



# The Big Deal About Big Data For Customer Engagement

by Sanchit Gogia, June 1, 2012

## KEY TAKEAWAYS

### **Big Data Is A Reality And Affects Customer Engagement**

As firms move from siloed, transaction-oriented systems to more integrated, socially aware ones, they will face challenges related to customer data. “Big data” is characterized by increases in data volume, velocity, variety, and variability. To improve customer engagement, companies must invest in solutions to effectively manage big data.

### **Business Leaders Must Own And Lead Big Data Initiatives**

Big data projects require business leaders to own the initiative, unlike typical IT projects where the CIO holds the reins. IT must actively support the project and manage technology selection and rollout, but the business ultimately owns the metrics and KPIs. Big data initiatives with little or no business involvement will ultimately fail.

### **CIOs Must Think About Big Data Holistically**

Most firms equate big data with massively parallel processing and overlook other aspects, like the need to redefine business processes. As companies use big data to improve decision-making, CIOs must approach big data technology rollouts holistically. Successful CIOs will work with the business to explore the data and target specific use cases.



## The Big Deal About Big Data For Customer Engagement

Business Leaders Must Lead Big Data Initiatives To Derive Value

by [Sanchit Gogia](#)

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### WHY READ THIS REPORT

As consumers use multiple touchpoints to obtain information, exchange reviews, and purchase products and services, organizations are struggling to better integrate systems and leverage social technologies to optimize the quality of customer interactions. Companies are directing investments toward applications and platforms to support nontraditional touchpoints like online communities, application marketplaces, and mobile devices. In turn, these investments are creating a new set of challenges in managing the growth in the volume, velocity, variety, and variability of data — widely referred to as “big data.” This report highlights the importance and challenges of big data for organizations, the key role business decision-makers must play in leading big data initiatives, and best practices for organizations seeking to leverage big data for improved customer engagement. Vendor strategists can use this report to better understand big data demand drivers and likely adoption patterns.

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Forrester interviewed more than 25 clients, user companies, and vendor companies, including Aircel, Capgemini, Dell, EMC, Essar Group, IBM, IMS Health, Infosys, Mahindra Satyam, MapR Technologies, Microsoft, NetApp, PwC, SAP, SAS, Shoppers Stop, and Wipro IT Business.

### Related Research Documents

[Leveraging Emerging Technology To Up The Ante On Customer Engagement](#)  
March 28, 2012

[Expand Your Digital Horizon With Big Data](#)  
September 30, 2011

[How Forrester Clients Are Using Big Data](#)  
September 20, 2011

[Big Opportunities In Big Data](#)  
May 18, 2011



## CHANGING CUSTOMER ENGAGEMENT MODELS ARE DRIVING BIG DATA GROWTH

To serve a growing customer base and better manage the customer experience across all customer touchpoints, organizations are moving away from siloed transaction-oriented systems — such as enterprise resource planning (ERP), customer relationship management (CRM), and dealer management systems — and toward more integrated and socially aware systems. This shift has a twofold effect: Organizations need to manage the surge in the type and overall volume of data and to analyze a large amount of complex data in real time. While the volume of structured data from traditional transactional business applications like ERP and CRM continues to grow, CIOs are facing an onslaught of unstructured data from multiple sources like social platforms and semistructured data from machine-to-machine (M2M) communication. This signifies the need for traditional business intelligence (BI) approaches to supplement big data approaches, even for basic structured transactions. Forrester defines big data as:

*Techniques and technologies that make handling data at extreme scale affordable.*

Big data is about having the technology and people with the appropriate analysis skills to allow firms to make sense of huge volumes of data in an affordable manner.<sup>1</sup> This data comes from several sources, requiring CIOs to rethink their information management strategies and invest in new capabilities and approaches to collecting, storing, analyzing, and distributing data:

- **Online platforms and communities generate large volumes of unstructured data.** Companies are taking advantage of social media's growing user base, using tools like Facebook, LinkedIn, and Twitter to engage with customers directly. Other examples of online communities include consumers reviewing products at mobile app stores and third-party merchant websites. Firms like AT&T, Carphone Warehouse, Domino's, Procter & Gamble, Tesco, and Unilever now regularly use a variety of these platforms to engage with their customers.<sup>2</sup> Data from social media helps organizations undertake sentiment analysis on their consumers and better tailor their market outreach programs. The challenge is that this data is lightly or poorly structured at best and completely unstructured at worst.
- **Data from mobile and other devices helps organizations better understand consumers.** Businesses are increasingly using mobile devices not only to push information to consumers, but also to engage with them via services like mobile banking and mobile wallets. Other devices continuing to grow in usage include self-service kiosks and smart cards that automate basic processes such as checking in at airports and paying for parking. For example, one telecom provider in Southeast Asia regularly collects location data from its customers' mobile handsets to better understand their behavior and thereby improve its marketing campaigns.
- **Intelligent systems transmit semistructured data that help drive operational improvements.** Sources like RFID and sensor networks, which are typically used in B2B environments, transmit semistructured data that firms must harness to make better business decisions. Retailers are

now able to use this data to gain insight into the demand for their products and better manage their inventory and supply chain. They can also use this data to improve decisions around new product development to improve the customer experience. Case in point: Cisco Systems uses IBM's big data products to centrally monitor and control its building systems. These products help Cisco optimize its energy consumption and automate the preventive and corrective maintenance of its building systems.

### Big Data Helps Organizations Leapfrog Their Competition

Leveraging data analysis to optimize customer engagement is not a new concept — but as data sources have changed, so too have the models and metrics for analyzing the data. While simpler, more traditional segmentations such as sales percentiles are still extremely popular, firms are now turning to sophisticated predictive models, such as the likelihood to churn, based on real-time data streams to better understand and measure their engagement with customers. Organizations that are using big data sources to better understand customers, unlock new revenue streams, and overtake the competition include:

- **A telco uses sophisticated metrics to better understand its customers.** To better manage and analyze customer information, an Indian telco is currently in the process of creating a single source for all customer databases and consolidating the information on a single enterprise data warehouse platform. The firm uses predictive models such as the likelihood to churn to tier its customer base and offer tailored customer service and is now planning to integrate customers' social profiles with their enterprise CRM profiles. Forrester believes that organizations can maximize the value of social technologies by taking a 720-degree view of their customers instead of the previous 360-degree view. Companies must manage and analyze their customers' profiles to better understand their interactions with their networks of friends, family, peers, and partners.
- **Data analytics enables increased per-customer profit for a retail bank.** In an innovative use of big data in the banking industry, EMC used its Greenplum product to help a US-based retail bank with market basket analysis and customer lifetime value computations enabling user-based recommendations.<sup>3</sup> The bank enriches the data with unstructured activity logs and uses the result to identify at-risk customers.
- **A credit card company retains customers by understanding social relationships.** If one person defects from a product or service, other people with social connections to that customer may also do so. To capitalize on this, a US-based financial services firm is mining point-of-sale transactions to identify these social relationships based on card usage patterns. As a result, it can better target its retention campaigns and is increasing its revenue and profit.<sup>4</sup>

## Big Data Affects Everyone, Including B2B Industries

Big data is often painted as a topic only relevant to consumer-facing industries like retail and telecom. However, conversations with senior decision-makers at organizations in industries that do not deal with consumers — like manufacturing and government — indicate a growing realization of the impact big data is likely to have on their business decisions. While online communities and consumer devices are relatively less important to companies in such industries, they can gain interesting insights from the semistructured data originating from M2M communication. For example:

- **Clinicians use real-time access to patients' health conditions to deal with complications.** IBM has helped the University of Ontario Institute of Technology (UOIT) better detect the warning signs of complications and offer insight into the minute-by-minute condition of patients.<sup>5</sup> UOIT is capturing data from medical monitors and analyzing it in real time, alerting hospital staff to potential health problems before patients manifest clinical signs of infection or other issues.
- **Real-time traffic information enables better traffic management.** Researchers at KTH, a technical university in Sweden, gather real-time traffic data from a variety of sources, such as GPS location data from large numbers of vehicles, radar sensors on highways, congestion charge check-ins, and weather reports. The researchers use the data to help intelligently identify current conditions, estimate how long it will take to travel from point to point in a city, offer advice on routes and travel alternatives, and eventually help improve traffic in a metropolitan area.
- **Environmental data promotes business, research, and public safety.** To better understand environmental data, IBM is helping the Marine Institute Ireland deploy new sensor platforms throughout Galway Bay to gather and distribute data regarding environment conditions, pollution levels, and marine life in near real time.<sup>6</sup> Users can access the data via customizable portals that support various trending and modeling efforts. The portal also allows users to set alarms to notify them when certain conditions arise, such as a potential flood or a sudden increase in pollution. This solution has helped increase the accuracy of flood predictions and support automated alarm systems, thereby improving public safety.
- **Predictive analytics prevent damage to life and property from wildfires.** Researchers from the University of Maryland, Baltimore County (UMBC) analyze weather conditions, terrain, and historical statistics to predict how fire and smoke will spread in real time, helping to prevent fatalities and property damage. Advanced predictive analytics takes in data from surface, aerial, and satellite sensors to pinpoint the movement and impact of wildfires in real time. Based on the prototype results, the solution can improve forecast accuracy by about 16% within the first three days after an emission.

## AN EXPLOSION OF AVAILABLE DATA CREATES NEW HEADACHES

As companies adopt new applications and approaches to cater to nontraditional touchpoints, they are faced with an explosion of information. This increase in data volumes poses a new set of challenges around information management and architecture. The technical challenges of managing, accessing, and analyzing real-time data streams means that IT teams are often unable to respond quickly enough to new market dynamics and improve customer experiences.

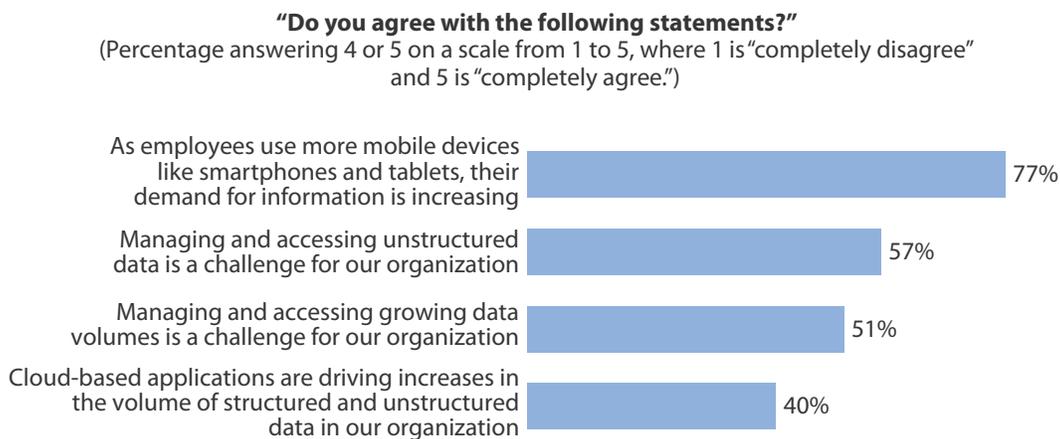
Conversations with senior decision-makers and a recent global survey of 60 Forrester clients with knowledge of or experience with big data confirm that the explosion of information — both from traditional data and big data — is not just about volume.<sup>7</sup> While respondents indicated that volume is the main reason for considering big data solutions, they also indicated the velocity of change, the variety of data formats, and structural variability as major concerns. A regional survey — Forrester's Forrsights Strategy Spotlight: Business Intelligence and Information Management in Asia Pacific Excluding Japan, Q4 2011 — of 452 IT and business professionals revealed that firms are struggling to manage a new set of challenges around the type, complexity, and volume of data (see Figure 1). More than three-quarters (77%) of the respondents expected mobility and consumerization to drive the demand for information. More than half of the respondents cited managing and accessing unstructured data (57%) and growing data volumes (51%) as a key challenge.

Thus, organizations should be aware of the five Vs — volume, velocity, variety, variability, and value — when considering big data.<sup>8</sup> Forrester's survey data and conversations with senior IT decision-makers also indicate that:

- **CIOs are using multiple approaches to tackle big data.** Given the complexity surrounding big data, CIOs in Asia Pacific are considering a mix of different approaches to launch their initiatives (see Figure 2). While nearly 20% said they would rather not have to deal with big data at all, the approach to solve big data problems that they chose most often (37%) was using optimized software solutions like Hadoop, closely followed by efforts around scaling up existing relational database technologies and using cloud infrastructure or service providers. This variance in approach illustrates CIOs' uncertainty about what the best approach to managing big data is and a clear desire to leverage existing assets as a starting point. Forrester believes that reusing existing assets is the right step forward — but if organizations fail to adopt a holistic approach to managing big data, big data will never significantly help them with their business imperatives.
- **Best practices for big data are poorly defined.** Given the relative immaturity of the concept, firms continue to grapple with issues around business processes, methodologies, governance, and security. Big data implementations must not live in isolation — and companies are still unclear on how to avoid another silo in the broader information management architecture. For example, one insurance company looking to use big data is currently grappling with multiple issues, including the approach to enterprise data warehousing governance and reusing existing assets to manage real-time analysis.

- **Involving business leaders in big data implementations is an ongoing challenge.** Senior decision-makers confirm that firms are launching big data initiatives without properly defining a use case and formalizing metrics and KPIs. Organizations are finding it challenging to enable employees to use insights produced by the advanced analytical models based on big data. For example, a retailer is undertaking a proof of concept (POC) to better understand the value of big data. While the CIO is leading the project, he is struggling to get active support from business leaders and define metrics specific to a strategic business unit (SBU) that big data can help measure. The retailer is also facing issues in extending access of the analytical tools to a large user base due to a lack of understanding of how to apply these insights to business problems.

**Figure 1** Big Data Poses A New Set Of Information Management Challenges For Organizations



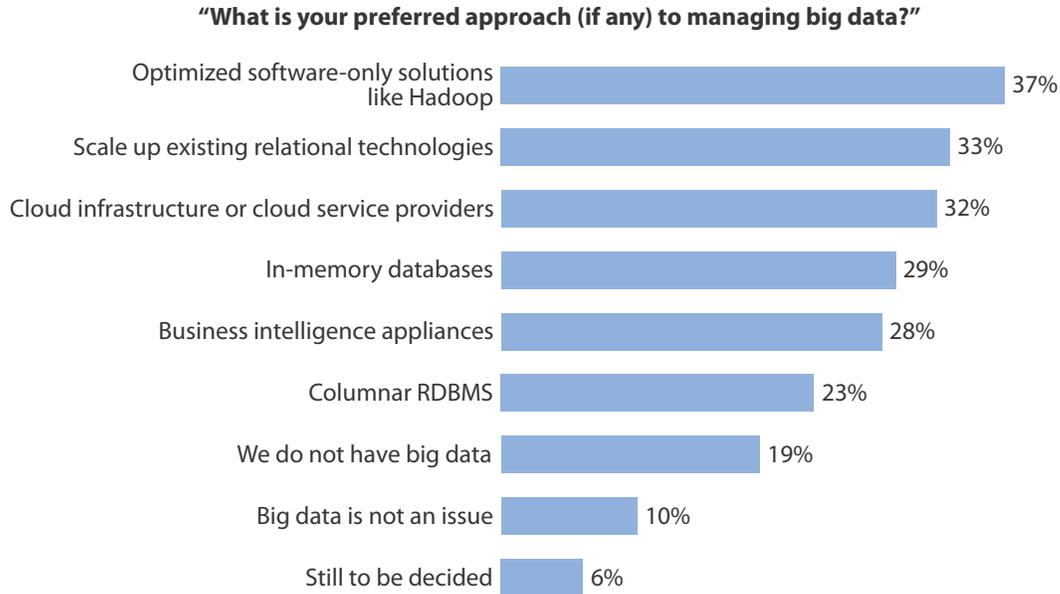
Base: 452 IT and business decision-makers in Australia, China, Hong Kong, India, Malaysia, and Singapore from companies with 20 or more employees

Source: Forrsights Strategy Spotlight: Business Intelligence And Information Management In Asia Pacific Excluding Japan, Q4 2011

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Source: Forrester Research, Inc.

**Figure 2** Companies Are Using Very Different Approaches To Handling Big Data



Base: 452 IT and business decision-makers in Australia, China, Hong Kong, India, Malaysia, and Singapore from companies with 20 or more employees (multiple responses accepted)

Source: Forrsights Strategy Spotlight: Business Intelligence And Information Management In Asia Pacific Excluding Japan, Q4 2011  
Note: “Don’t know” responses have been omitted.

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Source: Forrester Research, Inc.

## MANAGING BIG DATA REQUIRES CHANGING EXISTING INFORMATION STRATEGIES

While organizations have successfully adopted BI tools, technologies, and approaches to drive business value, they have chiefly addressed needs around structured data. With the rise of big data, companies are struggling to access, integrate, and leverage new types of data using previously existing information management architecture. Forrester believes that IT decision-makers must expand their BI focus to fully support unstructured and semistructured data as a key requirement for enabling and supporting improved customer engagement:<sup>9</sup>

- **Structured data remains critical to decision-making.** Multiple CIOs confirm that companies are keen to use analytics to better serve customers. As an example, Asian Paints is using web-based analytics to better target customer references — based on location as tracked by IP addresses. The analytics allow Asian Paints to better understand customer behavior at various stages of the website experience and monitor the stage at which customers typically opt out.

- **Unstructured data will help drive the customer engagement process.** Early awareness of the need to support unstructured data has been most acute in customer-facing organizations, especially those requiring critical response times, like hospitals and hospitality. Cloud-based social analytics tools like Radian6 (acquired by salesforce.com) have been implemented by companies across the globe, such as KLM, Ogilvy & Mather, Weber Shandwick, Edelman, AutoNation, and Kodak.<sup>10</sup> Dell is another example: The company has set up a dedicated Social Media Listening Command Center and uses Radian6 to track, monitor, and respond to discussions on Twitter and Facebook.<sup>11</sup>

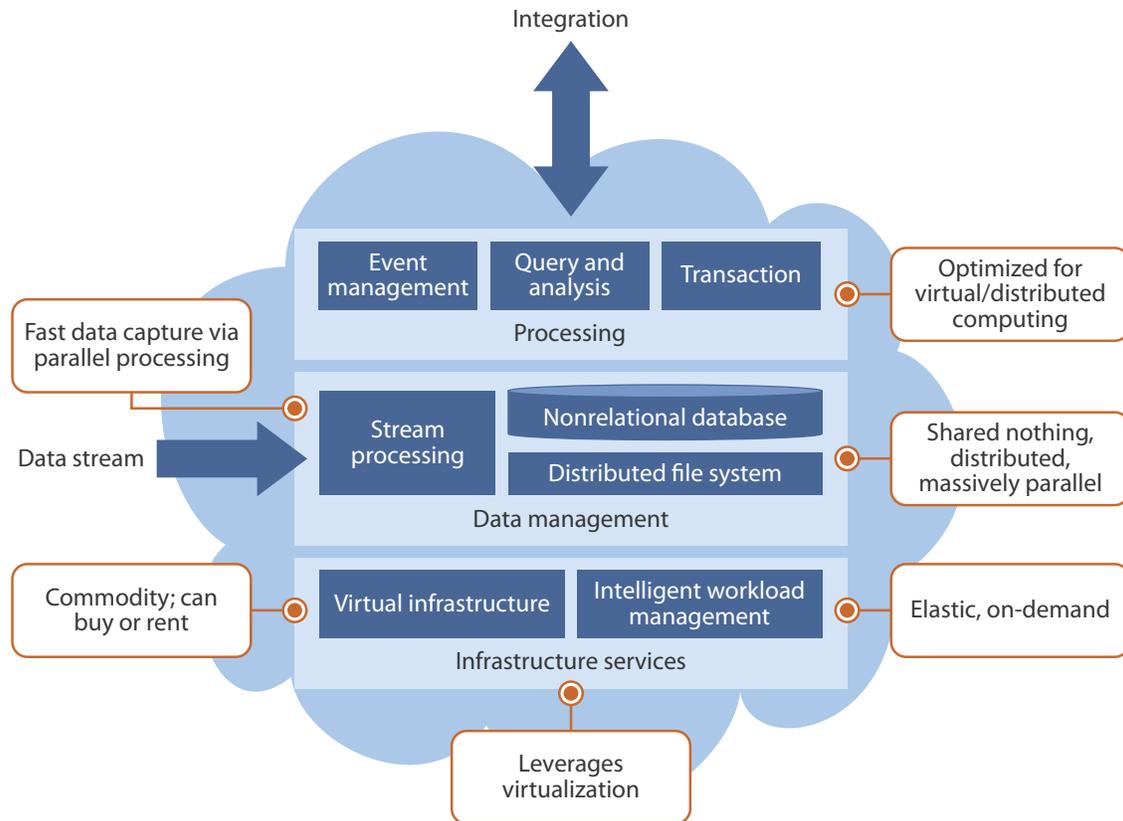
### Big Data Types Dictate Technology Choices

Big data technologies have matured rapidly; the situation has changed from just a few years ago, when the technology supporting big data processing was either not enterprise-ready or inordinately expensive. Netezza, SAP HANA, Vertica, and many others are now making it viable to store and process massive amounts of data in a matter of seconds. Open source options are also increasingly enterprise-ready; it's commonplace to hear names like Hadoop, HBase, Avro, Pig, ZooKeeper, Apache Commons, and Lucene during big data discussions.

Forrester believes that the need to process different big data types requires organizations to adopt different technologies. Based on this, we have devised a reference architecture that highlights three key aspects: 1) infrastructure services based on virtual commodity hardware and workload management; 2) horizontally scalable, distributed data management services and distributed processing; and 3) analysis optimized for operations in the cloud (see Figure 3).<sup>12</sup> However, this framework is not meant to imply that every big data solution has all of these capabilities; for example, streaming solutions and batch analytics solutions use different capabilities and different tools to implement a specific architecture.

Typical architectures for big data fall into three different categories: 1) real-time scenarios heavily based on complex event processing; 2) parallel processing/fast loading, typically based on Hadoop; and 3) high-performance query architectures based on in-memory or appliance architectures. Depending on the business need, organizations must then define the most relevant technology architecture and choose tools. In many cases, organizations can combine multiple architectures.

**Figure 3** The Architectural Building Blocks Of Big Data Processing



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Source: Forrester Research, Inc.

### Big Data Initiatives Require A Holistic Approach

As organizations explore technologies to complement their existing investments and support big data, it's critical to base decisions on the existing information management architecture and identify components that they can reuse and consolidate. Firms must adhere to the basic ground rule that they must only create customer profiles in a single system to avoid duplication and ensure consistency. Big data initiatives require organizations to take a holistic approach and bring together both business and IT leaders to stitch all of the pieces together.

- **Step 1: Centralize and redefine the data-gathering process.** Forrester believes that companies must view big data implementation as a business project, not as an IT project.<sup>13</sup> Traditionally, IT-enabled business processes have largely been defined around the structured data streams of process-based apps like CRM and ERP. But it's critical for organizations to change this to include external sources and to redefine the data acquisition process (sources and types).

Forrester that believes that firms must start big data initiatives at the business process layer and work with business execs to better understand business events that will eventually define job and workflow management. Involving business leaders at this stage can also help IT leaders outline the key SBU-specific metrics and KPIs that they will ultimately use big data implementations to monitor.

- **Step 2: Better manage customer profiles.** Better customer data management helps reduce duplication in the database and improve the accuracy of individuals' profiles.<sup>14</sup> While the process around managing customer data has traditionally been optimized for discrete attributes like age, gender, and name, big data is changing this drastically. Companies now need to allow customer profiles to include behaviorally oriented data like social networking information and mobile telephony data and ensure that they can combine this with the traditional attributes. Firms must expect their integration costs to grow in some scenarios, as the cost of adding new data can make traditional data integration methods too expensive.<sup>15</sup>
- **Step 3: Optimize the data warehouse environment.** In order to run analytic models for big data, organizations must invest in technologies that support massively parallel processing (MPP).<sup>16</sup> Forrester believes that it's important for senior decision-makers to pick and choose technologies that don't require them to rip and replace the existing architecture, but that will complement current investments. The ultimate goal should be a single platform for all data warehousing requirements, as opposed to disparate set of processing units. But in the meantime, most firms will have to govern three key pieces of their data warehouse architecture: traditional enterprise data warehouses, data warehousing appliances, and big data processing capabilities.
- **Step 4: Invest in analytical models and forecasting to better serve the business.** Analyzing big data requires organizations to adopt new analytical models and approaches that allow large-scale indexing of data entities and support relationship analytics to better understand the relationships between these entities.<sup>17</sup> Big data sources like location-based data, social networking information, and telecom user details can help organizations establish relationships among data entities. Real-time analysis of big data sources can provide companies with insights valuable for targeting and messaging. However, the new real-time analytics for big data have neither the luxury of historical data nor the time to allow for trending analysis and only offer directional insights; firms should expect slight degrees of variance. Instead, more traditional sources of data that do not require real-time processing are more likely to offer accurate insights for the business. It's important for organizations to define the right use case for both types of data; the value lies in harnessing insights from both types of data to inform business decisions. Further, organizations must invest in the resources to undertake time-series analyses on big data and help the business with forecasts around the metrics and KPIs decided at the outset.

- **Step 5: Keep information relevant to employees using visualization tools.** Senior decision-makers confirm that it's a struggle to ensure that information is relevant to the level and type of the employee accessing the data. Forrester believes that it's critical for firms to use visualization tools and ensure that they filter the data so it's the most relevant data for the person requesting it. For example, a telecom provider is using a visualization tool to tier the information by the level of the employee and ensure relevance by providing access to the data that is most critical to the employee's function. This tool also helps the company filter access to data based on seniority, role, and function. To add context, the telecom currently allows its executive team to monitor company-level KPIs and allows all SBUs to drill down into the data, but it does not allow SBU heads to monitor other SBUs' KPIs.

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## RECOMMENDATIONS

### THE EXPLORATION PROCESS WILL HELP DEFINE BIG DATA USE CASES

Organizations planning big data initiatives should begin with a data exploration process to identify use case scenarios and the relevant technologies necessary to process different big data types. Big data initiatives require holistic planning, and companies must plan for a phased rollout to ensure positive business outcomes. CIOs should use the following approaches to get the most out of their big data initiatives:

- **While IT and business need to work together, the business must own the initiatives.** The CIO's office must seek guidance from business leaders — the ultimate owners of big data initiatives — and assist them in identifying opportunities where the firm can extract value from both large pools of existing data and real-time data streams. Outlining metrics and KPIs that the implementations will ultimately monitor is key to the success of big data initiatives. Forrester believes that big data initiatives launched without defining formal use cases will ultimately fail.
- **Change the information management strategy to accommodate new data sources and types.** With the aim of reusing existing architecture, companies must plan to adopt big data technologies that complement current investments. More importantly, the CIO's office must ensure that these new technologies allow the organization to manage (and analyze) the types of big data most relevant to the business. Forrester recommends that companies identify new investments based on how they plan to capture and use the data.
- **Start small, avoid silos, and incrementally roll out big data initiatives.** Big data implementations require a high degree of involvement on the part of business leaders and hence require meticulous planning. Forrester recommends that CIOs roll out big data implementations over 12 to 18 months and identify multiple milestones to measure their progress and business success. The key is to start small, reuse components of the existing infrastructure, and solve the selected use cases. This will help a firm better manage the initiative, avoid silos, and measure success on an ongoing basis.

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**WHAT IT MEANS**

**WHAT IT MEANS FOR THE CIO'S OFFICE**

As companies transform customer engagement by integrating back-office and front-office apps to support both traditional and nontraditional touchpoints, IT teams will face a surge in data volume, velocity, variety, and variability. Successful CIOs will increasingly find that they need to link this new breed of data — popularly referred to as big data — to organizational metrics and measure customer engagement. Business leaders must champion big data initiatives and the CIO's office must work with them to identify use cases that they can solve using this new breed of data. Although MPP is core to big data initiatives, mature organizations will not focus solely on it; they will view the project more holistically, including aspects like the need for new analytical models and visualization tools and the need to redefine data-gathering processes.

**WHAT IT MEANS FOR VENDORS**

As more organizations realize the value that big data has to the business, vendors are finding increasing opportunities globally to undertake POCs. Forrester believes that, while vendors will continue to witness increasing traction for big data over the next two to three years, the key to driving incremental revenue and growth will be to link business metrics and outcomes directly to big data projects. The challenge, however, for most vendors will be to engage the business leaders in the prospective organizations who are either not aware of big data or don't know enough about it to see its direct link with business outcomes — customer engagement in particular. Ultimately, the CIO's office will only act as facilitators for big data projects and will not be the key sponsor or user of big data solutions.

**SUPPLEMENTAL MATERIAL**

**Methodology**

Forrester's Forrsights Strategy Spotlight: Business Intelligence And Information Management In Asia Pacific Excluding Japan, Q4 2011 was fielded to 452 IT executives and technology decision-makers and business decision-makers located in Australia, China, India, Malaysia, New Zealand, the Philippines, Singapore, and South Korea from small and medium-size business (SMB) and enterprise companies with two or more employees. This survey is part of Forrester's Forrsights for Business Technology and was fielded from July 2011 to August 2011.

Each calendar year, Forrester's Forrsights for Business Technology fields business-to-business technology studies in more than 17 countries spanning North America, Latin America, Europe, and developed and emerging Asia. For quality control, we carefully screen respondents according to job title and function. Forrester's Forrsights for Business Technology ensures that the final survey population contains only those with significant involvement in the planning, funding, and purchasing of IT products and services with direct oversight of their team's or group's budget.

Additionally, we set quotas for company size (number of employees) and industry or job function as a means of controlling the data distribution and establishing alignment with IT spend calculated by Forrester analysts. Forrsights uses only superior data sources and advanced data-cleaning techniques to ensure the highest data quality.

We have illustrated only a portion of survey results in this document. To inquire about receiving full data results for an additional fee, please contact [Forrsights@forrester.com](mailto:Forrsights@forrester.com) or your Forrester account manager.

### Companies Interviewed For This Report

|                 |                   |
|-----------------|-------------------|
| Aircel          | MapR Technologies |
| Capgemini       | Microsoft         |
| Dell            | NetApp            |
| EMC             | Pentaho           |
| Essar Group     | PwC               |
| IBM             | SAP               |
| IMS Health      | SAS               |
| Infosys         | Shoppers Stop     |
| Mahindra Satyam | Wipro IT Business |

### ENDNOTES

- <sup>1</sup> At extreme scale, traditional data management and business intelligence (BI) become impractical, and your business does not get what it demands — more insight to drive greater business performance. Big data helps firms work with extremes to deliver value from data cost-effectively. However, CIOs must understand that this is not business as usual. In fact, big data will disrupt the data management landscape by changing fundamental notions about data governance and IT delivery. Take the time to understand big data and its implications and begin a balanced approach that considers more than just the technology hype. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.
- <sup>2</sup> These organizations are using multiple online communities, platforms, and social websites to engage with their customers on a regular basis.
- <sup>3</sup> Source: André Münger, “Nouvelle Génération de l’infrastructure Data Warehouse et d’Analyses,” EMC, November 2011 (<http://suisse.emc.com/campaign/global/forum2011/pdf/suisse/suisse-forum-2011-track-1-greenplum-andre-muenger.pdf>).
- <sup>4</sup> For more details, see the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.

- <sup>5</sup> Source: “University of Ontario Institute of Technology,” IBM (<ftp://public.dhe.ibm.com/common/ssi/ecm/en/odc03157usen/ODC03157USEN.PDF>).
- <sup>6</sup> Source: IBM ([http://www.ibm.com/developerworks/data/library/dmmag/DMMag\\_2009\\_Issue3/SmarterIs/index.html](http://www.ibm.com/developerworks/data/library/dmmag/DMMag_2009_Issue3/SmarterIs/index.html)).
- <sup>7</sup> Forrester published data from the June 2011 Global Big Data Online Survey in a companion report. See the September 20, 2011, “[How Forrester Clients Are Using Big Data](#)” report.
- <sup>8</sup> At extreme scale, traditional data management and business intelligence (BI) become impractical, and your business does not get what it demands — more insight to drive greater business performance. Big data helps firms work with extremes to deliver value from data cost-effectively. However CIOs must understand that this is not business as usual. In fact, big data will disrupt the data management landscape by changing fundamental notions about data governance and IT delivery. Take the time to understand big data as well as its implications and begin a balanced approach that considers more than just the technology hype. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.
- <sup>9</sup> IT decision-makers will likely need to leverage multiple business intelligence (BI) tools to efficiently access, interpret, and exploit both structured and unstructured data throughout the customer engagement process. IBM demonstrated this well in its engagement with Asian Paints, using web analytics to help the firm personalize content and campaigns to its customers based on their level of engagement. See the March 28, 2012, “[Leveraging Emerging Technology To Up The Ante On Customer Engagement](#)” report.
- <sup>10</sup> Source: Radian6 (<http://www.radian6.com/about-us/customers/>).
- <sup>11</sup> Dell is a global brand that generates more than 25,000 online conversations every day. Keeping up with that volume isn’t easy, but the firm uses its Social Media Listening Command Center to successfully scale the work and learn from and engage with its customers. How does Dell do it? By training its employees on social media best practices and listening platform technology and using a formalized data collection and reporting process to help spread insights across the organization. See the July 1, 2011, “[Case Study: Dell’s Social Media Listening Command Center Builds Customer Relationships](#)” report.
- <sup>12</sup> Opportunities to improve the bottom line exist in a flood of information; however, gaining insight from data becomes challenging as it grows extremely large. Emerging technology applies the power of distributed, virtual computing to the problem of large data, providing new tools and techniques that shift the way businesses use information to compete. Big data processing raises key questions for both business and IT — address them now and be prepared to capitalize as opportunities emerge. See the May 18, 2011, “[Big Opportunities In Big Data](#)” report.
- <sup>13</sup> IT teams need to partner with their business peers to identify opportunities and solutions. While business executives at some firms immediately get it, we expect the concepts of big data to be foreign to most. CIOs who understand the state of the art and are perceived as strategic partners will be well positioned to help executives justify investments and reap new benefits. Conversely, CIOs without a seat at the business strategy table may struggle, as big data solutions are not business as usual. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.

- <sup>14</sup> Many firms depend on having central databases at the heart of their applications to provide a single, consistent version of the truth — the truth is that this architecture will not serve them as scales reach the extreme. Instead, we see designs emerging that trade off immediate consistency and integrity for scalability, availability, and fault tolerance using technologies such as big data and NoSQL. For these firms, the ability to operate on a massive scale outweighs other needs, and they are learning how to deal with local and relative truth. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.
- <sup>15</sup> Growth in integration costs along with the number of data formats because rules must be developed for each, and integration processes must be changed and redeployed. The cost of adding new data feeds makes traditional data integration methods too expensive for some scenarios. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.
- <sup>16</sup> Big data processing overcomes limitations by utilizing a massively parallel, distributed architecture to capture, store, and iteratively sift through raw data at extreme scale. See the May 18, 2011, “[Big Opportunities In Big Data](#)” report.
- <sup>17</sup> Stored data can be analyzed by parallel processing frameworks. For example, data scientists can experiment with mining techniques by lifting and transforming petabytes of data as easily as writing a few lines of script. Sophisticated tools on top of parallel computation frameworks are empowering business experts to rapidly build analytic applications. See the September 30, 2011, “[Expand Your Digital Horizon With Big Data](#)” report.

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