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TDWI E-BOOK

BIG DATA ANALYTICS

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Q&A: HOW TO MAXIMIZE BUSINESS VALUE WITH BIG DATA ANALYTICS

Big data is more than just buzz. In this discussion with Harriet Fryman, director of business analytics for IBM Software, we explore what's driving the move to big data analytics, how to overcome obstacles to its adoption, and how to get started with and capitalize on the technology.

TDWI: What makes "big data" different from the "traditional" data organizations leverage today in BI and analytics?

Harriet Fryman: We define *big data* simply as information that goes beyond what organizations are able to leverage today in their BI and analytics programs. Although most easily characterized in terms of greater volume, velocity, and variety, we find it useful to define big data by how it drives the way we need to think about BI and analytics.

First, greater context and broader insight. Big data goes far beyond the single source and relative simplicity of ERP and transactional data. Big data provides greater context of time, location, source, and networks, be it sensor data, RFID tags, scanners, videos, networks, or social media as well as enterprise content captured from people and communities. This richness enables more people, places, and processes to be analytics driven than ever before.

Second, richer analytics and new styles of interaction. Even though some of this data was available before, it was hard to make sense of it. We didn't have the information management platform and techniques to provide an easy way to capture, house, or process it, nor did we have a good way to understand what it was telling us. Big data requires greater use of analytics to uncover hidden patterns and relationships and to net out the news, as well as new ways to visualize and explore it. No longer can we "pass through" all the data to a dashboard and ask the business to trawl through using today's reports, graphs, and hierarchical navigation.

Finally, cost-effective scale. Even with the availability of big data sources and the techniques to make sense of it all, we need the scale, performance, agility, and management to make it feasible and worthwhile for the business to pursue.

Therefore, big data as we define it encompasses new information that wasn't available before, new technology advances to work with it, and cost-effective approaches to deliver its value to organizations.

How does an organization recognize the tipping point for where and when to start a big data initiative?

We typically see organizations start with either an IT-driven or business-driven approach. Each has its own tipping point and each leads to different outcomes.

An IT-driven approach takes a technology viewpoint about how to embrace big data in terms of volume, velocity, and variety. These programs:

- Are often driven by performance, agility, or other technology advantages. They can also be research-based and tied to the data management infrastructure team rather than a specific business initiative with defined requirements.
- Have a tipping point driven by pain points such as data warehouse performance, real-time currency of information, agility to respond to future business demands, or simply a desire by an organization to gain understanding of newer technologies.
- May tackle specific challenges such as how to handle volume with data warehouse appliances (such as IBM Netezza) for analytics on petabytes; tackle velocity with technology (such as IBM InfoSphere Streams) to deliver information in milliseconds; or embrace variety with big data technologies (for example, Hadoop Distributed File System) with solutions such as IBM BigInsights.
- Are typically funded as an infrastructure upgrade, IT optimization, proof of concept, or service-level improvement.

A business-driven approach takes a value viewpoint where a specific initiative's outcome is improved by incorporating what big data can offer. These programs:

- Often drive the need to bring in new information platforms and apply new styles of analytics and visualization to exploit them.
- Have a tipping point when business appreciates that broader information sets, new sources, and types of information can deliver valuable additional insight.
- Tend to have an executive sponsor, clearer requirements, and go through smoother funding against a measurable business value outcome.
- May not be termed a big data analytics project but will incorporate big data and analytic approaches as a way to optimize their impact.

An example of a business-driven initiative is optimizing customer experience. This initiative may incorporate big data sources such as social media, call center interactions, Web behavior, warranty and repair histories, purchase details, and demographics. It may employ advanced analytics for segmentation with IBM SPSS Modeler, sentiment analytics from IBM Cognos Consumer Insight, network analytics to understand relationships, and technologies such as IBM SPSS Decision Management to employ business rules and predictive models to drive the next-best action for a customer interaction in real time. It may also drive a focus on bringing the output of this analysis to the business in visualizations and for exploration tied to sales and financial transactions to provide a more complete view of the business dynamics. The outcome of this example may be measured in reduced customer churn, high customer lifetime value, and more positive sentiment through earned reputation.

There is a lot of talk in the market about the management and storage of big data but not much about big data analytics. Why is that?

There are many factors that drove the discussion to center first on the technology, processes, and approaches at the platform level. The newness of the technology means the tooling is not quite as mature as, for example, relational databases, and organizations require education and examples of what they are, what they do, and how to best deploy them.

Also, because much of the analytic processing with big data is pushed closer to the data (for example, MapReduce on Hadoop or algorithms on real-time data flows), the line between the platform and the analytics has blurred. This means data-savvy analysts and data scientists also need knowledge about the platform to exercise it and find interesting facts to surface for business use. Indeed, as big data platforms are better understood and mature to provide more management, tooling, and analytic processing (such as the IBM Big Data Platform), we already see the conversation shifting.

On the analytics side of the equation, many applicable analytics already existed, albeit on smaller data sets. For example, content analytics products apply text processing to find patterns and are used for tasks such as e-discovery for legal cases. Analytics were also custom built for specific line-of-business applications, and, therefore, not generally available for others to use.

The good news is that we see a growing market conversation on big data analytics. In our opinion, this conversation is an evolution and expansion of the existing business analytics purview, not something separate. Analytics has always been about helping organizations drive better business outcomes, and big data helps deliver on that objective. It is an expansion of BI, discovery and search, and advanced and predictive analytics. It is an evolution of technology to both embrace the volume of big data and offer new capabilities for big data, including:

- **New analytic techniques:** advanced entity and network analytics, more sophisticated text analytics using natural language processing
- **New visualization and exploration:** heat maps, tree maps, network diagrams, etc.
- **New analytics-driven automation**, such as decision management
- **New computing models:** cognitive systems, learning systems

Although the hype has mainly centered on managing the volume, velocity, and variety of data, we see an emergence of the new "V"—value—and that is where big data analytics will come to the forefront.

What is the biggest obstacle preventing the adoption of big data for BI and analytics initiatives in today's organizations?

The number-one obstacle is organizations thinking big data is one initiative when, in fact, big data is an umbrella term that covers many problem spaces, data sets, technologies, and opportunities for business value.

Critical to adoption is to identify the business initiative and quantify tangible business value. Organizations often misstep by thinking of big data as just a data source for BI. For example, they may issue a BI request for proposal with the requirement for Facebook or Twitter interfaces, but with little consideration of what to do with the data: how to process it, what analytics are required to make sense of it (in terms of interpreting sentiment, misspellings, sarcasm, monitoring evolving topics, and uncovering networks and relationships). Indeed, their business may be better served analyzing blogs, user communities, or call center records.

The second obstacle is fear—and sometimes the reality of inadequate skills. Because of the market discussion about Hadoop and advanced algorithms, organizations tend to think of big data initiatives as beyond their technology skills and requiring data scientist skills. Again, it depends. The big data project could be data warehouse performance or stream processing. Both are proven technologies that don't require Hadoop or data scientists—and therefore the obstacle isn't real. In cases where it *is* real, there are platforms now that provide the tooling, management, and control around Hadoop. Furthermore, there are advanced analytics technologies (such

as IBM SPSS Modeler) that make it simple for data analysts working on big data sets (e.g., by automatically suggesting the best algorithm to apply and listing the most relevant fields in the data).

The best way to overcome these obstacles is to take advantage of the education available today for big data and engage consulting services to help define the strategy, identify the initiative of most value, navigate the many technologies and vendors available, and provide guidance on how to succeed.

What analytic tools does an organization need to capitalize on big data, and how are they different from the tools they use today?

When organizations look to big data analytics, they should look for four main capabilities to expand their existing BI and analytics initiatives.

1. The first, and most critical, is advanced analytics to uncover patterns previously hidden. With new types of data comes the need to apply new types of algorithms, such as entity analytics, network analytics, text analytics, and real-time scoring. These analytics must scale—it is well known that improved accuracy comes with additional sources and data volumes. Analytics must be able to push these algorithm processes closer to the data for in-database processing and interpretation of text, images, and video streams.
2. Second is visualization and exploration to help the business find more complete answers to their business questions. With new types and greater volumes of data, and the need to consume the output of analytics, comes the need for new forms of visualization (such as heat maps) to best represent the data to the user and highlight important patterns to the human eye. Here, tools that enable interactive, iterative, search-like, visual data discovery are key. In addition, data scientists also require navigation and user experiences like IBM BigSheets to discover the relevant information and almost pre-process the data set for the business.
3. The third capability is to turn insight into action to drive a decision—either with a manual step or an automated process. To apply analytics to streaming big data requires technology such as IBM SPSS Decision Management to apply predictive models and business rules to automate decisions and surface outliers for business judgment.
4. Finally, and as table stakes, analytic tools must assemble the right mix of information in a way that makes sense to the business. This may include:
   - Tooling to compose fast-performing queries on very large data sets or to access high-performance analytic databases or appliances such as IBM Netezza
   - Analytic processing capabilities to ingest data in motion, apply filters, and surface relevant real-time data
   - Query and process returned data from unstructured data (for example, in HDFS)

Are different skills needed to work with big data analytics, either as data management professionals or business end users?

Certainly adopting the newer technologies of big data requires new skills. As with every new initiative, organizations need a thorough skills assessment. In addition to skills normally required for any BI and analytics initiative, we highlight three particular roles to focus on.

First is the role of the data scientist, who possesses a blend of skills that includes statistics, applied mathematics, and computer science. The data scientist can use these skills on large, complex, and often dirty data sets, find significance in the data, and make that significance easily understood and acted upon by others.

Second is the role of the business analyst, who possesses a blend of business understanding with data manipulation acumen to determine what data is important and who acts as the "in-between" between business and IT and between the business and the data scientist.

Third is the role of application development manager, who possesses the skills to identify and effectively assemble the relevant set of big data technologies and developers (for example, Hadoop and Hive skills) to deliver on the business initiative.

What are the biggest misconceptions IT, or, indeed, business users, have about big data analytics?

Three misconceptions come to mind:

Misconception #1: Big data analytics equates to Hive and Hadoop for analysis of social media data.

As big data is better understood, organizations realize big data is much more. In terms of technology, it includes expert optimized systems, warehouse appliances, streaming technologies, advanced algorithms, new visualizations, and interactive discovery. In terms of data, it includes machine data, sensor data, videos, audio, documents, enterprise content in call centers, e-mail messages, wikis, and, indeed, larger volumes of transactional and application data.

Organizations may well identify the area of biggest business value as sentiment analytics of social media data, but other areas may have equal or greater need—for example, in such areas as predictive maintenance, fraud detection, traffic optimization, cybersecurity, network monitoring, and churn prediction.

Misconception #2: Big data analytics requires the same governance and quality as analytics on data warehouses of transactional data.

The world of big data can be equated to the Wild West of information in that the quality and governance of mission-critical financial data may not be appropriate for social data, videos, or wiki data. Applying the right level of control for the type of data, use, and risk exposure is important.

Second, big data is exploratory in the sense that you don't know what is important or relevant until you have taken a look. The initiative may well be stifled from day one if you apply the rigor of requirements gathering and process management of a BI competency center. Better outcomes are driven when an organization consciously enables big data projects to be iterative, exploratory, and, in some cases, transient.

Misconception #3: Big data analytics needs IT to surface all the information to the business in its raw form.

No business person can look at big data and conclude all that is relevant—analytics must be employed to help surface interesting patterns—and then visualizations and interaction provided to help in understanding what the analytics is surfacing. In addition, many analytic advances are to not surface the result in a BI tool but to fuel an analytics-driven process or the application itself.

Organizations should expand their current thinking about the project life cycle and shift away from the process where IT identifies sources, builds the warehouse, and offers BI to the business. The big data analytics process is iterative and collaborative where IT and business users explore interesting sources of data, the data scientist is involved to refine what is important, algorithms are applied to identify patterns, and all of this is either provided to the business for exploration or into a process for automation.

Is big data simply the current big hype or are organizations really getting value from big data analytics?

Although there is a lot of buzz about big data in the market, it isn't all hype.

Here at IBM, our clients see tangible ROI using IBM solutions to address their big data challenges:

- In healthcare, a 20 percent decrease in patient mortality by analyzing streaming patient data from multiple sensors
- At a telco firm, a 92 percent decrease in processing time by analyzing streaming networking and call traffic to detect network problems and identify churn
- In the utilities industry, a firm improved accuracy by 99 percent by efficient power-generation resource placement after analyzing 2.8 petabytes of untapped data
- There are more examples on IBM's website.

How do you recommend organizations get started with big data analytics?

We recommend finding a business-driven initiative with measurable outcomes that would benefit from a broader information set and the application of analytics. In our discussions with organizations, we ask them to ask themselves three fundamental questions:

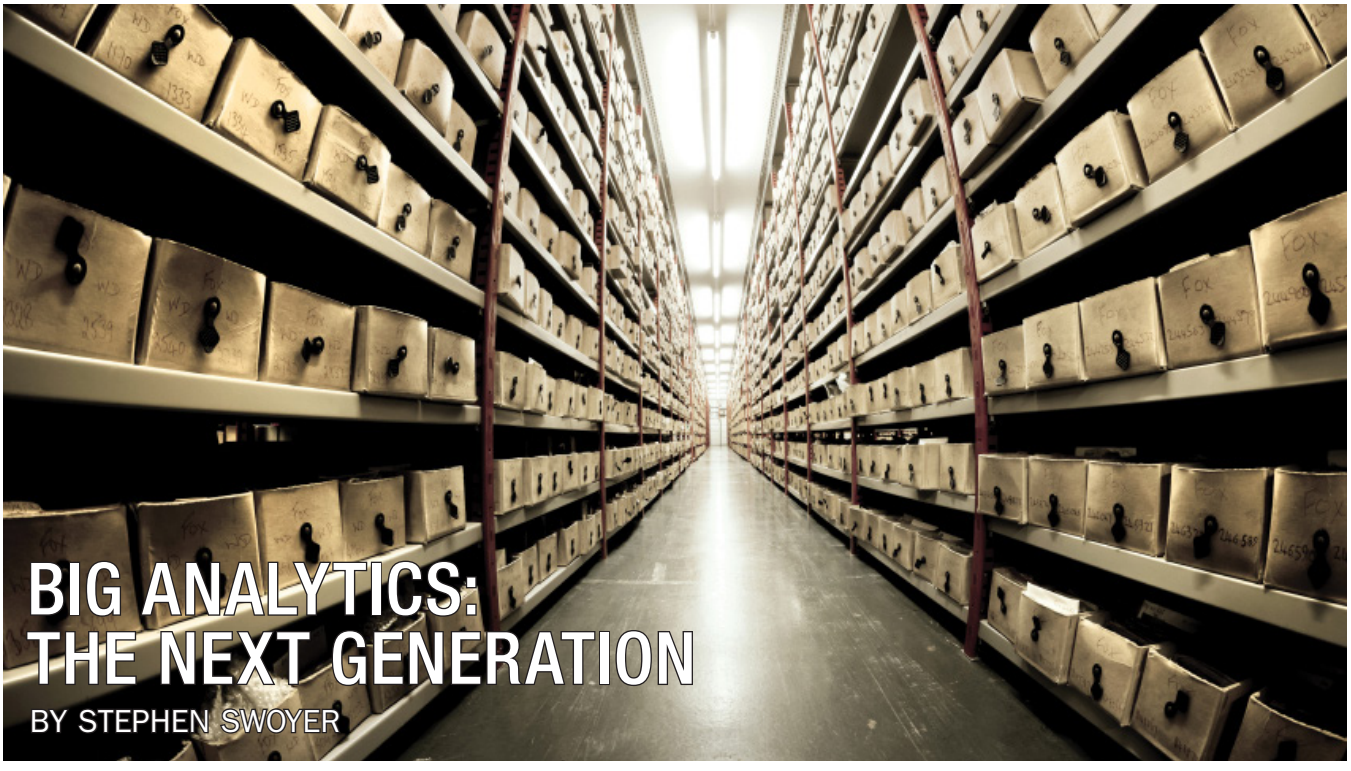
- **What part of the business would benefit from expanding the data set and analytics to provide more complete answers?** For example, a brand manager investigating decline in sales transactions would be interested in augmenting the analysis by tying in insight from call center records, Web logs, and sentiment in consumer conversation on social media sites for his product and competitive products, quality, functionality, or price.
- **What part of the business is not using analytics today, but because of new information sources (either internal or external), would benefit from analytics for their user community or to fuel their processes?** For example, rather than sampling river water for pollution control in a local authority, capture and analyze hundreds of thousands of sensors in the whole catchment area for biologists to see impact on wildlife, hydrologists on water levels, local businesses on effluent control, and so on.
- **What information do I collect today, or what analytics do I perform, that would be highly valuable as an information set to others that I could create a revenue stream, or that by applying analytics enables me to more effectively monetize a part of my business that I wasn't able to before?** For example, using analytics to immediately make a relevant offer after a credit card is used to compel another transaction versus just storing the transaction itself for later reporting.

Where is big data analytics headed in, say, the next 1–2 years?

The exciting news is that many organizations are realizing the value of big data analytics today. We see this adoption growing over the next 1–2 years. Here at IBM, we see a few key areas I'd like to highlight:

- Insight-driven, information-centric initiatives will be deployed where the ability to capitalize on the volume, variety, and velocity of information will create new opportunities for organizations to exploit.
- Decision management will empower first-line workers and systems to quickly and consistently make the right decisions. By incorporating big data, combining and integrating predictive analytics, local rules, scoring, and optimization techniques into business processes and systems, decision management helps deliver decisions that are consistently optimized and aligned with the organization's desired business outcomes.
- Social analytics will ensure businesses know how, when, and where to creatively engage with individual consumers and social communities to foster trusted, one-to-one relationships and better understand and manage the way their companies are perceived. Integrating demographic and transactional data with what can be learned about attitudes and opinions allows organizations to truly understand the motivations and intents of its constituents to better serve them at the right time and place.
- Predictive analytics will help organizations uncover previously hidden patterns, identify classifications, associations, and segmentations, and make highly accurate predictions from structured and unstructured information. Organizations will use real-time analysis of current activity to anticipate what will happen and identify drivers of various business outcomes so they can make strategic course corrections.
- Cognitive systems such as IBM's Watson technology will represent a new class of industry-specific analytical solutions that leverage deep content analysis and evidence-based reasoning. It learns through interactions and outcomes, leverages natural language, and is capable of generative hypotheses to provide confidence-weighted probabilistic responses at the point of decision. These systems leverage big data, analytics, and scale by bringing data and computing power closer together.

Big data analytics is here, so I recommend organizations look to the value they can gain, starting today.



BIG ANALYTICS: THE NEXT GENERATION

BY STEPHEN SWOYER

Big analytics doesn't distinguish between conventional information sources and big data sources. It emphasizes understanding information in context.

Because big data is so new, and because it's imperfectly understood, we tend to treat it with a kind of deference (i.e., big data is a "special region" with its own set of rules). However, getting the most out of our analytics requires that we get past this deference.

Big data isn't—or shouldn't be—something that's separate, but rather something that's understood in the context of an overarching information management continuum.

Big data, along with traditional sets of relational data—and any other conceivable information type, for that matter—is a part of this continuum. This makes for an exceedingly broad view of enterprise-relevant information, one that requires a new kind of analytics: "big analytics."

Big analytics dispenses with the (artificial) segmentation between conventional information sources and big data sources. It emphasizes understanding information *in context*.

"It's not a separate thing," argues Harriet Fryman, director of business analytics software with IBM. "For example, you can actually augment your understanding of a product sales decline or a production quality issue by looking at the consumer sentiment in social media sources, or sensor and RFID data from manufacturing or along the supply chain."

In most cases, BI today serves up "answers" (i.e., pre-packaged "insights" based on transactional data and delivered in the form of reports, dashboards, or scorecards) to information workers. This used to involve reporting on or analyzing data from operational systems; over time, it's come to incorporate information from nontraditional providers, such as third-party subscription data or geographic information systems (GIS). Big analytics incorporates these and other new sources of insight. In fact, information from big data sources is already being used to enrich conventional reports or dashboards, for example.

Businesses are doing this today, but big analytics also places a much greater emphasis on the problem of discovery: of exploring the information continuum to glean and harvest insights; of matching events in transaction data with signals—with events, trends, or other kinds of information—in the big data stream. In other words, big analytics asserts that the information we get from so-called "big data" sources is most valuable when it's combined with information from *other* sources, including—especially—traditional operational applications. "You can use big data to provide more complete answers when you connect it with transactional data," Fryman says.

She cites the example of a brand manager who decides to peer more closely at product sales. Traditional BI analytics can tell her just so much; however, once her sales information is supplemented by big data—once she's able to see things in what Fryman calls "high-definition"—she's got a contextual view with more and broader data points: a big picture, in HD.

"In typical BI, a manager would be trending their product sales, see a decline, and then they'd investigate why by looking at their data from transactional systems," she notes. "With big analytics, they can now augment this [view]: they may look back further [across time], requiring more volume of history, or they may look at other sorts of related data," Fryman continues. "They would be looking for the reason why, so they might compare this [transactional data] with social media data, so that they can understand what the sentiment is [among customers] about their products. They can look at machine data: at sensor data. They can explore what's happening in high-definition."

The information we associate with big data sources (e.g., social data, machine or sensor data, semi-structured or nontraditional information sources such as video, photo, and audio, or even simply more information in terms of history or detail than we use today) will become part of the information continuum: a pool of all the information that factors into making business decisions. Big data isn't a separate category in this scheme: it's just one provider among many different kinds of providers, all of which become grist for big analytics.

"A continuum is a good way of looking at it," says industry veteran Colin White, president and founder of consultancy BI Research. "Big data and big analytics involve more than large volumes of multi-structured data. They represent a continuum of technologies that have evolved over the past five decades to support IT workloads that push the boundaries of existing hardware and software capabilities. They enable organizations to support analytical solutions that were not previously possible because of cost or technology constraints."

Does More Data = Greater Value?

Big data isn't—or shouldn't be—something that's separate.

Or should it? After all, some types of analysis simply benefit from having more data: from having *huge volumes* of data.

One obvious example is sampling: according to experts, big analytics could permit us to move away from sampling and address the totality of information sets.

The ability to analyze "big data"—in the sense of a huge volume of information—can decrease an organization's dependence on sampling, while easier-to-deploy analytic technologies can decrease the statistical know-how required to develop and maintain sophisticated sampling algorithms, IBM's Fryman notes.

Social analysis—"social studies," so to speak—can likewise benefit from having more data.

With social media, there's plenty of data to be had. One upshot of this, says Fryman, is that while the unit value of a big data type such as a tweet is negligible, the value of finding relevant patterns in millions or billions of tweets can be substantial.

"The unit of value of an individual tweet or [of] an individual post on Facebook ... is small when compared to the unit value of a transaction like a sales order. The former can be lost or not of high quality, whereas it is critical to govern the latter," says Fryman. "Social media is the Wild West of information and will cause enterprises to [develop] a continuum of quality and governance rules that are driven by the [different] data sources and types."

Wild West or not, there's value in that thar social media. From the perspective of a manufacturer or brand that wants to better target its commercial buys, in fact, social data can be a veritable gold mine. For example, big analytics can tie the massive volume of relevant tweets and social commentary to program schedules and purchase data. This can help drive more informed segmentation than focus groups or sampling, says Fryman, who argues that "the unit value of one tweet becomes enormous value in the aggregate."

More generally, an analysis of this information could help to fuel new product development, more effectively target marketing, or discover hitherto unknown cross-sell and up-sell opportunities. "The unit value of social data is less than the traditional ERP transactions, but the social data is almost more insightful in the aggregate than the sales order because the sales order holds no information on why," she maintains. "Sales orders only record what happened," Fryman continues, noting that—while "informative"—this isn't as useful as "determining what could have happened, what should have happened, or what will happen."

BI Research's White concurs. "[W]e are often faced with having to aggregate or maintain only a subset [of] the detailed data used for decision making [on account of] cost and performance reasons," he points out. "Some of the new technologies now allow us to avoid aggregation and [to] maintain and analyze more detailed data," White points out, citing, for example, an ability to store and analyze 10 years' worth of information history instead of just two.

This, says Fryman, is the essence of big analytics. "Big data is about having more information than ever before about the world around us," she concludes. "And big analytics is the key to unlocking that information so more organizations and more people can make sense of it."

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Q&A: ANALYST SEES BRIGHT FUTURE IN BIG DATA

BY LINDA BRIGGS

One of the most interesting aspects of big data, says author and industry analyst Judith Hurwitz, is the ability to examine huge sets of data for trends that might be overlooked otherwise. Big data is "not about what you already know," she says. "You want to ... find out what you *don't* know."

Hurwitz is president and CEO of Hurwitz & Associates, Inc., a strategy consulting and research firm focused on the business value of emerging computing technologies, and a well-known analyst, author, and commentator with decades of experience observing the technology arena. In the first segment of this two-part interview, she discussed her new book, *Smart or Lucky: How Technology Leaders Turn Change into Success*. In this portion, she focuses on trends and innovations she sees taking place in business intelligence.

TDWI: As a longtime observer of the technology space, how important is the "big data" explosion?

Judith Hurwitz: Well, everybody is suddenly talking about "big data," certainly. Companies are coming out of the woodwork—companies that did something else for years but are suddenly a "big data" company. The trend is real, there are real products, and it is huge.

One of the most important advantages with big data isn't about asking the questions you already know you want to ask about your data. Where big data starts is when you don't necessarily know *what* questions to ask. Instead, you have lots of information and you're trying to figure out whether there's something there you should know about.

Big data allows you to take huge volumes of data and say, "OK, if I look at this data, what is it telling me?" Maybe it looks at geography. "Where were my customers located over the last two years?" You start to look at patterns in the largest context. Once you do that, you get insights you never imagined.

You can then say, "OK, knowing that, I no longer need three trillion terabytes or whatever of that data anymore. I want to home in on this subsection of data." Now, you can apply more traditional analytics tools because now you've figured out what you need to focus on.

That's the difference; that's where big data really begins to have a role. It's not what you already know. You want to look at things from a much more predictive standpoint, to find out what you *don't* know. When you look back, you might well say, "Oh, that's so obvious. It was staring me right in the face. … Had I realized that, I would have changed my whole marketing strategy."

So I might be able to tease patterns out of big data that I couldn't see in smaller subsets?

That's exactly right. Typically, when you're doing the smaller subsets, you're asking questions such as, "Tell me how much my sales are growing. Tell me what's happening in this territory." That's fine. You need that, but where big data comes in is that it starts to look for patterns, and it starts to look at issues that don't just jump out at you. Maybe it's because there's too much information there and maybe your search is too broad. Maybe three-quarters of it is white noise, but you're not going to know until you look further.

After doing that, you need to build an integration bridge between show-me-everything and OK-now-let-me-look-at-that.

Regarding predictive analytics, which you mentioned in context of big data, where are we headed? Half of TDWI members say they want to be using predictive analytics productively in the next three years, but few are using it today. Are we at a tipping point there?

Predictive analytics does have a relationship to big data. What we're looking at is the technology that helps us not just to assess where we are, but to start to make connections between pieces of information. [By doing that], I'm going to get more value from not just what I can understand but what this means for the future. So, being able to predict the future, being able to see if certain factors are true and if I can understand the connective tissue between elements, I can start to say, "Oh, there's something going on here."

Maybe that means that I need to sell differently. Maybe that means I need to develop new go-to-market strategies.

For example, there is technology out there that lets you look across a broad swath of the market at what people are saying about certain products or certain television programs or whatever. I can look across television, Twitter feeds, Facebook, information from call centers, information from what critics say, and what is written in local newspapers. If you can start taking information like that—that you could not have put together in the past—and you can start to understand what it's telling you, then you're in a much better position to act. …

It's not a new idea. It's really what we have, for a long time, hoped that business intelligence would prove to be. We just didn't have the maturity of technology, and at a reasonable cost. …

When we talk about analytics, is it becoming something that everyday users can take advantage of, or are BI analytics tools still for experts?

I think it depends on what you're trying to do. Something as simple as a Google search is a type of analytics, after all. Thirty years ago, the idea of being able to search a vast warehouse of data and say, "Where is the closest gas station to the corner of 5th and Main?" would have been unthinkable.

With more sophisticated analytics, though, you still need a skilled, trained person.

We're at a fascinating time in information technology, and you've been watching this space for a while. What do you see as one of the most important trends heading into the next 18 months or so relating to business intelligence in particular?

One thing is the ability to aggregate more and more data, [and have] systems that do a much better job of understanding context. It's very complicated, but we're getting into an era where more can be put into algorithms [and] can be used by people to start learning and understanding the context of how things are related. Our ability to turn that data into usable solutions is improving because we are getting much better at understanding what the context is.

Really, that's the whole background of [IBM's] Watson project. It isn't just feeding in information, then [letting the computer] figure out the answers. Watson actually starts to understand context, and over time, it learns more and more as it finds the right answers to things, and as the people who are tuning the systems feed it more information. Systems like that will become useful tools for figuring out solutions to problems we've never been able to tackle.

That takes us back to our original discussion about artificial intelligence and how far we've come.

That's right. There really is nothing new under the sun. People such as Marvin Minsky, the father of artificial intelligence, were having these discussions 30 years ago. All of the seeds of this, all of the potential to transform industries and businesses, has been around for a long time, but making it practical, making it usable, and making it so that people can take those concepts and make it practical and affordable—that's the difference between success and failure in technology.

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