fs viewpoint

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Where have you been all my life?

How the financial services industry can unlock the value in Big Data

pwc

Forward

Point of view

Using Big Data to get the right information to identify the right markets and customers at the right time enables institutions to make the right strategic decisions.

What does Big Data encompass?

Big Data encompasses structured, semi-structured, and unstructured information from demographic and psychographic information about consumers to product reviews and commentary; blogs; content on social media sites; and data streamed 24/7 from mobile devices, sensors, and technical devices.[1]

Processing increasingly large volumes of data in a timely manner has become a major challenge for financial institutions.

The digital era of this century is pushing the envelope for financial institutions on many fronts—including customer data, capacity, risk measures, market expectations, and operational efficiencies.

The numbers tell the story:

- The Big Data market is at **$5.1 billion** this year and is expected to grow to **$32.1 billion** by 2015—and to **$53.4 billion** by 2017.[2]
- We create **2.5 quintillion** bytes of data daily;[3] **90%** of the data in the world today has been created in the last two years alone.[4]
- **62%** of companies believe that Big Data has significant potential to create competitive advantage.[5]

As we see it, the exponential advancement of social media, mobile, and cloud in today's world—combined with relentlessly escalating regulatory pressures around the globe—is in turn pressuring financial institutions to rethink the way that they do business. Before they can succeed in gaining a competitive edge in today's dynamic, digital global marketplace, institutions need to evolve into data-centric organizations.

Institutions that leverage Big Data to gain insights into their operations, customers, and market opportunities can position themselves for ongoing success. But transforming Big Data into actionable insights requires sophisticated analytics tools.

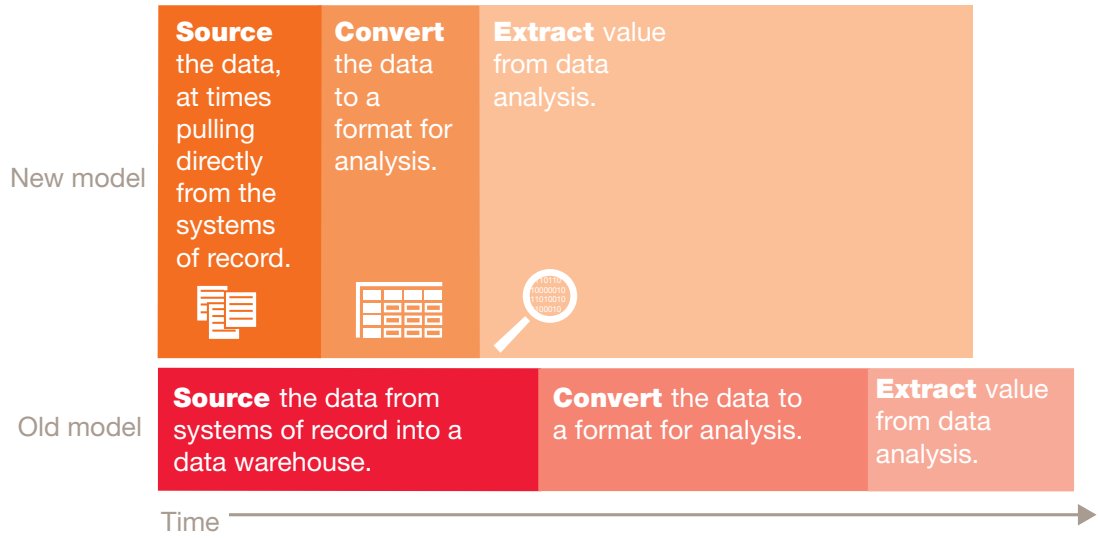
1 PwC, "Capitalizing on the promise of Big Data: How a buzzword morphed into a lasting trend that will transform the way you do business," January 2013, www.pwc.com/us/bigdata.
2 Kyle Alspach, "'Big data' center hack/reduce getting big buzz," November 8, 2012, www.factiva.com, accessed February 5, 2013.
3 Mike Hogan, "Big Data of Your Own," August 2013, www.factiva.com, accessed September 24, 2013.
4 John Adams, "Be Careful or Big Data Could Bury Your Bank," January 25, 2013, www.factiva.com, accessed February 5, 2013.
5 PwC, "Capitalizing on the promise of Big Data: How a buzzword morphed into a lasting trend that will transform the way you do business," January 2013, www.pwc.com/us/bigdata.

As opposed to more traditional business intelligence systems, Big Data techniques allow institutions to analyze data for patterns more quickly and at a much lower cost.

Sophisticated new analytical tools are greatly improving the process by which organizations can analyze Big Data.

Until recently, financial institutions that wanted to examine large pools of data needed to devote significant time and resources into organizing "structured" data, which may be scattered across several departments and data warehouses, into one location to be indexed, searched, and analyzed. In certain cases, some sources of information proved too unwieldy to search, preventing analysis.

Fortunately, advances in technology–including processing power, data warehouse storage, and software–are now enabling speedy organization of structured data and starting to allow large pools of unstructured data (including previously unavailable sources such as blogs and social media) to be indexed and made searchable in a shorter period of time. In addition, the emergence of sophisticated analytics software tools is enabling organizations to analyze vast stores of Big Data more easily and quickly, using fewer resources in the process.



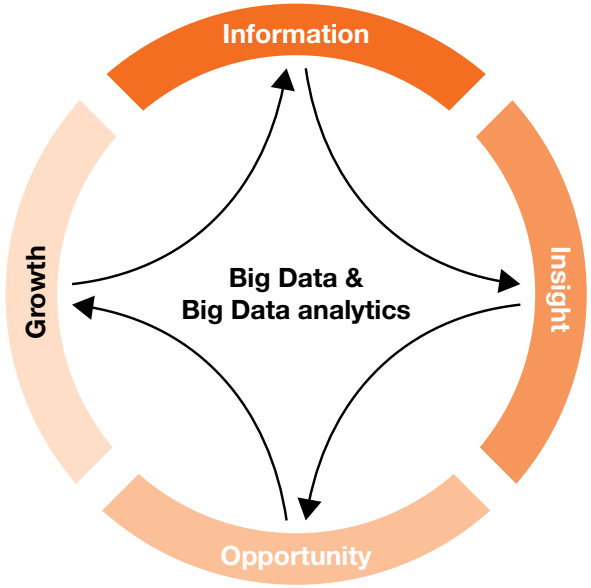
Note: Big Data enables organizations to spend less time on the first two steps in the diagram above and more time on the third step: Extracting value. Time spent on each step will vary by organization.

Trying to unlock the power of Big Data without data analytics is like trying to harness the power of the Internet without a search engine.

Without powerful analytics software, organizations cannot unlock the true potential of Big Data.

Institutions have been doing look-back analysis for years, but generating trends based on historical data is now a very common technique. New software tools on the market today enable organizations to engage in predictive and deep analytics. These tools allow organizations to look forward, helping them to become more competitive and to answer questions such as:

- What do we know and not know about our customers?
- What can we do with this information?
- How can we innovate and transform using this information?
- The combination of trend analysis and predictive analytics enabled by Big Data has the potential to be transformative.



At the root of Big Data lies an important value chain.

Historically, financial institutions collected copious amounts of data. However, they were unable to use that data to generate **meaningful information** in a timely manner, which fragmented their view of business **insights**. Because they were unable to develop Big Data analytics and process the data in real time, they had difficulty *predicting and responding* to changing business needs and rising **opportunities**. As a result, business **opportunities** and related **growth** were tied to a much slower roadmap. This value chain is at the foundation of Big Data.

We have observed three key attributes of Big Data—volume, velocity, and variety—which we refer to as the "3 V's." Traditional data management practices cannot accommodate these attributes.

The "3 V's" defined...

Volume: *The vast quantity of Big Data available—often hundreds of terabytes, or even petabytes of data.*

Velocity: *The speed at which data must be stored and/or analyzed—in some cases, up to tens of thousands of transactions per second.*

Variety: *The huge variation in types and sources of Big Data—from highly structured files to unstructured video and audio information.*

In the face of fierce competition, growing regulatory constraints, and evolving customer needs, we see institutions seeking new ways of leveraging technology to differentiate themselves and gain efficiencies.

Today's institutions require new data management capabilities.

- **Velocity:** As services such as trade order management become a commodity, firms have begun to gain a competitive advantage by focusing on the ability to process more trades at a faster rate than their competitors.
- **Variety:** Information about an institution's business is no longer limited to the structured data generated by the organization. Unstructured social media data—including tweets, status updates, blogs, tags, pins, and videos—is needed to keep up with evolving needs of the customer. And semi-structured information, such as trade messages and standard reporting format, is needed to standardize communication between business partners. Next generation technology needs to be able to manage structured, unstructured, and semi-structured information.
- **Volume:** Banking and capital market institutions need the ability to manage a huge amount of tick data; asset management firms need a large volume of market data to make investment decisions; and insurance firms need the ability to manage massive amounts of policy/claims data. Many financial institutions grapple with the need to store large amounts of structured and unstructured data.

When the size of the data deluge exceeds the ability of software tools to acquire, manage, and process data within an acceptable defined duration, institutions need to gear up to accommodate the 3 V's of Big Data.

Big Data goes beyond the capabilities of traditional data management because it can handle volume, velocity, and variety. That, in a nutshell, is the all-important difference between the two.

First and foremost, Big Data can handle the 3 V's, while traditional data management practices cannot. Focusing on large-scale data acquisition, **Big Data** requires little organization, has quick turnarounds for deep analysis, and promotes innovation.

Traditional data management practices—such as data warehousing, business intelligence, and master data management—support business operations and focus on creating long-term consistency and trust in enterprise information. But the rise of Big Data need not mean the death of traditional data management practices.

	Challenges of traditional data management techniques	Big Data differentiators
Volume	• Traditional analytics are often designed to analyze relatively small sample sizes. • Data storage across multiple drives presents problems for traditional techniques. • The cost to analyze large data sets using traditional techniques is too high, both in time and memory.	• Big Data techniques are designed to handle huge amounts of data spread across multiple storage devices and platforms. • Big Data technologies facilitate massive parallel processing for faster access and analytics. • Low-cost storage and cloud storage are becoming more prevalent.
Velocity	• Rapidly updating data sets require dynamic, real-time analysis that is not available with traditional techniques. • Information management processes need to intelligently decide in real time what data to save and what to discard.	• Big Data techniques that dynamically analyze data in near real-time can efficiently update results based on new information. • Advanced algorithms can identify useful data to keep versus low-value data to discard so as to appropriately address storage needs.
Variety	• The proliferation of data types and models creates compatibility issues with traditional tools. • The increasing demand for data mash-ups and deep insights challenges traditional data techniques that struggle with non-numerical data.	• Big Data frameworks are designed to accommodate varying data platforms and data models. • Advanced technology stacks are designed to provide insightful analysis on a diverse range of structured and unstructured data sets.

Financial institutions are no longer questioning the need for Big Data. Yet, we see many holding back.

IT plays an important role in driving the Big Data initiatives but is not the sole owner of Big Data:

- ***Big Data leads to important business insights that only the business can drive.***
- ***The Big Data platform serves as a space for the business to conceive and develop ideas. Once these ideas are determined to be valuable, they can be put into production.***

Even among those that "get" the Big Data differential and the power and potential that it can deliver when effectively applied, many institutions feel that they are not yet ready to join the Big Data revolution.

Perceptions of Big Data differ from organization to organization. Concerns and questions persist, keeping some institutions from moving ahead to use and enable Big Data tools and technologies.

- Financial institutions often mistakenly view Big Data as primarily being a technology challenge rather than a business opportunity. In reality, data is created by the business, owned by the business, and used by the business. As the custodian of Big Data, IT is still in the process of figuring out how to gain the buy-in of their business leaders.
- Many financial institutions are not sure what it will take to translate the flood of information into business insights and intelligence. Additionally, Big Data policies are still evolving in many institutions.
- Some view Big Data exclusively as a technical efficiency play; while that is important, they overlook Big Data's ability to get to the analysis step faster and with greater depth.
- Others are concerned about whether they have the right analytical skills and technologies in place and, if not, whether they will be able to attract the data scientists they need.
- And those that are ready to join the data management revolution are asking where and how to begin transforming data into insights, intelligence, and ultimately, competitive advantage.

Despite these concerns, institutions are recognizing that Big Data is the wave of the future, and that they need to gear up to prepare for the surge. In our experience—and as research shows—investment in data management is rapidly increasing among financial services firms globally.

We do see industry leaders actively seeking strategies and solutions that will empower their organizations to comply with differing cross-border business initiatives, become more nimble, seize business opportunities, foster innovation, and improve their position in the marketplace.

Recognizing that Big Data is an innovation that delivers business insights and opportunities, we see leading institutions beginning to utilize the power of Big Data.

Leading institutions are now considering how to apply Big Data in ways that are right for their institutions. These "right movers" are laying the foundation for an innovative Big Data culture that empowers institutions to learn more, create more, and do more.[1]

Due to advances in information technology, access to powerful new analytics, innovative system architectures, and declining costs, we see barriers to success beginning to slowly topple. Some leading financial institutions have begun to apply Big Data to their pressing business issues—reshaping their operations and quickly seeing business results.

Proactive companies are experimenting with harvesting consumer data from social media, blogs, and mobile devices to gain intelligence on customers' changing perceptions, needs, and expectations—and then funneling that information into predictive models to gain insights into customer acquisition, conversion, behaviors, and patterns. In short, financial institutions are beginning to apply Big Data to generate solid business results, specifically in the customer space.[2]

To effectively leverage data, leading institutions are adopting an enterprise view of data. They are toppling their silos, and units are working together to align themselves with this new initiative. Big Data is seen as a platform to support business operations, as well as a *transformation* achieved through innovation.

In our view, the overall industry still has a long way to go in terms of the data management revolution.

1 PwC, "Capitalizing on the promise of Big Data: How a buzzword morphed into a lasting trend that will transform the way you do business," January 2013, www.pwc.com/us/bigdata.
2 *Ibid.*

What does it take to turn information and insights into gold?

In our view, collaboration between IT and the business should take place not only at the outset, but also throughout the entire initiative:

- ***Upfront****—So that the overall needs and objectives are well defined at the enterprise level, not just unit by unit.*
- ***Ongoing****—Throughout the creation, evolution, and ownership of the Big Data initiative.*

Based on the 2013 PwC Digital IQ survey, FS companies with collaborative C-suites intertwine business strategy and information technology, and are often rewarded with stronger company performance.[1] They can also adapt quickly to market changes to maintain an advantage over competitors. Approaching Big Data as a business problem is a key factor in realizing greater benefits.[2]

Big Data has the power to transform data into real-time, real-world insights and intelligence, innovation, data monetization, effective risk management, and other key goals. To that end, we believe that institutions should:

Upfront

- Recognize that Big Data is not a technology problem. Rather, it is a business opportunity. Look beyond technology challenges and objectives alone to include business needs and goals in their strategy to implement and leverage Big Data.
- Prepare their organization to face the Big Data storm that is a whirlwind of data, technology, skills, business models, and economies. The analyst community will need to shift their thinking to ask new or different questions, and IT will need to shift its role from primarily data movers to idea enablers.
- Educate their business leaders around both the *value* and the *how-to* of making Big Data-driven, fact-based business decisions. Relying on "gut instinct" can result in erroneous actions that can be very costly in terms of poor return on investment (ROI) and competitive positioning in the marketplace.

Ongoing

- Be prepared to fail early and dispose of unused data that is not adding value.
- Recognize that Big Data technologies are still evolving and require careful and ongoing needs assessments.
- Rather than focusing solely on external data, strive to achieve the benefits of Big Data by combining third-party data with internal data assets. While financial services companies are, for the most part, not yet buying third-party Big Data information, we recommend moving in that direction—especially for capabilities such as sentiment analysis.
- Look at Big Data as an *enterprise asset* that should be leveraged to create opportunities using analytics. With Big Data, firms can break ground in new areas by gaining deeper insights into the business they think they already know.
- Leverage Big Data to think globally and act locally. Collect and analyze information from across regions and divisions, and use insights to improve the enterprise and local organizations.

1 PwC, "PwC's 5th Annual Digital IQ Survey: Digital Conversations and the C-suite," February 11, 2013, www.pwc.com/us/digitaliq.
2 *Ibid.*

How can institutions apply Big Data to take advantage of opportunities and solve problems?

A real-life example of Big Data's power to transform an institution.

Working with PwC, the risk management function of a major financial institution quickly developed and deployed a solution to better manage portfolio risk. Due to high volumes of data, the solution demanded increased computing power to manage, store, and analyze data quickly in support of dynamic business needs. By adding low-cost computers at the rate of 60 per working day and over 15,000 over the course of the year, the risk management function was able to quickly and cost-effectively scale its Big Data solution to effectively manage very large volumes of data while conducting enhanced analyses more quickly than ever before. By doing this on its own, the risk management function was able to lighten the burden on the IT function.[1]

The nature and complexity of analytics have migrated from simple to advanced analytics, such as predictive modeling and deep analytics. These tools and techniques present distinct opportunities for institutions across the industry—especially when it comes to *customer impact, risk management and regulatory reporting,* and *transactions*.

Customer data monetization: Gaining a *360-degree view of the customer* is a critical success factor for institutions striving to compete effectively in today's rapidly evolving marketplace. Institutions should apply the combined power of Big Data and deep analytics. By getting customer buy-in, institutions can integrate *external unstructured* data sources (social media and correspondence) into their traditional *internal structured* data sources (payments, statements, etc.).

Transactions and operations: In the past, it was difficult for the operations team to perform the analysis required at the level required—simply because it was difficult to process huge volumes of data in almost real time. But today, investment managers, sales teams, and servicing groups have the ability to predict market movements, forecast sales, and provide superior customer service by leveraging innovative business models enabled by Big Data.

Risk management and regulatory reporting: Increasing global regulatory risk and reporting requirements are requiring today's institutions to store transactional data for longer periods of time and to hone their ability to report across geographies despite disparate databases and technology platforms. Faster access to large amounts of unstructured and structured data is vital.

To actively measure, monitor, and mitigate regulatory risk, financial institutions with global footprints need to stay on top of their enterprise risk across markets, geographies, and counterparties. They must be able to integrate and analyze data from disparate sources on demand to see that activities stay within their defined risk thresholds.

For a deeper discussion of Big Data applications, please refer to pages 15–18.

1 PwC, "Capitalizing on the promise of Big Data: How a buzzword morphed into a lasting trend that will transform the way you do business," January 2013, www.pwc.com/us/bigdata.

Institutions that successfully transform Big Data into insights and intelligence—and at the same time adopt a more flexible mindset so as to make the most of Big Data's capabilities—will position themselves to reap significant benefits in key areas.

Topic		Key benefits of Big Data
Customer data monetization	Customer centricity	Institutions with global footprints can apply Big Data to develop a single view of the customer, which can promote delivery of an enhanced customer experience and, in turn, improve branding and increase revenues.
	Customer risk analysis	Retail lenders and other financial institutions can also apply Big Data to analyze behavior profiles, spending habits, and cultural segmentation—thereby gaining a 720-degree view of customer risk that will enhance the lender's risk management capability.
	Customer retention	Using Big Data, financial institutions can analyze their internal customer logs and social media activity to generate indications of customer dissatisfaction, allowing time to act.
Transactions and operations	New products and services	Social media analytics generated from Big Data can be leveraged in various stages of new products and services—from conceptualization to launch. Institutions can use social media to ascertain pre-launch sentiments and expectations to effectively define marketing strategies.
	Algorithmic trading and analytics	Institutions can leverage Big Data to store large volumes of historical market data to feed trading and predictive models and forecasts. Institutions can also use Big Data to perform analytics on complex securities using reference, market, and transaction data from different sources.
	Organizational intelligence	Institutions can use Big Data to measure organizational intelligence using employee collaboration analytics. In addition, a Big Data-based culture of innovation empowers workers to learn more, create more, and do more.
Risk management and regulatory reporting	Risk management	Increased regulatory focus requires institutions to manage enterprise risk across risk dimensions. Big Data can enable market events across geographies to be captured in real-time via unstructured data sources such as news, research, graphs, audio, visuals, and social media.
	Regulatory reporting	To respond more efficiently to regulatory demands, institutions can combine regulatory data with supporting documents, contracts, and attestations, thereby enabling better risk management.

Financial institutions are finding it challenging to enable data-oriented business capabilities with Big Data, but are finding ways to overcome these barriers.

Barriers to adoption	Big Data solutions
Confusion around which problem Big Data is intended to solve.	Define a business statement that will describe the Big Data vision; characterize how it will be used to create new capabilities and improve existing ones.
Lack of the right tools; or having too many tools in-house for Big Data.	Understand what technology is intended to solve which business problem, and standardize. Develop and deploy common infrastructure execution environment(s).
It is unclear how to determine if the capability will deliver value once implemented.	Measure value realization in small segments and in each step. Consider risks early-on in the Big Data planning process. If it is going to fail, fail fast and discard the capability if it is not delivering value.
Undefined or ill-defined data policies.	Create a data policy that addresses how long certain types of data should be retained, who should be allowed to see it, and the appropriate field of use.
Unpreparedness to drive a shift in organizational mindset.	Think through the ways that the business model, processes, and people skills will need to change. Develop the Big Data capability, and coordinate efforts so it will add value when applied.
Big Data is viewed as an IT problem.	For Big Data to be successful, IT must collaborate with the business so that the insights pursued and gained are relevant to the overall business strategy.

Where do I begin?

It is important to begin with a real-world view of Big Data—what it is and what it isn't.

Most organizations still struggle to integrate the data they have collected over the years. Realistically, Big Data alone will not solve that problem—*but enabling Big Data will reveal opportunities and lead to potential solutions.*

Before investing in Big Data, first consider whether your organization is already using its existing data effectively.

Does your organization currently:

- ***Collect** the data you need?*
- ***Analyze** what you need?*
- ***Discard** what you do not need?*
- ***Distribute** what adds value?*

If the answers to these questions are *yes*, then all systems are go for launch. It's time to start your engines.

PwC's framework for response provides the structure of a well-defined approach to Big Data.

1. **Determine if Big Data is the right answer for you:** Do not explore emerging technology for the sake of academic blue sky. Assess what the business problem is, whether it is valuable, and if it can be enabled by Big Data.
2. **Design and establish an organization:** It is imperative that financial institutions take a systematic approach to build a centralized data organization to foster data innovation and agility.
3. **Establish a business case evaluation:** Create a framework to consistently evaluate benefits, risks, and strategic alignment of Big Data implementations.
4. **Pilot, assess, and operationalize:** Run research and development experiments on Big Data opportunities, and operationalize if they add value.
5. **Evaluate and improve:** Determine if the opportunity adds the value that was expected, and look for ways to improve the organization's Big Data capability.

Despite the concerns and complexities surrounding the adoption of Big Data, doing nothing is not an option for most institutions.

To comply with the unprecedented spate of regulations, remain relevant, and compete effectively amid a new era of data management, institutions must rethink the way they manage the data deluge. Those that sit back and do nothing will leave major opportunities on the table. These institutions will be unable to:

- Generate insight from documents, news, graphs, Interactive Voice Response (IVR), emails, internal data (such as payment information), and external data (such as social media).
- Process data that is growing exponentially in terabytes, petabytes, or even exabytes.
- Leverage internal data across businesses, geographies, and IT platforms to better manage enterprise level risk before regulators force the issue.
- Predict business needs to grow and generate higher revenues based on proprietary data.
- Leverage insights from analyzing relationships with customers and patterns of behavior to get out in front of competitors.
- Listen to customers and markets before someone else does.

A deeper dive

Institutions can leverage Big Data to improve customer impact across multiple channels.

Projected benefits:

- *Greater focus on customer centricity.*
- *Improved customer risk analysis.*
- *Higher customer retention.*
- *Improved ability to introduce new products and services.*

Common challenges

Financial institutions are seeking ways to achieve more focused marketing. The global adoption of Web 2.0 transformed consumer behavior and created new opportunities for marketing in online banking. However, there is a multitude of customer information that is not being leveraged to its true potential, including;

- Online banking service channels—customer service, credit card payments, consolidated bank statements, account management, and Interactive Voice Response (IVR) logs—that contain a wealth of information about customers.
- Know Your Customer (KYC) regulatory requirements, which are often seen only as a cost of doing business and not used for additional benefits.
- Marketing campaigns, which rely heavily on business executive heuristics and customer information available to the public.
- Payments and statement-related transactions, which are extensive, but only used as a historical record.

Possible Big Data approach

- Leverage Big Data technology to extract unstructured information from IVR and customer service systems, and combine it with the power of social media.
- Use Big Data distribution technologies to integrate data from both traditional sources (such as internal structured data) and new sources (such as social media and customer correspondence).
- Perform predictive analytics on payment and statement information to forecast buying patterns.

Potential value to the organization

- More relevant proprietary marketing campaigns and product recommendations.
- Better service to clients due to improved utilization of integrated data from online delivery channels.
- More robust customer profiles for improved customer micro-segmentation.
- More effective front-office customer engagement.

Institutions can use Big Data to make fact-based investment decisions by improving the trade lifecycle and managing risks related to structured products with underlying loans.

Projected benefits:

- *Real-time trade governance.*
- *Detailed historical market data to power algorithm trading and analytics.*
- *Improved insight into organizational intelligence.*

Common challenges

Investment banks underwrite, buy, and sell mortgage-related products such as mortgage-backed securities (MBSs), collateralized loan obligations (CLOs), and collateralized mortgage obligations (CMOs), also known as secured loans. But fast-managing macro and micro parameters around interest rates, the declining housing market, and escalating regulatory constraints made managing credit risk on such products a challenge. As IT platforms have become unable to address the issue, financial institutions are seeking opportunities to build efficient predictive models to measure and monitor the performance of secured loans.

Possible Big Data approach

- Develop and deploy a distributed "compute farm" that uses commodity hardware to execute mortgage models.
- Create functionality that allows a mortgage analyst to submit a model for processing, both on demand and in batch form.
- Integrate data throughout the lifecycle of the loan—from origination, to servicing, to close—for better quality and consistency.

Potential value to the organization

- Shorter processing times and the ability to process a high volume of trades.
- Value-based risk management. Smarter and faster investment decisions.
- Efficient analytical platforms that reduce processing costs.

Institutions can leverage market and pricing data to manage enterprise risk across markets, geographies, and counterparties.

Projected benefits:

- *Improved risk management that incorporates multiple data sources.*
- *Efficient and responsive regulatory reporting.*

Common challenges

Institutions struggle to integrate large volumes of transactional data into real-time market data and aggregate global positions, pricing calculations, and the Value-at-Risk (VaR) crossing capacity of current systems. They also struggle to assess counterparty exposures in near real-time and amass unstructured market data to calculate market risk. These institutions operate in a dynamic economic environment further stressed by ongoing regulatory changes, emerging market trends, and declining economies. These challenges necessitated IT improvements, which further expose the institution to risk and related costs.

Possible Big Data approach

- Use Big Data distribution technologies to integrate both structured and unstructured data from firm-wide sources.
- Measure risk and exposures by applying Big Data to integrate external market data into internal transaction data.
- Develop stress strategies, and perform parallel simulations.
- Build dynamic data structures to increase agility when faced with changing compliance and reporting requirements.

Potential value to the organization

- Insights from an "on demand" enterprise risk view.
- Front-office efficiency and productivity in conducting VaR testing and generating outputs via dashboards.
- Faster analytics to track anti-money laundering, counterparty exposure, cash management, and fraud.
- Improvements in operational efficiency, funding projections, and collateral management.
- The ability to model derivative contracts for structured products and deal management using hypothetical data.

How can the financial services industry use Big Data?

	Asset management	Banking	Capital markets	Insurance
Customer data	• Sentiment analysis-enabled sales forecasting • Sentiment analysis-enabled lead/referral management • Quality of leads analytics • Closed loop marketing campaigns • Investment product distribution channel effectiveness • Micro-segmentation • Sentiment analysis-enabled brand strategy management • Cross-asset class product impact analytics • Fund price discovery analytics	• Client experience closed feedback loop • Customer life event analytics • Next best offer • Real-time location based offerings • Sentiment analysis-enabled sales forecasting • Sentiment analysis-enabled lead/ referral management • Micro-segmentation • Customer gamification • Sentiment analysis-enabled brand strategy management	• Sentiment analysis-enabled sales forecasting • Sentiment analysis-enabled lead/ referral management • Closed loop marketing campaigns • Sentiment analysis-enabled brand strategy management	• Micro-segmentation • Closed loop marketing campaigns • Sentiment analysis-enabled brand strategy management • Client experience closed feedback loop • Customer life event analytics • Next best offer • Real-time location based offerings • Sentiment analysis-enabled sales forecasting • Sentiment analysis-enabled lead/ referral management • Customer needs sentiment analysis
Transactions	• Best trade templates • Log analytics • Real-time capital calculation • Operational data store (ODS) consolidation • Trading sentiment analysis • Time series data management	• IVR analysis • Business-to-business (B2B) merchant insight • Real time capital calculation • Log analytics • ODS consolidation	• Time series trade data management • Real-time margin calculation • Log analytics • Over-the-counter (OTC) contract optimization • ODS consolidation • Trading sentiment analysis	• Customer experience analytics • Log analytics • ODS consolidation • Claim leakage/increased payout analytics
Risk management	• Centralized risk data management • Counterparty risk management • Reputational risk management • Anti-money laundering	• Management information systems (MIS)/regulatory reporting • Disclosure reporting • Real-time conversation keyword tracking • Anti-money laundering • Indirect risk exposure analytics • Reputational risk management	• Centralized risk data management • Counterparty risk management • Insider trading analytics • MIS/regulatory reporting • Disclosure reporting • Reputational risk management	• Social media customer behavior fraud analytics • Reputational risk management

Competitive intelligence

In our experience, few financial institutions have figured out how to truly integrate Big Data into their organization, but leading firms are taking the first steps.

	Financial institution 1	Financial institution 2	Financial institution 3	Financial institution 4
Organization profiles	Sales and Trading and Wealth Management divisions of a large investment bank.	Capital arm of global conglomerate with focus on retail finance, mortgages, corporate debt, and funding.	Commercial banking business of a large financial services conglomerate.	The Institutional Transactions division of a large asset management firm.
Assessment of Big Data	The departments are assessing Big Data as an opportunity, and have already taken steps toward implementing Big Data solutions.	The departments assess Big Data as the way to solve some specific business problems, such as compliance, and have taken some steps toward implementation.	The organization is assessing which business opportunities can be resolved.	The organization views Big Data as an opportunity and is planning to move ahead with an assessment in the near future.
Analytical models	The institution is looking into ways to marry Big Data sources with their analytics and build analytical models.	The organization is looking into building analytical models using proprietary data. There is no focus on market or social media.	The organization has started an assessment for new avenues of information and their value to business.	The organization has not yet considered new sources of information for analytical models.
Commitment to Big Data	The needs of the department trump the needs of the enterprise.	The firm is committed to make each entity data driven but is still lacking organization-level commitment.	The enterprise has invested in a Chief Data Office that focuses on the strategy and execution of data-driven projects.	The organization is still trying to determine how to make data-driven versus heuristic decision making, but some departments leverage analytics extensively.

Leading On par Lagging

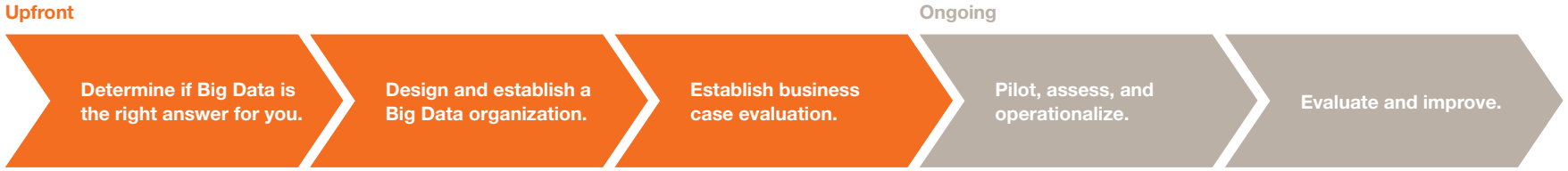
In our experience, few financial institutions have figured out how to truly integrate Big Data into their organization, but leading firms are taking the first steps (continued).

	Financial institution 1	Financial institution 2	Financial institution 3	Financial institution 4
Human capital	The organization has the right skill set for experimenting with new technologies, and has set up an organizational structure for Big Data initiatives.	The organization has not only a good mix of in-house technical and functional talent, but it also has good partnerships with consulting firms to bring in new talent related to Big Data initiatives.	The organization has not thought about what roles would be needed to enable the Big Data capability in detail.	The organization has recently invested in an emerging technologies group to evaluate new technology options and will set up an organizational structure for Big Data initiatives.
Analytics techniques	The organization has highly qualified analysts who leverage sophisticated infrastructure to run complex models.	The organization has analysts who perform look-back analytics, but not predictive analytics.	The organization has highly qualified analysts who leverage sophisticated infrastructure to run complex models.	The organization has a large staff focused on advanced look-back and predictive analytics, but they are not able to run complex models.
Evaluating new technologies	The organization is constantly evaluating new technologies it can leverage to be more competitive. Also, it has built capabilities by hiring experienced personnel and the organization plans to scale up for implementation in the near future.	There is a technology research group reporting to the CIO, which constantly evaluates new technologies from technical, operational, and value perspectives, and they are able to scale their new technology for implementation.	The organization is evaluating new technologies, but has not adopted anything yet.	The organization is evaluating new technologies, but has not adopted anything yet.
Benefit and costs monitoring	One division has a mature chief data office with cost control and benefits realization monitoring capabilities. The organization plans to establish an enterprise-wide cost monitoring capability.	The organization has good processes to monitor costs and return on investment (ROI) during initial periods, but lacks feedback mechanisms for improvements.	Currently, no control is in place to monitor benefits realization.	The organization has project management controls to monitor costs. Benefits realization is measured only indirectly.

Leading On par Lagging

A framework for response

A well-defined approach to Big Data consists of five steps.



Actions	Identify potential Big Data opportunities (for example, need for product/servicer differentiation, need for customer intimacy). Determine if Big Data has been used previously to solve the problem in question. Determine whether these opportunities align with the organization's current and future goals, culture, and appetite for risk and innovation.	Develop Big Data organizational structure and confirm that the Big Data goals align with firm goals. Determine current state of appropriate skill sets within the organization and how the Big Data team would integrate with current structure and strategy. Assess training needs.	Determine costs, request funding to establish a Big Data organization, and execute on the approved ongoing initiatives. Outline benefits to the organization. Detail risks and alternatives. Promote strategic alignment with goals of the organization. Help prioritize proposed initiatives. Establish key performance indicators (KPIs) to be measured.	Enable opportunity with Big Data by running pilots. Assess potential business value. Determine if any valuable insight was found in exploration and if the opportunity met or exceeded expectations. If met/exceeded, determine how to capitalize on future opportunities. If not met/exceeded, determine alternate approach.	Keep current with Big Data industry trends and themes. Continually incorporate improvements into Big Data capability.
Outputs	Foundational goals and objectives of Big Data opportunity.	Alignment of Big Data organization with enterprise. Identification of resources with the right skill set.	Opportunity prioritization. Resource allocation.	Go/no-go decision on opportunity.	Value stemming from Big Data solution. Constantly maturing Big Data capability.

Determine if Big Data is the right answer for you.

Does your organization have business issues or opportunities that point to Big Data?

- Have competitors recently adopted Big Data to leapfrog ahead?
- Have business unit leaders initiated projects where they need new types of business intelligence analysis?
- Is the organization able to monitor its image on social media?
- Would specific lines of business benefit from Big Data-enabled analysis?

Is Big Data the right way to solve your problems?

- Does your institution have the right resources to quickly and easily analyze its vast stores of data?
- Do the challenges your business faces lend themselves to proven applications of Big Data, such as pattern recognition, predictive modeling, time series analysis, or visualization?

Is Big Data a good fit for your organization?

- Does your organization have a culture and appetite for risk and innovation?
- Does your institution have the right resources to quickly and easily analyze its vast stores of data?
- Do some of your departments leverage analytics extensively?
- Does your institution have the right skill set for experimenting with new technologies?
- Does your organization have experience in evaluating new technologies from technical and operational perspectives in addition to measuring their value?

Design and establish a Big Data organization.

Big Data adoption can be likened to a perfect storm of data, technology, business management, and economics. Adopting a systematic approach is critical for Big Data initiatives, as is building a centralized data organization to foster data innovation and agility.

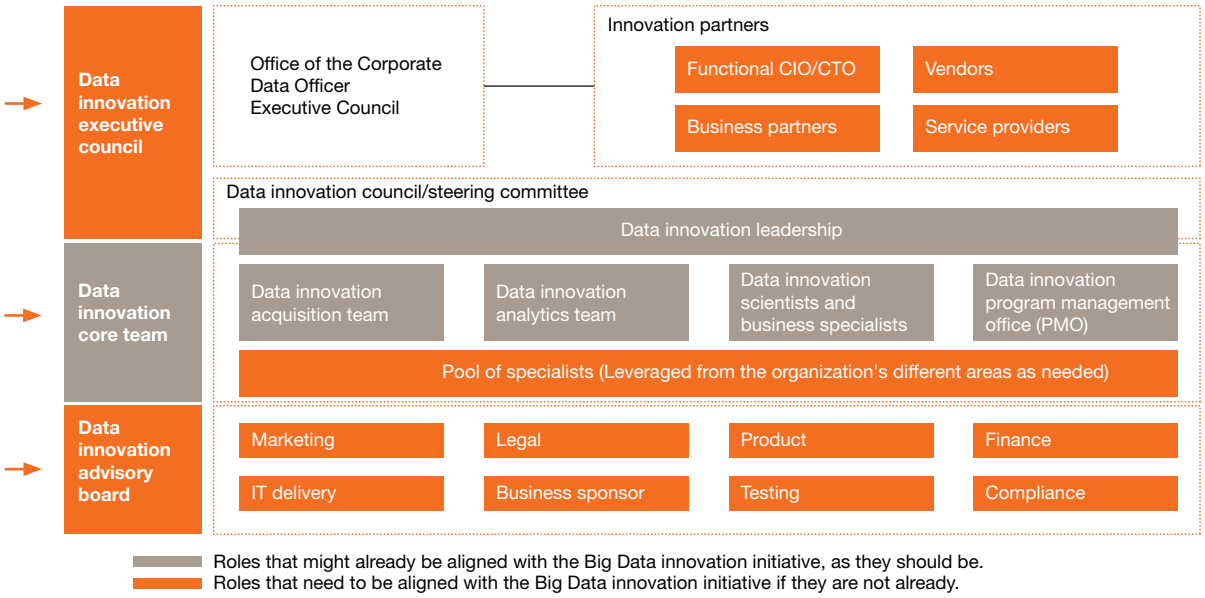
It is critical that the Big Data organization is led by an Executive Council, has a core solution team, and is governed by strong guiding principles. This team should have a vision of how Big Data can transform the organization. The Executive Council would help to formalize a strategy and facilitate business decisions.

A core development team, composed of business strategists, data scientists, and data architects, should focus on delivering solutions.

Guiding principles:

- Insulated, but not isolated.
- Emphasize experimentation and learning.
- Ideas should be based on qualified business values.
- Leverage ecosystems and partnerships.
- Innovation cannot be constrained by heavy processes and compliance.
- Test fast, fail fast, adjust fast.

Example: Big Data talent organization



Build a standard business case model with which to evaluate Big Data pilot opportunities.

Big Data organizations need to promote and foster innovation, and shift the focus away from immediate needs. As such, they should establish a business case framework to:
(a) assess potential business value;
(b) promote strategy alignment;
(c) help prioritize, in a sustainable way, proposed Big Data initiatives; and
(d) measure KPIs.

The business case framework defines the sponsors, rationale, risks, investments, benefits, users, stakeholders, resources, and required services.

The framework will serve as a funnel for Big Data opportunities and help to establish that opportunities align with business goals.

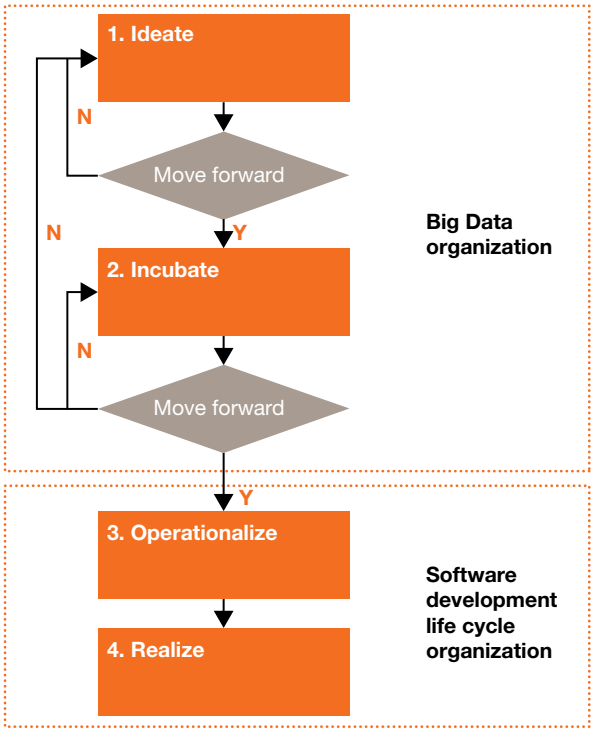
Use organizational drivers as inputs into the decision-making process along with horizontal (for example, cost takeout, growth) and functional (for example, products, customers) drivers to assess and prioritize the opportunity.

The specific value of the initiative may not be known at this time, but the goal is to make sure the direction of the initiative is valuable and aligned with the needs of the organization.

This phase is **intended to be a very high-level and quick activity** that will determine if moving forward with the opportunity is directionally a good idea. Business executives, IT executives, and architects should be involved in the assessment.

Pilot, assess, and operationalize.

By adopting and implementing a business-oriented approach to Big Data, an organization can improve performance and IT investments, and have better success at achieving business strategy. A well thought-out Big Data approach consists of the following steps.



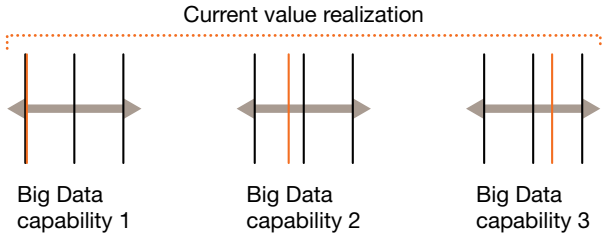
1. **Ideate**—Once the business problem has been vetted in the *Determine if Big Data is the right answer for you* phase and the business case has been defined and prioritized in the *Design and establish a Big Data organization* phase, brainstorm potential technical solutions that will enable the capability.
   - If the idea is viable with the given technology and skill set, move on to the next step.
   - If the idea is not realistic, continue brainstorming alternative solutions.
2. **Incubate**—Create a small-scale execution environment to conduct proof of concept (POC) activities on ideas that passed the Ideate step. Any data needed to conduct the POC will be made available. Work with the business units to confirm if value is realized.
   - If value is realized, then move on to the next step.
   - If value is not realized, consider alternative ways to code the solution or consider alternative ideas.
3. **Operationalize**—Transition the POC developed in the Incubate step to the standard software development process. Promote the solution from the development to the production environment, and meet with your production support team to work out how the solution will be maintained once it is in production.
4. **Realize**—Realize the value of the capability and operate it in production. The business can now use the features implemented, and the capability is owned and maintained by the production support team.

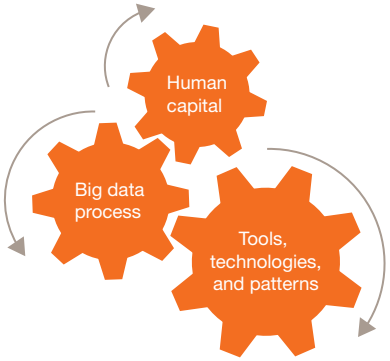
Note: Steps 1 and 2 are owned by the Big Data organization so that innovation momentum is not thwarted. Steps 3 and 4 are owned by the organizations involved in the software development life cycle (SDLC), and the capability must abide by the required guidelines.

Evaluate and improve.

Measuring the value of Big Data initiatives keeps the organization focused and aligned with the needs of the enterprise. Without this step, firms run the risk of adopting new technologies without having anything to show for them in the end.

Determine if Big Data capabilities are delivering value by continually monitoring performance. To continuously improve Big Data capabilities, focus on improving performance by taking action in response to staff feedback and market trends.





Big Data is a rapidly evolving domain that is not as mature as many of the other data management domains. There is significant opportunity to improve the Big Data capability, as most organizations are at a relatively low level of maturity.

Once in production, the capabilities should be reevaluated on a regular schedule (for example, quarterly, annually) to measure progress until either full value is realized or it is determined that full value realization is not needed.

Existing implemented architecture should occasionally be reevaluated to determine if the architecture can be improved.

Employees should have the right mix of on-the-job training and formal education, so that their Big Data knowledge is up to date with the rest of the industry.

As the Big Data capability matures in an organization, how the capability is enabled should also be assessed to understand steps that should be added, removed, or improved.

How PwC can help

What makes PwC's Financial Services practice distinctive.

Integrated global network	With 34,000 industry-dedicated professionals worldwide, PwC has a network that enables the assembly of both cross-border and regional teams. PwC's large, integrated global network of industry-dedicated resources means that PwC deploys the right personnel with the right background on our clients' behalf, whenever and wherever they need it.
Extensive industry experience	PwC serves multinational financial institutions across banking and capital markets, insurance, asset management, hedge funds, private equity, payments, and financial technology. As a result, PwC has the extensive experience needed to advise on the portfolio of business issues that affect the industry, and we apply that knowledge to our clients' individual circumstances.
Multidisciplinary problem solving	The critical issues that financial institutions face today affect their entire business. Addressing these complexities requires both breadth and depth of experience, and PwC service teams include specialists in strategy, risk management, finance, regulation, operations, and technology. This multidisciplinary approach allows us to provide support to corporate executives as well as to key line and staff management. We help address business issues from client impact to product design, and from go-to-market strategy to operating practice, across all dimensions of the organization. We excel at solving problems that span the range of our clients' key issues and opportunities, working with the heads of business, risk, finance, operations, and technology.
Practical insight into critical issues	In addition to working directly with clients, our practice professionals and Financial Services Institute (FSI) regularly produce client surveys, white papers, and points of view on the critical issues that face the industry. These publications—as well as the events we stage—provide clients with new intelligence, perspective, and analysis on the trends that affect them.
Focus on relationships	PwC US helps organizations and individuals create the value they are looking for. We are a member of the PwC network of firms with 180,000 people in more than 158 countries. We are committed to delivering quality in assurance, tax, and advisory services.

Our Big Data service offerings.

Big Data innovation
Develop information-driven innovation models by defining new processes and then creating an operating model—using existing data sources as well as outside data sources to discover new insights.

- **Executive workshops:** Educate and identify opportunities for Big Data through a catalyst workshop.
- **Innovation operating model design:** Establish the processes and capabilities for innovation using Big Data.
- **Outside-in data innovation:** Identify outside data sources that are impactful for improved insights.
- **On-demand analytics:** Pilot the use of a Big Data source to prove out value.

Big Data strategy
Identify and define business capabilities that are enabled through improved insights achieved through Big Data, and develop a roadmap for execution.

- **Capability strategy and roadmap:** Identify the capabilities required for Big Data and conceptual architecture; develop roadmap.
- **Information strategy:** Create a cohesive information strategy for realizing traditional and Big Data insight capabilities.
- **Risk and governance:** Develop approach for managing risks with Big Data and establish overall governance.

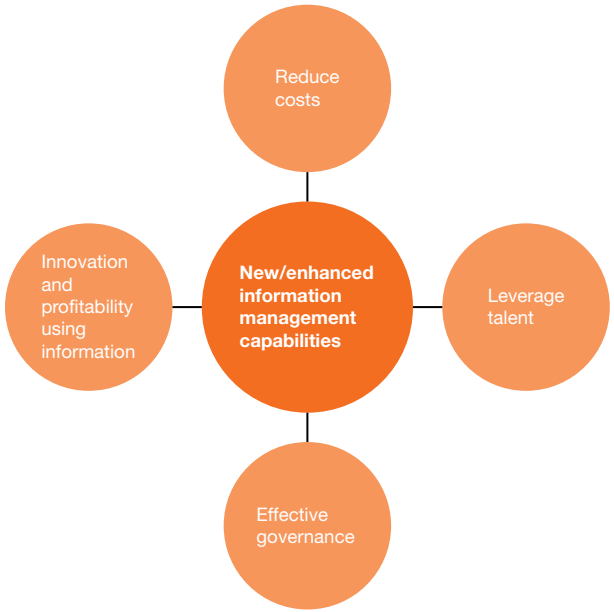
Big Data design
Architect solutions that create scalable harvesting of large data sources into Big Data solutions that interlock with existing analytical solutions.

- **Opportunity prototyping:** Use a pilot case to test Big Data design. Set up the infrastructure, data provisioning, and analytics to jump-start corporate Big Data capabilities—and then evaluate if the opportunity is worth significant investment.
- **Solution design:** Develop Big Data solution, which can then be used for construction, including tool selection and request for proposal.
- **Platform architecture:** Develop an overall platform architecture for Big Data.

PwC is distinguished by the depth and breadth of its professionals.

Experience	Specialists
We have a mature information management capability that we have leveraged across financial services institutions to design and develop solutions for our clients.	PwC's Information Management leadership team has served in various capacities at leading banks and financial services institutions, providing us valuable insight on data management best practices.
We have established formal networks of technology partners to support the critical aspects of business intelligence, content management, and data analytics.	Many of our teams members also have financial industry technology experience, covering trading systems, investment banking, asset management, mergers, integration, and risk.
PwC has worked with clients to tailor data management frameworks so that our deliverables meet the specific needs of our clients.	Each of our senior team members has over 15 years of experience in consulting and industry data management. Many of them have held senior-level positions, spanning across traditional financial services organizations as well as technology, credit card, commercial leasing, and insurance companies.
We continue to capture leading practices through experiences with our clients, remain on the forefront of industry news, and develop thought leadership on the implications of new techniques and technologies.	We have advised many of the largest financial services institutions in data management issues, including information management strategy, business intelligence, and technology selection for commercial banks, investment banks, and hedge funds.

Client needs and issues.



Client needs	Issues we help clients address
Reduce costs	• Identify areas where Big Data may help reduce costs. • Consolidate Big Data technologies that meet client needs. • Increase efficiency through shared services.
Leverage talent	• Develop new roles and responsibilities. • Assist in staff training development. • Build strategies to share domain knowledge across the organization.
Innovation and profitability using information	• Deploy an infrastructure that enables complex analytics (for example, grid, public/private cloud). • Develop analytical models and algorithms. • Maintain and manage analytical models. • Use network (graph) analysis.
New/enhanced information management capabilities	• Exploit Big Data technologies to increase application flexibility. • Leverage Big Data to process unstructured data and integrate with structured data. • Use Big Data technologies to enable low latency retrieval and high write performance for large time series data sets.
Effective governance	• Create and gain consensus on the business case for Big Data. • Develop effective management, monitoring, and controls for Big Data. • Establish alignment between Big Data and the other IT enterprise initiatives.

Appendix

Building a high-performance direct distribution operating model—Fortune 500 life insurance company

Issues	This large life insurance company determined that fast-moving marketplace changes would require a hard-hitting and sweeping analysis of its sales and marketing strategies in the online space. Auto insurance sales had moved online quickly and become commoditized over the past decade—70 percent of today's auto insurance purchasers have obtained an online quote—and the company needed to know if the life insurance sales that were central to its growth were destined to follow the same evolution to direct distribution. The life insurance company planned to build a high-performance direct distribution operating model to support future growth of online sales, but it had many questions: How quickly to ramp up? What barriers would be encountered? What sales criteria would change the market most? Which customers were most likely to gravitate toward online purchase options? Getting answers to crucial questions required a deep and far-reaching analysis of huge amounts of data.
Approach	PwC brought its understanding of the opportunities, sources, quality, and use of available third-party data sets and its analytical capabilities to give the client the insights it needed. PwC helped analyze macroeconomic data, consumer data, and technology advancement data, and model it out five to ten years. PwC also assisted the client with collecting external third-party data sets that showed down to the ZIP-plus-4 level how many people have life insurance, what type it is, what their net worth is, what demographic categories they fall into, how digitally savvy they are, and even how much time they spend online per week. Armed with that model, the company could easily find the prospects most likely to shop online and create marketing programs that would target them with a laser-like focus. The model was flexible enough to be adjusted for improving economic conditions, new competition in the market, or changes in adoption rates. In addition, PwC helped analyze the types of technological and operational underpinnings the client would need in order to create a direct distribution system that could analyze a customer's application, write a policy, and confirm it with the kinds of response times that customers expect from online sales interactions. PwC also helped the client develop a scenario analysis of sales and a scenario analysis of the client's potential market share over the next three to five years.
Benefits	PwC helped the company find more than $10 billion in potential market sales if the market conditions were right. The insurance company's Big Data solution concluded that if the company increased its marketing spend to increase market awareness of its products, decreased the customer dropout rate at various stages in the online purchase process, and increased the ease of use and accessibility of the online channel, it could see remarkable increases in sales.

Streamlining multiple Big Data initiatives to create one cost-efficient, enterprise-wide solution—Global investment bank

Issues	A global investment bank was investing enthusiastically in many sophisticated Big Data initiatives, but with six individual business units launching their own projects independently and without an overarching enterprise-wide plan in place, the bank was missing the opportunity to formulate a master plan for its journey into Big Data's future. The leaders of the bank's Big Data analytics group suspected that with multiple projects being developed at the same time, there were likely to be inefficiencies and redundancies that could be eliminated if the bank could organize this Big Data creativity under a more unified plan.
Approach	To continue successfully on its Big Data path, the bank needed a complete inventory and assessment of the projects currently underway and in place. Our approach included helping the client to: • Launch an extensive survey of the bank's current Big Data initiatives. • Gain consensus among the business units on the problems that Big Data analytics could solve for them. • Understand the technologies and solutions currently in place as well as each business unit's unique requirements and issues. PwC helped the client examine the types and amounts of data being processed, including both internal and external third-party data. We also helped them evaluate their ability to retrieve data as needed and the speed with which they accessed it. Lastly, PwC cross-referenced the problems that the business units wanted to solve with the technologies already deployed to solve them. This resulted in a list of commonalities that the Big Data analytics group could exploit to create more streamlined and cost-effective Big Data solutions that could be deployed enterprise-wide.
Benefits	Rather than advocate for any one solution, we were able to help analyze the many solutions the bank had already deployed and assess each on its own merits, matching the appropriate tools to the appropriate tasks. PwC's analysis provides the crucial baseline for the bank's future Big Data planning, and the bank can now see where it will need to fill gaps and add technology to create more common platforms and solutions for the entire enterprise. Armed with this evaluation of the current state of its Big Data ecosystem, the bank can move forward toward leveraging Big Data in a more cost-effective and consistent way.

Consolidating operations for a Big Data solution to reduce build time and enable cross-domain analytics—Global investment bank

Issues	The client, a global investment bank, needed assistance with migrating its middle- and back-office operations reporting to a Big Data architecture. In doing so, its goal was to reduce application build time spent on system integration, enhance cross-product and function analytics, provide one view for operations across business functions, and support self-service analytics for end users.
Approach	PwC worked with the client to consolidate several global legacy data warehouses covering trade life cycle; Dodd-Frank reporting; and counterparty reference data for all asset classes, whose varying sources were resulting in duplication and low-quality data. The client also needed help to inventory its data sources and ongoing projects, identify data gaps within the legacy reporting environment, and develop a roadmap for migration to a consolidated Big Data repository. Our approach involved collaborating with the client to: • Assess data flows and data requirements across functional areas, asset classes, and geographies. • Conduct a current-state analysis, including user base, data usage patterns, domain coverage, existing data structures, data sources, and reporting requirements. • Perform a thorough data analysis of existing reports, including mapping outputs to database tables and, ultimately, to original sources. PwC also worked with client data specialists to build a thorough data flow analysis, from data source to operational reports; identify gaps and areas of duplication; and produce key integration metrics by source system. To gauge system-by-system readiness, PwC helped the client formulate a maturity scoring model by cross-referencing system impact and Big Data integration factors. We then helped the client to combine the data flow analysis and maturity scores to create a workable, phased roadmap for migrating to a single document-centric Big Data repository.
Benefits	As a result of our assistance, the client realized the following benefits: • A multi-faceted view of its data landscape, with critical gaps and duplications highlighted. • A ranking of source data systems by value and integration risk. • An overall view of data coverage for key areas, broken down by function and across asset classes. • A roadmap for its migration to a Big Data architecture. Finally, PwC also worked with the selected Big Data vendor to help the client move forward with confidence on its ambitious Big Data plans.

To have a deeper conversation, please contact:

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"Where have you been all my life? How the financial services industry can unlock the value in Big Data," PwC FS Viewpoint, October 2013. www.pwc.com/fsi

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