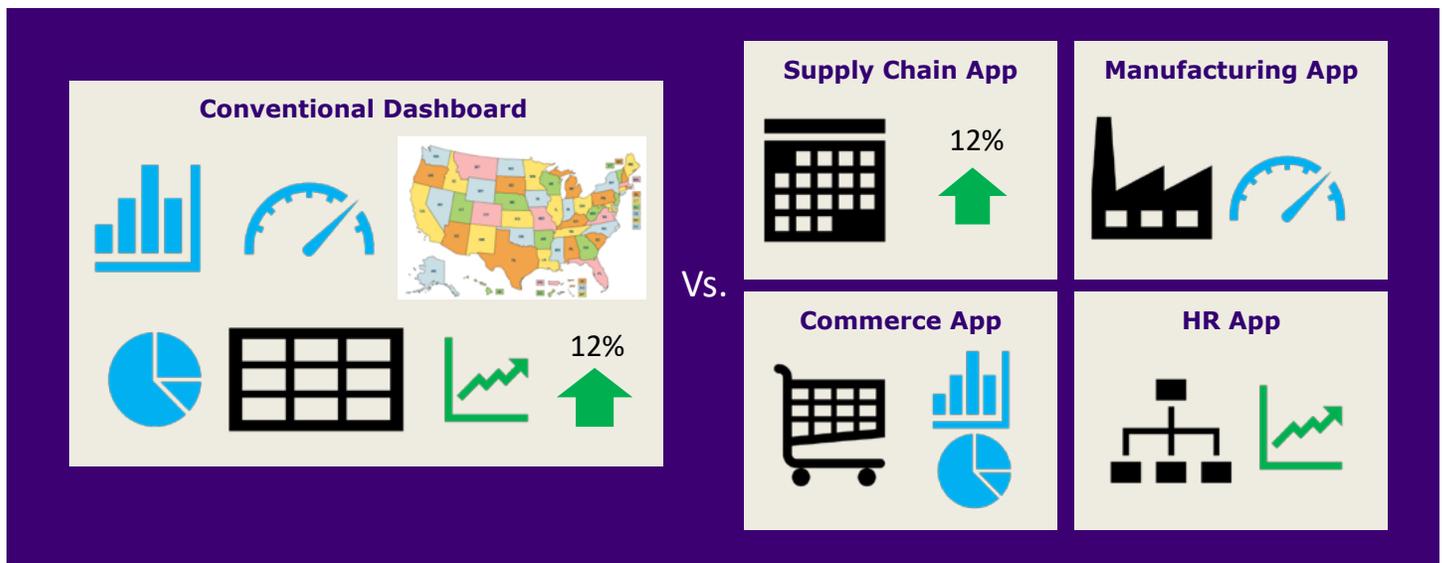


Source: Constellation Research

single-sign-on experience and brings analytics closer to the point of work, but there's still a separation between analytical and transactional interfaces.

- **Level 3: SaaS/COTS embedding.** The next step up in sophistication—an approach that's quickly growing in popularity—is embedding targeted visualizations or complete dashboards into SaaS offerings or commercial-off-the-shelf (COTS) software. SaaS apps such as Salesforce, NetSuite and Workday; on-premises apps such as SAP ECC 6 and Oracle E-Business Suite; and even personal productivity apps, such as Microsoft Office apps, are leading targets for embedded analytics. Here's where prebuilt integrations, two-way interactivity and support for authentication and row-level data-access controls support in-context embedding. Depending on the architecture of the BI and analytics platform and the sophistication of the integration options, SaaS/COTS embedding might also support the granular, decision-specific embedding described below at Level 4.
- **Level 4: Concise, real-time and interactive embedding.** Here's where innovators—whether commercial software vendors or leading end-user organizations—are embedding concise analytics at the point of decisions and actions (see Figure 2). The

**Figure 2. Dashboards Are Typically Purely Analytical; Concise Analytics Can Be Embedded at Decision Points**

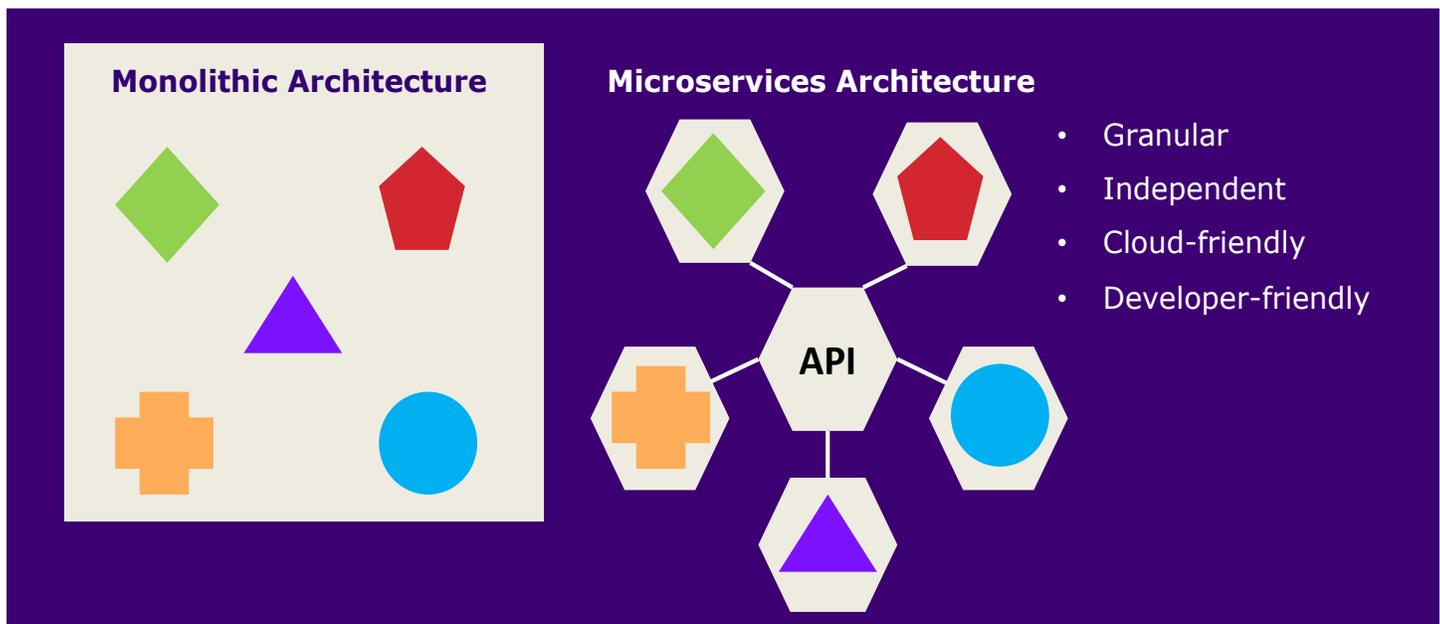


Source: Constellation Research

innovation might also extend to personalization, near-real-time insight, interactivity and even predictive capabilities. This level of sophistication demands rich software development kits (SDKs), customized branding and color schemes, and embeddable analytic engines with data integration, modeling, scaling and caching or data-mart capabilities to ensure flexible development, deployment, scalability and performance. In an advance over monolithic architectures, BI and analytics platforms with modern microservices architectures and RESTful APIs support embedding of concise analytics at specific decision points within applications (see Figure 3). This cloud-friendly design gives developers much greater flexibility and agility by permitting discrete changes, upgrades and customization of applications.

- **Level 5: Embedded analytic apps and action-oriented dashboards.** Spurred on by an important tech trend that is democratizing application development, leading BI and analytics vendors are adding low-code and no-code development options as well as support for event triggers, workflows and automation. These options support both the development of custom analytic applications and active dashboards with embedded

**Figure 3. Microservices Architectures and Granular APIs Have Enabled Embedding of Concise, In-Context Analytics**



Source: Constellation Research

transactional capabilities that can trigger actions in third-party systems. At the cutting edge, predictive features, support for analyzing edge analytics gathered from connected devices in Internet of Things (IoT) scenarios and automation capabilities can be exploited to recommend next-best actions or even automate actions without requiring human intervention.

## Digital Leaders Innovate with Analytic Apps and Services

Diving deeper into where and how end-user organizations are embedding analytics, below are a handful of examples demonstrating creative and powerful uses of embedded analytics delivered in context to drive action:

- **A major European grocery retailer** with more than 1,200 locations wanted to give individual store managers the ability to track shrinkage, cashier efficiency, store-specific product assortment and more. Store managers previously resorted to ad hoc Excel reports. The retailer used an embedded BI and analytics platform to develop an extensive collection of standardized, company-branded dashboards, delivered through a portal, for store-specific analysis of everything from customer traffic levels and historical sales by product to employee efficiency and electricity consumption. The deployment cut time spent on reporting by half while bringing consistent store-level insight to local and central managers. As a result, stock management, promotions and sales efficiency improved, and the chain went on to develop embedded dashboards for purchasing.
- **A regional insurer** embedded concise analytics and ad hoc exploration features into its internally developed underwriting and claims systems. The supporting BI and analytics platform's granular APIs and security integrations ensured that authorized underwriting and claims staff would get needed insights. Customization and styling capabilities seamlessly blended the analytics into the insurer's transactional applications at the point of decisions.

- **A network equipment manufacturer** developed an analytic service for its telco customers drawing on log data from the equipment that customers had deployed in the field. This log data was originally used for on-demand customer-service support and internal reporting, but the manufacturer realized it was sitting on a potential gold mine of data. With opt-in permissions from customers, the secure service provides telcos with self-service reporting capabilities to help them better understand calling trends and projected service levels. It also helps them to proactively plan equipment repairs and upgrades. The service has improved customer satisfaction while also increasing customer retention and sales of the manufacturer's newly intelligent equipment, which was enhanced by the value-added analytical service.

*“There’s a popular saying that ‘every company is now a software company,’ but in Constellation’s view, that’s an overstatement. Transformational apps are being built by innovators and fast followers.”*

- **A national property management company** developed an application that enables its thousands of commercial property owner customers to monitor heating and air conditioning equipment, backup generators and other critical equipment and then schedule and manage maintenance proactively. The analytics platform behind the app supports remote data collection and integration, real-time monitoring, customizable alerts and predictive capabilities that enable each customer to schedule service based on asset performance and predicted failures rather than generic maintenance schedules. The application has reduced maintenance costs for property owners while preventing unplanned outages and improving customer satisfaction for property owners and tenants.
- **An actuarial consulting company** developed a cloud-based risk platform with embedded financial reporting and risk-modeling capabilities. The platform starts with a data management layer that lets insurance companies integrate, transform, manage and

monitor structured and unstructured data. The embedded analytics solution supports multitenant delivery of customer-branded interactive dashboards and reports. Cash-flow and actuarial modeling workflows are automated, supporting core predictive requirements. The platform frees highly skilled insurance company actuaries from routine reporting and data-modeling drudgery. Most importantly, the platform is a lucrative, ongoing source of revenue and profit for a consulting company that previously relied on feast-or-famine, project-oriented engagements.

There's an increasingly popular saying that "every company is now a software company," but in Constellation's view, that's an overstatement. Transformational, data-driven applications such as those described above are only being built by innovators and fast followers—the leading 20% to 25% of organizations that are trying to differentiate and transform their organizations. Embedded analytics are often the centerpiece of such applications and services, and as discussed below, the state of the art in terms for analytical functionality will continue to evolve.

## Prediction, ML and Automation Are Next Steps

Descriptive and diagnostic analytics—the kind explaining what happened and why, and typically associated with BI—are now baseline, expected capabilities. Leading organizations increasingly also want to see predictive analytics that help them see what's coming. That's why the next act in BI and analytics, and in embedded deployments, will be predictive capabilities, including machine learning. Toward this end, BI and analytics vendors are increasingly adding "augmented analytics" features that support trending, forecasting and prediction. These features typically support a limited set of analytical techniques while automating the iterative testing and selection of best-fit algorithms.

Automated predictive capabilities start with simple push-button trend analysis. Here, one or more algorithms are applied behind the scenes to extrapolate historical trends into the future. Some of these features can even take influences such as seasonality into account. More advanced are automated forecasting features that use built-in algorithms for linear or logistic regression, time-series analysis, clustering and so on.

An obvious use for these forward-looking capabilities in embedded deployments would be to predict desirable or undesirable outcomes within the context of the associated application. Which transaction is risky and which is a safe bet? Which asset in a predictive maintenance application will need service and which will not? Which customer or employee is likely to churn and which is not? Embedded predictive capabilities such as these are available, but not all embedded BI and analytics platforms are capable of supporting prediction—at least not yet, or not without the help of partner integrations.

The next level of sophistication—achieved in pioneering commercial applications but not yet available in the mainstream embedded market—is creating closed-loop environments in which models learn from the outcomes of the actions taken within the application. These learning models can then inform prescriptive recommendations delivered at key decision points within the application. When there are high confidence levels, the next obvious step is to automate actions without requiring human review or decision-making.

*“The journey toward next-generation embedded analytics should not start with a search for a vendor. Organizations must first develop a clear understanding of their immediate and long-term goals.”*

This last level of sophisticated automation is mostly seen in pioneering custom and commercial applications today. Think of ride-hailing apps, such as Uber and Lyft, that have transformed transportation into a digitally connected experience. Instead of standing in line, or trying to call or hail a cab, riders are connected to drivers through a digital platform and app. Predictive analytics inform the rider when the vehicle will arrive, how long the ride will take and how much it will cost. Real-time data feeds models that keep the driver and rider up to date on estimated times of arrival. When traffic conditions change, artificial intelligence automatically prescribes a new route and updates everybody on the new time of arrival.

These sorts of prescriptive recommendation and automation capabilities are rare today, but we’re already seeing trending, forecasting and prediction features added to mainstream BI and analytics

platforms. Constellation expects to see more learning, recommendation and analytics-triggered workflow and automation capabilities in the embedded market within the next three to five years.

## RECOMMENDATIONS

The journey toward next-generation embedded analytics should not start with a search for a vendor. Organizations must first develop a clear understanding of their immediate and long-term goals, their intended user community and the type of embedded analytics or analytic applications they wish to create. Only then can the organization approach the technology selection process with a well-informed list of requirements. With this sequence in mind, following are recommended questions to consider internally and in the vendor review process.

### Know Thyself: Questions to Ask Internally

A key challenge for organizations wishing to create innovative services or drive action with embedded analytics will be to identify would-be use cases, user communities, user skill levels, and development and deployment constraints. Here's a list of questions that will help refine organizational goals and expectations:

- 1. What are the pain points and opportunities?** Does your organization have swaths of users who are making decisions without benefit of analytical insight? Why are they unserved or underserved? Have they tried but failed to adopt conventional BI? Could a cure be to deliver more relevant, personalized reports and dashboards, or is there a need to embed concise, action-oriented analytics right into the context of SaaS, COTS or custom applications? Does your organization have data that could power differentiating applications or services? Gather a cross-functional team including line-of-business constituents for brainstorming sessions to come up with a list of potential embedded analytics projects. Focus on documenting potential business benefits and prioritize the list accordingly.
- 2. What are the intended user groups and their skill levels?** With the list of potential projects in hand, document the skill levels of the targeted users of analytic interfaces, applications or services. Are they internal or external users, and what is their familiarity and demonstrated proficiency and

adoption of reports and dashboards? Are they using available analytics assets or ignoring them? What are the essential analytical requirements of each proposed project?

- 3. What are the desired deployment options?** Having identified the skill level of would-be users, what's the most appropriate deployment option? Will conventional reports and dashboards do, or should you embed personalized assets with specific views and preset filter settings closer to the point of decision? Do you need to take the next step toward ease of use and action by embedding event triggers into dashboards or concise analytics into the context of very specific decision points within SaaS, COTS or custom applications? Is it strictly an internal deployment, or will multitenancy be required? Will mobile interactions be desirable or required?
- 4. What are the current BI and analytics capabilities and constraints?** What are the capabilities of incumbent BI and analytics tools and platforms, and are they being fully exploited? Are there upgrades or embedded capabilities available that should be considered? Are current tools or platforms being phased out or have specific technical limitations been identified that preclude their use for embedding?
- 5. Consider build-vs.-buy options.** If the list of potential embedded projects is short and the requirements are very simple, you could consider custom development without benefit of an analytics platform, but carefully weigh the functionality needed, development time, skill requirements, and ongoing upgrade and maintenance requirements that this will place on your development team.

## Questions About Embedded BI and Analytics Options

In the case of end-user organizations, it's ideal to find one platform that can serve both conventional and embedded needs and requirements. The good news is that most BI and analytics vendors now offer embedding capabilities, but how deep and extensive are these offerings, and what's the vendor's experience in supporting embedded deployments? Here are key questions to explore when considering embedded analytics capabilities.

- 1. What's the architecture and deployment flexibility?** Does the platform have a modern, microservices-based architecture with APIs for delivering highly granular analytic services? Does the platform support hybrid-cloud and multicloud options for deploying on-premises and a choice of cloud platforms? If the platform itself is a cloud-based service, is it deployed on the organization's preferred cloud provider with integrations and visibility to native-cloud infrastructure and services? Does the platform support multitenancy for deploying business unit-, partner- or customer-specific instances? What are the mobility options, and do they support both iOS and Android devices?
- 2. What are the provisions for data management and data science?** Does the platform include a broad set of native- and real-time data connectors and data-transformation or data-prep features, and does it include its own database or integrations with third-party databases or cloud database services? Does the platform support data modeling, data certification and repeatable metrics and measures? Is there support for embedding R or Python code, and does the platform include an embeddable execution engine? Are integrations available for popular AutoML products and public cloud services and emerging IoT frameworks?
- 3. What are the provisions for customization and extensibility?** Can interfaces and analytic assets be styled and skinned to match host applications or company branding, with customizable colors, fonts, logos, buttons, and menu styles? Is an SDK available to customize and extend the platform, and what development languages are supported? Does the vendor offer prebuilt widgets and other customizable user interface components? Can you pass context or event triggers between the analytics platform and third-party applications with support for workflow? Does the vendor have options for low-code or no-code development?
- 4. What are the security provisions and ongoing maintenance requirements?** Does the system have provisions and integrations for single-sign-on, host-application authentication, identity management and fine-grained, row-level access-controls? What are the ongoing administrative demands of managing, scaling and monitoring the platform, and can admins be integrated with the host application?

5. **Are prebuilt integrations available for popular SaaS and COTS applications?** When embedding analytics into popular SaaS or COTS applications, what is the nature, diversity and deployment speed of prebuilt integration options? Will user identity and access management be covered by the host application, and will there be two-way interactivity between the target application and the BI and analytics platform?
6. **What are the licensing options and terms?** Embedded scenarios often call for creative licensing options, particularly when they extend into partner- and customer-facing scenarios. Having more options is better, so look for user-, core-, instance-, usage- and event-based options and unlimited-usage terms. Are open source libraries, servers and APIs or SDKs available, and what are the terms and availability of support options?

## Deployment Considerations and Systems Integration Support

Are you venturing into data monetization, insight services or delivery of customer-facing software for the first time? There's more to consider before getting started, including data ownership, opt-ins, data-enrichment requirements, and support and service guarantees backing software and services. If this is unfamiliar terrain, consider tapping the guidance of leading systems integrators. Accenture, Capgemini, Deloitte, Infosys, Tata Consultancy Services and Wipro are examples of systems integrators with analytics and data-monetization expertise as well as experience guiding chief data officers and chief analytics officers and helping to lead embedded analytics initiatives. Their experience can help your organization extract more value from data and avoid costly delays and mistakes.

## ANALYST BIO

# Doug Henschen

Vice President and Principal Analyst

Doug Henschen is Vice President and Principal Analyst at Constellation Research, Inc., focusing on data-driven decision making. His Data-to-Decisions research examines how organizations employ data analysis to reimagine their business models and gain a deeper understanding of their customers. Data insights also figure into tech optimization and innovation in human-to-machine and machine-to-machine business processes in manufacturing, retailing and services industries.

Henschen's research acknowledges the fact that innovative applications of data analysis require a multi-disciplinary approach, starting with information and orchestration technologies, continuing through business intelligence, data visualization, and analytics, and moving into NoSQL and big data analysis, third-party data enrichment, and decision management technologies. Insight-driven business models and innovations are of interest to the entire C-suite.

Previously, Henschen led analytics, big data, business intelligence, optimization, and smart applications research and news coverage at *InformationWeek*. His experiences include leadership in analytics, business intelligence, database, data warehousing, and decision-support research and analysis for *Intelligent Enterprise*. Further, Henschen led business process management and enterprise content management research and analysis at *Transform* magazine. At *DM News*, he led the coverage of database marketing and digital marketing trends and news.

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# ABOUT CONSTELLATION RESEARCH

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## Organizational Highlights

- Named Institute of Industry Analyst Relations (IIAR) New Analyst Firm of the Year in 2011 and #1 Independent Analyst Firm for 2014 and 2015.
- Experienced research team with an average of 25 years of practitioner, management and industry experience.
- Organizers of the Constellation Connected Enterprise—an innovation summit and best practices knowledge-sharing retreat for business leaders.
- Founders of Constellation Executive Network, a membership organization for digital leaders seeking to learn from market leaders and fast followers.



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