

TEC BUYER'S GUIDE 2015

Special Edition

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Business Intelligence: Data Discovery and Visualization

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BI Buyer's Guide

Data Discovery and Visualization

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About This Guide

Organizations today are grappling with making sense of the incredible amount of data that they have at their disposal in order to make better business decisions. Companies across a wide range of vertical sectors have been using software solutions for years to uncover important patterns and trends hidden in their data and to visualize their data in new informative ways, allowing for informed and relevant decision making.

This buyer's guide presents the trends and opportunities for insight and informed decision making in the areas of business intelligence (BI), particularly data discovery and visualization. It provides a comprehensive overview of the wide spectrum of software solutions currently available on the market that can address the multitude of challenges associated with data discovery and visualization that different types of organizations face today. The guide is intended for business owners, managers, decision makers, and anyone interested in learning about the deployment of data discovery and data visualization solutions within their organizations. It offers guidance for the successful selection and deployment of a data discovery and visualization solution for any company.

The guide also presents and reviews the individual components of data discovery and data visualization solutions and their support of business processes. It offers comprehensive comparison charts of the features and functions of the different data discovery and data visualization software solutions currently available on the market. It also includes a variety of real-life case studies depicting how different companies have used specific data discovery and data visualization solutions to gain important insights and improve their business operations.

DATA DISCOVERY AND VISUALIZATION— UNCOVERING THE HIDDEN STORY BEHIND YOUR DATA

The analysis of data originating from disparate sources for the purpose of discovering patterns and behaviors is not a new practice. In fact, many academic institutions and businesses worldwide had been analyzing data in the hopes of achieving business insights for decades. But it is within the last decade that solutions permitting the discovery and visualization of data have grown dramatically—both in numbers and capabilities. As an integral component of the sciences and technology disciplines, data discovery and visualization has been used for at least a decade by many corporations looking at data as the raw material for business analysis and decision making.

The use of reliable data discovery solutions, along with effective ways to process, visualize, present, and consume the data, can have a great impact on the way organizations run and analyze their business. These solutions (regardless of their type, shape, or form) can help companies make informed and reliable decisions at all levels of the organization—increasing operational efficiency and business performance, and enhancing opportunities for success.

Nearly every organization in every vertical industry today exploits some form of data discovery activity and/or data visualization method for gaining data insights. Data discovery and visualization has become a vital part of any data management and/or business intelligence (BI) initiative, regardless of whether it comes from a traditional powerhouse BI solution provider or a modern newcomer. And those organizations aspiring to expand their business operations in the most efficient way possible know how important it is to have a modern BI and analytics initiative that relies on informative data discovery and visualization tasks.

STATE OF THE MARKET—DATA DISCOVERY AND DATA VISUALIZATION

The world is visual

The use of graphics, symbols, and figures for representing data has deep historical and academic roots. Data discovery and visualization has been used in fields ranging from cartography and history to economics and general science (figure 1), the historically has been about looking for new ways to enhance knowledge and obtain insights or transform data into useful and actionable information.

“Numbers have an important story to tell. They rely on you to give them a clear and convincing voice.”

Stephen Few, Founder,

Perceptual Edge

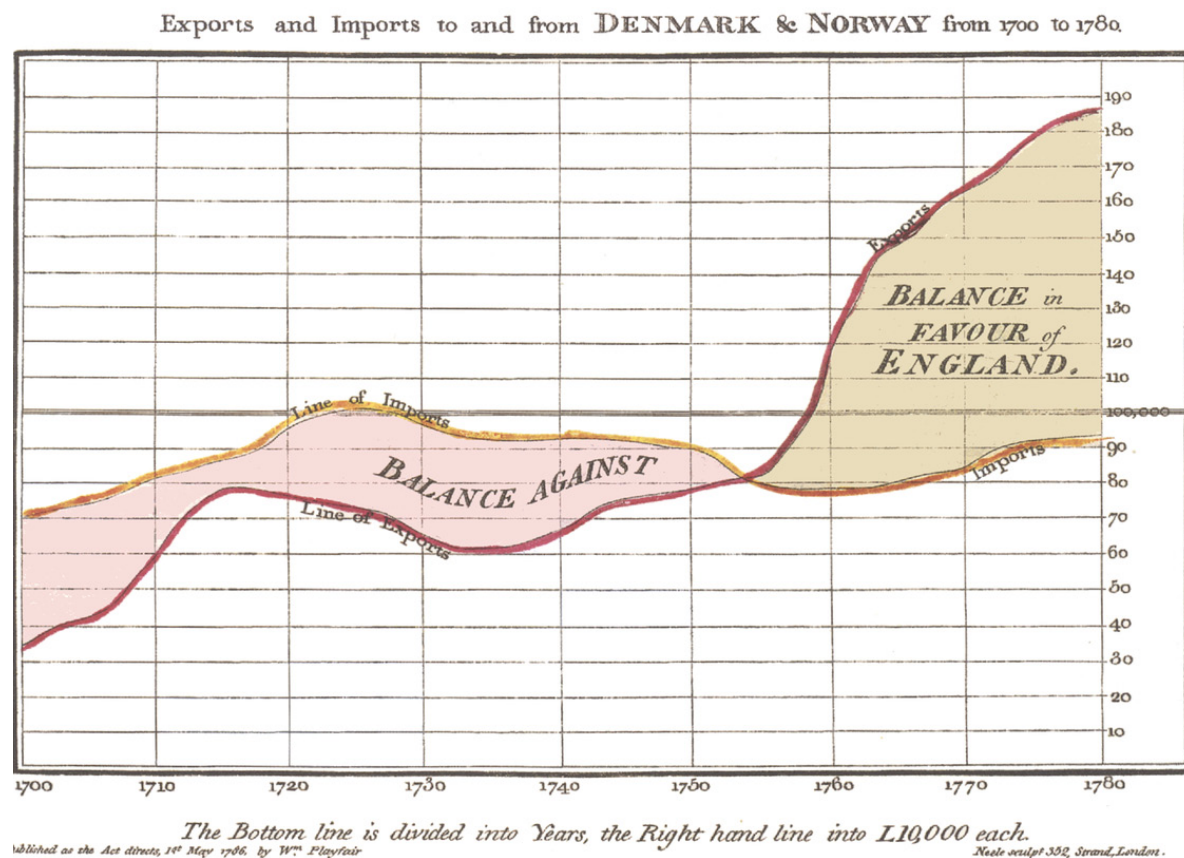


Figure 1. Trade-balance time-series chart, published in Commercial and Political Atlas (1786) by William Playfair

Data discovery and visualization techniques and solutions have come a long way—evolving dramatically from simple bar and time-series charts to the advanced and interactive dashboards that we have today connecting millions, if not billions, of data points originating from different sources. Today people across many organizations are increasingly adopting the use of charts and graphical elements to visualize data, such as financial data, and interact with information. Tools and software solutions are evolving at a rapid pace, and continuously reshaping the way organizations treat, analyze, and process data in order to gain insights and drive vital conversations and decisions.

The use of graphics can signal trends and suggest courses of action that will improve an organization's finances. Effective data dashboards and scorecards can allow upper management and operational management to have a full business view at a glance. These tools can also present effective ways to group, slice and dice, and intuitively process data—and enable trends, patterns, and anomalies to become more apparent. Graphical information can present data clearly and effectively, so that it is more intuitive, enabling users to interpret large amounts of data more efficiently.

Over the course of the last two decades, the fields of data visualization and data discovery have expanded in a number of ways. There has been an increase in the specific types of tools and functionalities available to users for data analysis. These include data discovery applications, dashboarding and scorecarding tools (see example in figure 2), as well as advanced analytics solutions. All of these use different techniques and methodologies to present information at different levels of detail as needed. Data visualization and data discovery have also expanded to serve a wider number of lines of business and industries.

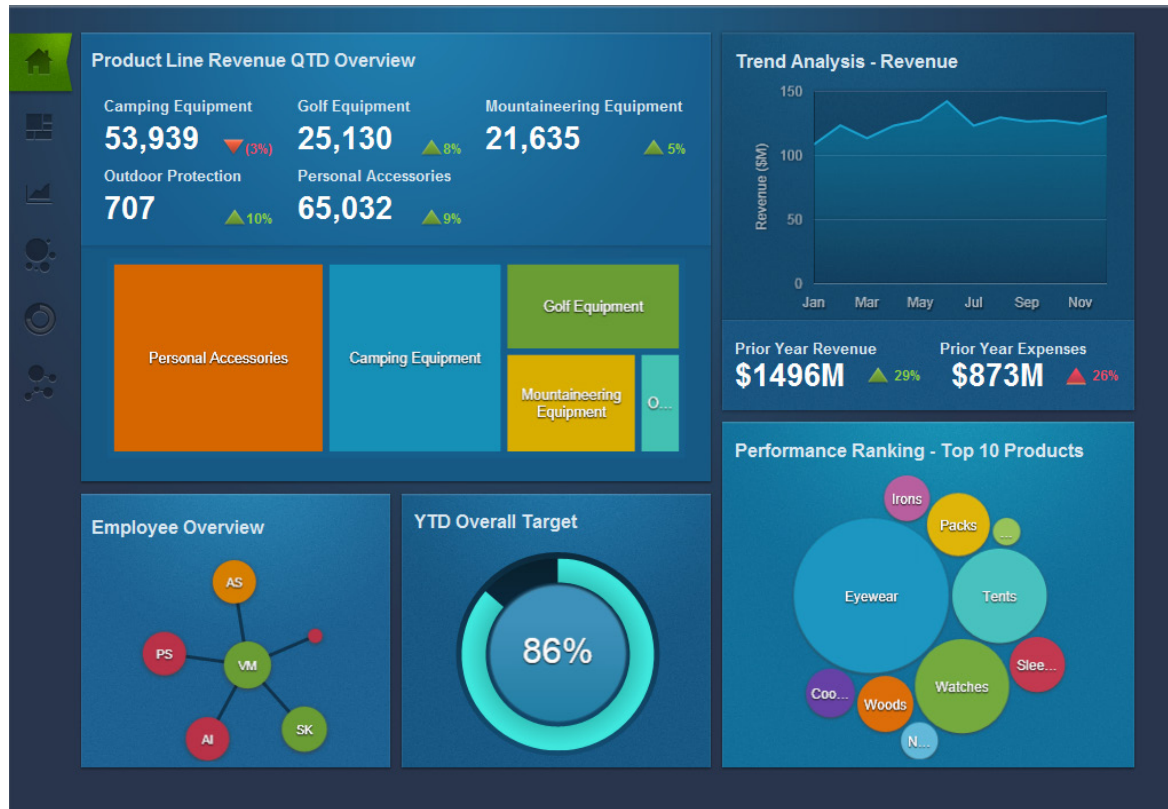


Figure 2. IBM Cognos Business Intelligence data dashboard and scorecarding (courtesy of IBM)

These are exciting yet challenging times for the analytics and data management market. Software providers need to continuously improve upon the myriad of innovative solutions with different capabilities already available on the market for users to unravel the secret messages inherent in data. Users need to be able to view and analyze relevant, contextual, and up-to-date company data to inform their understanding of the state of the business for better decision making.

Today, businesses, researchers, and individuals have a variety of tools at their disposal for exploring their data—dashboards and data discovery tools, scorecard applications, and analytics suites, among other software tools. Still, organizations need guidance to ensure that they exploit data discovery and visualization tools to their fullest potential for the best possible business advantage.

But there are numerous caveats. The discovery of innovative ways to collect, analyze, and visualize data comes with not only many benefits, but also new challenges regarding data privacy, governance, and misuse of data. The stage is set for a new era of BI and analytics solutions that acknowledges that, yes, the world is visual.

Data discovery and visualization: An academic perspective

Why the visual representation of knowledge?

Researchers from the University of Berkeley estimate that about 1 exabyte (1 million terabytes) of data is generated every year and most of it is available in digital form. As a result, technological advances must keep pace in order to allow today's computer systems to support the storage of increasingly larger amounts of data.

Nowadays, data is recorded from a vast number of sources and much of it is registered automatically—via sensors, monitoring systems, enterprise software solutions, mobile devices, etc. Even simple common daily transactions—such as paying by credit card, using the telephone, or placing an order via the web—are now typically registered by computers. The data is collected because people and organizations believe that it is a potential source of valuable information and can provide knowledge, insights, competitive advantage, or value of some sort. Still, finding the value within data can be a difficult task.

Due to their transactional nature, many traditional data management systems focus on showing just small portions of the data. And most of this data is presented in text format to explain specific transactions of interest (receipts, notes, individual patient records). The amount of data that can be displayed on screen will be at most in the range of a hundred data items. Another problem arises from the nature of the data itself. A limiting factor of data presentation is the increasing parameterization of data (according to time, place, type, etc.), increasing not only the volume but also the complexity of the data, resulting in data with increasing dimensionality.

Traditional data management systems are not very effective for dealing with data sets containing thousands or even millions of data items to be analyzed. It is simply impossible to explore these large amounts of data in an effective way; the data becomes useless and large databases become mere data repositories.

Using a method for visualizing data can allow the user to gain insight and come up with new ideas and hypotheses about what the data means. Exploring data in a visual way calls for an integrative process between the individual human and the software system—the user applies his/her perceptual abilities and transforms the data in a way that helps to better study large data sets. In addition, using visual discovery and data visualization can prove to be effective in at least three ways:

- Data visualization and discovery doesn't require an understanding of complex mathematical or statistical algorithms or parameters, enabling users to exploit them with a good level of efficiency. This is because they are intuitive by nature.
- Data discovery and visualization tools and techniques can make it easy for users to handle heterogeneous and noisy data.
- Visual data exploration techniques can provide a higher degree of confidence in the findings from the exploration process.

Thus, data discovery and visualization techniques and software tools can allow for faster data exploration with an acceptable degree of accuracy, as well as produce findings that are self-explanatory and do not require much analysis to derive value, as shown in the image below (figure 3).

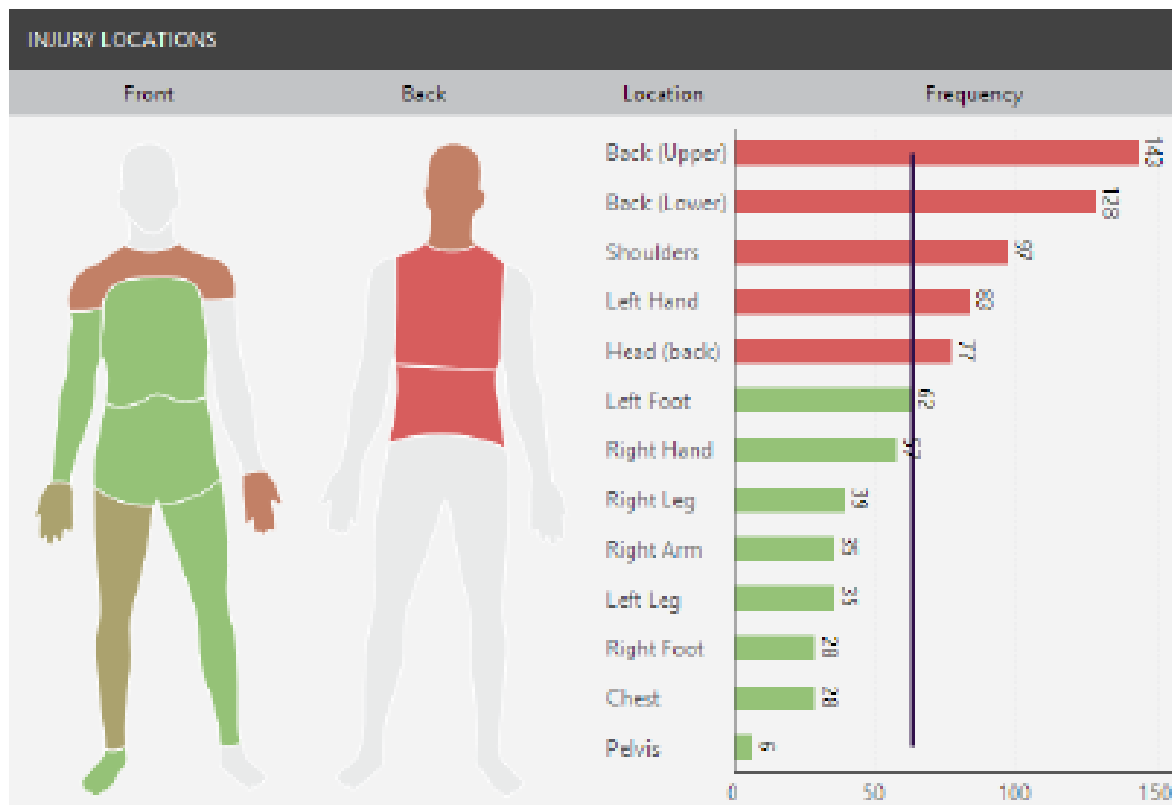


Figure 3. Example of faster data exploration with an acceptable degree of accuracy (courtesy of Dundas)

What is data visualization and discovery?

The main concept of data visualization and data discovery techniques and tools is to present the data in a visual form. And the main goal of this concept is to enable users to directly interact with the data, obtain insights from the data, reach conclusions based on the data, and perhaps even make important decisions based on the data. And while data visualization emphasizes how the data is laid out, data discovery techniques emphasize how data can be explored, particularly for large datasets.

Data discovery can be especially useful when there is not much information about the data, and when the goals of the exploration process are not precisely defined—making it possible to immediately adjust these goals as needed. Thus, data discovery and data visualization tools are increasingly on high demand. Nowadays, they are indispensable complementary tools to more automated exploration techniques, such as data mining, and traditional data analysis techniques, such as BI tools.

The visual information seeking mantra

Perhaps one reason why data visualization and discovery can be so easy to perform while being so powerful is that it usually follows an interactive process. [Ben Shneiderman from the University of Maryland](#), calls this process the *Visual Information Seeking Mantra*. The mantra states three main steps for visual data discovery (figure 4):

- **Overview first.** The user needs to get an overview of the data to identify patterns and focus his/her attention on one or more of these patterns.
- **Zoom and filter.** To analyze the patterns, the user needs to drill down and filter the data to get access to the details.
- **Details on-demand.** Depending on the visualization, the details on-demand technique can provide additional information about a certain data point without changing or modifying the original view, thereby adding context and clarity.

Based on this mantra, Mr. Shneiderman proposes that the data discovery process comprises seven tasks by data type taxonomy (dimensional aspects discussed below):

- **Overview:** Gain an overview of the entire collection.
- **Zoom:** Zoom in on items of interest
- **Filter:** Filter out uninteresting items.
- **Details-on-demand:** Select an item or group and get details
- **Relate:** View relationships between items.
- **History:** Keep a history of actions to support undo
- **Extract:** Allow extraction of subcollections of data and of the query parameters

He also proposes that there are six types of data in the context of data visualization:

- **1-dimensional.** For linear data types, including textual documents, program source code, and alphabetical lists of names organized in a sequential manner.
- **2-dimensional.** For planar or map data, including geographic maps, floor plans, or newspaper layouts.
- **3-dimensional.** For real-world objects such as molecules, buildings, and body parts.

- **Temporal.** For timelines, which are vital for visual representation.
- **Multidimensional.** For data that is mostly configured within relational and statistical databases.
- **Tree.** For data that is organized in hierarchies or tree structures, such as file directories or nodes within a network.

Data discovery and visualization technologies may be used for all three steps of the data exploration process. Essentially, data visualization techniques can be useful for showing an overview of the data, while the process of discovery allows for zooming in and filtering data to show the data on-demand. This in turn allows the user to identify and further explore interesting data subsets by drilling down to get the details about the data.



Figure 4. Most discovery and visualization solutions apply the Visual Information Seeking Mantra (courtesy of TIBCO Spotfire Metrics)

As these techniques and software technologies have evolved, the mantra has undergone many changes (some of which are discussed in the next sections of this guide). However, the Visual Information Seeking Mantra remains the fundamental starting point for considering the development and/or the use of data visualization and discovery technologies. In addition, current visualization technologies can provide the functionality not only for each one of these steps but also for closing the gaps between them. For example, they can give users the ability to collect, store, and analyze the data within the same solution or provide tools to mix both automated and manual discovery techniques, such as including trend lines within the discovery and visualization process.

And as these data discovery and visualization technologies and techniques have evolved, their adoption has increased significantly in many areas of research and in many industries. They have become a vital tool for complementing—not replacing—other automated data discovery techniques, such as data mining, predictive analysis, and machine learning. This evolution has also enabled the emergence of new trends in business software, mainly in the BI and analytics field, reinforcing the pervasiveness and evolution—due to ease of use—of self-service analytics tools and applications.

Data discovery and visualization as a practice

Knowing some of the basics of data discovery and visualization allows for understanding the importance of this area in any analytics cycle and how it fits within the practice of many disciplines, whether in research or in business. In this context, it is necessary to first consider data discovery and visualization as a practice and not just as a functional part of a particular type of software tool. In other words, data visualization needs to be considered not merely as a product—but as a discipline. This perspective implies that it is more than a set of functions and features. In this light, data discovery and visualization tools need to use the data to tell a story, and that story needs to be accurate, appealing, timely, and, most importantly, relevant.

Developing the right data visualization strategy entails ensuring that the approach complements the rest of the analytics platform and delivers on what is expected from the analytics infrastructure. From an analytics perspective, ideally the process of data discovery and visualization needs to offer:

- An accurate abstraction and interpretation of a real situation, issue, or scenario
- A simplified view that can be used for understanding, analysis, and potential explanation
- An environment for exploration of new potential business opportunities
- A tool for discovery of new analytic avenues—i.e., new trends and facts
- A possible indication of appropriate action

Despite the evolution of software and hardware technology for providing new methods for data visualization, new more impactful and more efficient visualization models still need to be devised. Regardless of the technological innovation, the underlying principles remain the same—enabling users to achieve knowledge and wisdom from the analysis of information.

Data discovery and visualization in the context of BI and analytics

A large number of organizations have already implemented or are in the process of implementing a BI or analytics solution of some kind. Of course the main goal is to enable business analysts, decision makers, and other information workers to monitor, understand, and improve the performance of their business.

As businesses have increased their demand for and consumption of data, a large proportion of this data has fallen outside the reach and scope of traditional BI solutions. This is not to say that some traditional BI solutions do not have the flexibility that a flexible and versatile data discovery and visualization solution has. But data analysis today has been complicated by the different sources and formats of the data that is now available to companies. These sources can range from structured database tables and semi-structured forms to unstructured documents such as free-form text.

Data discovery and visualization solutions can enable rapid and more intuitive exploration and analysis of this widely varied data. It can also provide more interactive and flexible ways to analyze data and uncover insights, affording a new level of visibility into data and business processes. Some benefits may include:

- Easier access to recent data. Data can be delivered in real time or near real time. Users then can analyze and make decisions based on the most recent data at their disposal.
- Increased insight and visibility into the repository of data to help users to find the right data for analysis.
- Data sources (assets) can be reused and discoveries saved—avoiding having to recreate the discovery process each time, thereby helping companies to reduce costs.
- Information workers can create user-oriented discovery artifacts to enable business professionals exploit the available data. This can lead to higher adoption rates and faster time to value of data discovery and visualization solutions.

In the context of incorporating new technologies into the BI and analytics practices of the business, the basic principles of data management remain the same:

- Data is the source of information, and therefore of knowledge and wisdom (figure 5). As such, data must be presented appropriately, in the right context, and at the right time to facilitate decision making and encourage appropriate action.
- Maintaining high-quality data throughout the entire process—from collection to delivery—is key to deriving the highest possible value.
- The success of a BI and analytics solution in producing value depends on how data is not only processed but also delivered and consumed.

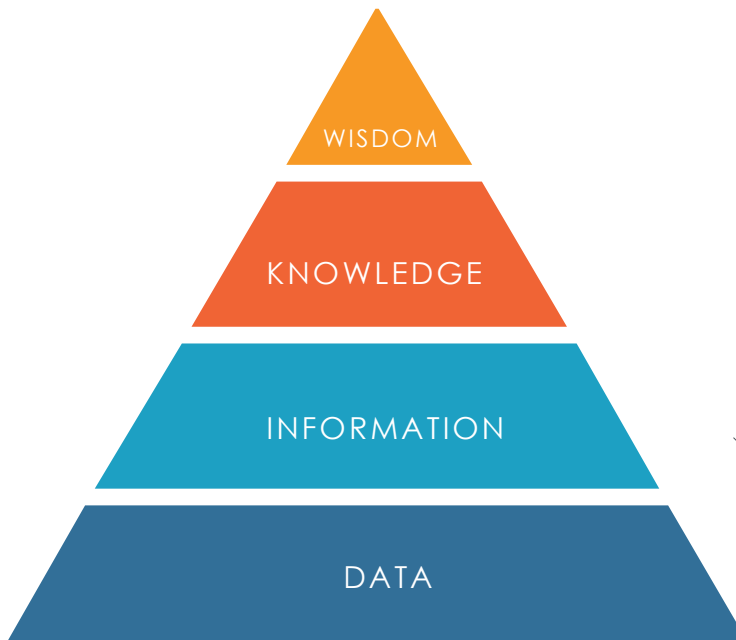


Figure 5. Knowledge pyramid

As analytics and BI practices evolve, it is becoming increasingly evident that a data discovery and visualization tool is needed for delivering data to its final consumer, whether this is an information worker, a business analyst, or a decision maker. Multiformat, multipurpose information must be generated to supply information in the form of the right story to the right people at the right time.

In modern analytics and BI infrastructures, data discovery and visualization capabilities are perhaps the most important vehicle for delivering and transforming data into knowledge. They are fundamental requirements for gaining an understanding of increasingly complex business processes and for generating insight to encourage more informed decision making.

In [Designing Data Visualizations](#), Noah Iliinsky and Julie Steele define important aspects of discovery and visualization as follows:

“Explanatory visualization: Data visualizations that are used to transmit information or a point of view from the designer to the reader. Explanatory visualizations typically have a specific ‘story’ or information that they are intended to transmit.

Exploratory visualization: Data visualizations that are used by the designer for self-informative purposes to discover patterns, trends, or sub-problems in a data-set. Exploratory visualizations typically don’t have an already-known story.”

So having data discovery and visualization capabilities allows modern businesses to either arrive at answers to specific questions based on the explanatory nature of visualizations, or to discover new questions and solutions via their exploratory nature (figure 6).

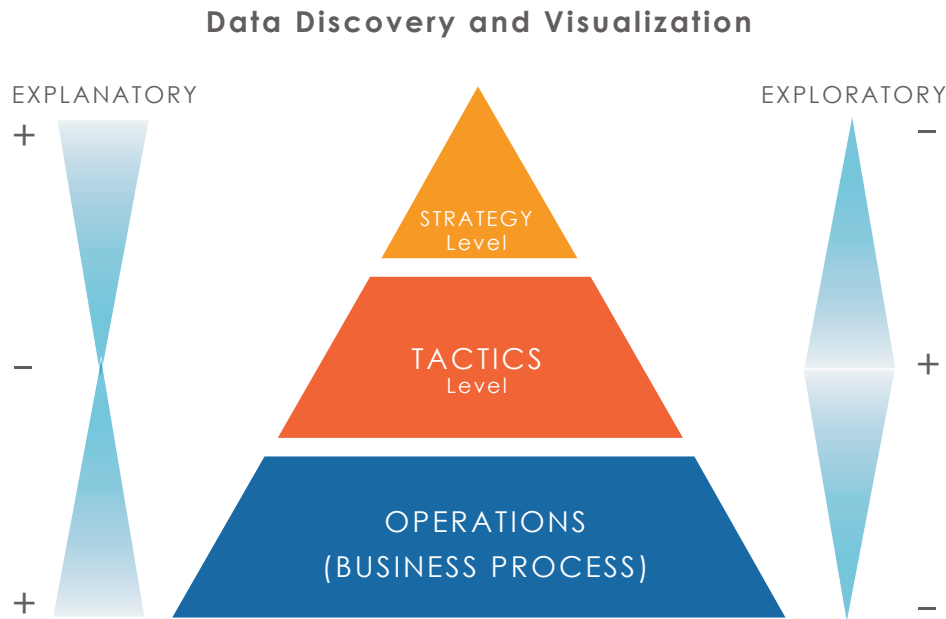


Figure 6. Explanatory versus exploratory visualization usage

Explanatory visualization processes, such as reports and data-driven dashboards, tend to have strong presence in operational and strategic processes or levels. Here the data plays an explanatory role, to facilitate decision making that not only drives and enhances operations, but also improves the business's strategy over the long term. On the other hand, information workers, such as business analysts and data scientists, can “play” with data for tactical purposes: to discover trends and uncover new questions worth asking—for exploratory purposes.

Data visualization in decision making

The practice of data visualization has been progressively taking on a key role in the decision-making process. While improving decision making at executive levels, data visualization also helps to expand the reach of analytics throughout an organization. As a result, the data visualization process is becoming a more relevant and integral aspect of the BI toolset.

The intrinsically dual nature of data visualization—explanatory and exploratory—enables information workers and especially decision makers to base their production on clear and concise visuals. These visuals can be more effective than showing raw data within text

reports or complex electronic sheets. Visual mechanisms can also be used easily for further exploration if additional data is needed to make informed decisions. While decision makers do not necessarily produce the data visuals, they hold them in great regard. Modern tools provide highly interactive data visualization capabilities that enable fast and useful analysis cycles.

The importance of data visualization can be felt in all areas of the organization. Data visualization can have a significant effect on major aspects of decisions made at all levels of the organization—from operational to executive decisions. It has proven critical for:

- Improving operational efficiency
- Detecting and responding to business change
- Identifying business opportunities
- Measuring and monitoring business productivity
- Increasing compliance to both internal and external regulations

Finally, data visualization helps to align the complete decision-making structure, and can even enable more accurate communication company-wide.

DATA DISCOVERY AND VISUALIZATION IN THE BUSINESS PLACE

The right practices and the right tools

Encouraging the use of data discovery and visualization strategies, practices, and solutions is an essential aspect of a modern BI and analytics initiative. Both explanatory and exploratory data visualization tasks can help users discover and resolve problems, analyze large sets of data easier and faster, and obtain results in real time or near real time due to the extreme speed of new hardware and software technologies.

Moreover, having effective data discovery and visualization tools in place helps to not only solve issues but also pose new relevant questions. This encourages the discovery and research process to go beyond pre-established data analysis tasks to explore new patterns and trends that can potentially boost business efficiency. So in essence, data discovery and visualization solutions are a critical component to the BI and analytics process and are paramount to effective data delivery, yet they also incentivize the spirit of original research of data analysis.

Data discovery and visualization tools can allow workers at all levels of the organization—from BI specialists who need to generate the right report, to data scientists who want to explore the data—to use data analysis tools according to their needs. This may include, for example, financial analysts who need real-time information presented in a clear graphical way and data scientists who combine the capabilities for visual slice-and-dice data sets with mining elements such as forecasts and trends.

Challenges

As with any software technology, data discovery and visualization solutions are associated with various challenges. These challenges must be overcome to ensure the efficient practice and operation of data discovery and visualization from both the application and technology perspectives.

A main challenge in a BI and analytics context is to ensure the consistent analysis of data from multiple perspectives and assumptions. The goal is to achieve an understanding of past and present business scenarios and allow for collaborating in all aspects of the analytical process: monitoring, forecasting, and identifying specific recurrences. Under these circumstances, the effectiveness of data discovery and visualization tools also has to do with addressing the following needs:

- **Achieve real-time analytics.** Creating new use cases for data discovery and visualization as well as using new tools that can provide responses at high speed, and be more adaptive and flexible.
- **Gain data discovery and visualization insights into big data projects,** where it is both important and more challenging because of not only the volume of data that must be analyzed but also the diversity of sources and formats of the data (figure 7).
- **Make BI and analytics way more agile** as overall information workers (BI teams, business analysts, data scientists, and decision makers) need to rely on faster and more iterative and efficient methods of turning data into actual business value.

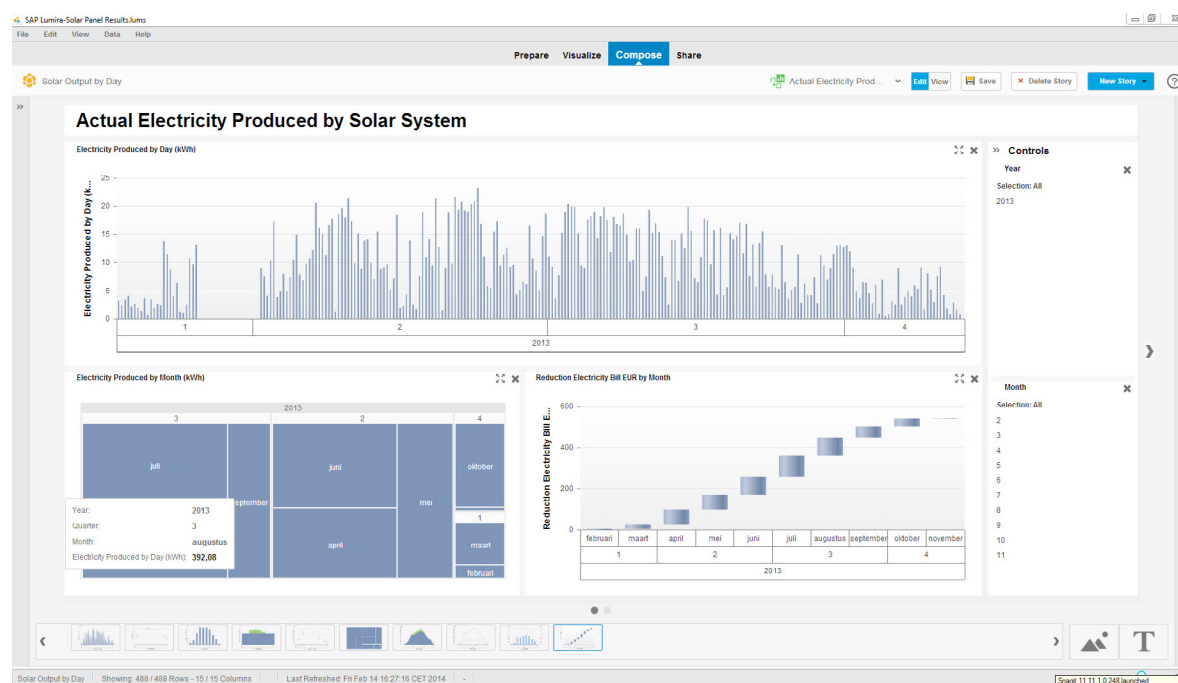


Figure 7. Data discovery and visualization in big data projects (courtesy of SAP [SAP Lumira])

Today's information workers have already recognized the vital importance of data discovery and visualization. While there is a need for better tools and methods, the efficiency and results of these efforts can vary widely depending on the knowledge and practices applied. A good tool must be accompanied by a good method. Data discovery processes are being performed more frequently and in more diverse ways as a complement to every step of the business process. Data discovery and analytics applications can help, for example, analysts to obtain insights and understand the history and development of the stock market. They can also support the decision-making process of an organization—by monitoring the stock market in real time to help take proper actions to gain a specific competitive advantage or gain insights for establishing a more general tactic or strategy.

Also, in many cases, the discovery process can and must become a cycle where the analysis of data to find answers to specific questions helps uncover new areas that require closer examination and new questions that need to be addressed. This results in the collection and analysis of new data sets to produce an ever-improving cycle of discovery.

From a more technical point of view, some of the challenges reside in ensuring that a data visualization strategy contemplates the necessary elements:

- Ensuring a proper **data governance** approach. As users increase their demands for data exploration and gain access to larger and comprehensive datasets for achieving new insights, frustration can quickly set in when access to new data is restricted or denied by the information technology (IT) department. The role of IT is to ensure that all enterprise data is accurate, complete, but, most importantly, secure. With the increase in data volumes, this mandate sometimes places a big burden on IT—to manage the manpower and storage requirements, management costs, as well as data protection issues. And many times it is within data protection in the context of data discovery and visualizations that conflict emerges. This conflict often relates to restrictions and limitations to data availability. IT must find a balance between ensuring that high-quality data is secure from internal as well as external threats while satisfying users' need to access and analyze the data.
- Ensuring efficient and proper **data quality** processes to avoiding uncertainty and provide reliability in data as much as possible. There is a strong association between the quality of the data source and the quality of the information (insights) it can generate. In almost all application fields—ranging from natural sciences to business and information security—data is processed and arranged in many ways and passed through different stages. Ensuring that data is passed through the necessary quality stages is vital to maintaining a clean and efficient discovery and visualization process—from beginning to end.

- Ensuring a full understanding of both the **business logic** and the **problem-solving mechanism**. Problems ought to be solved by understanding not only the data discovery and visualization technology but also the logic, reasoning, and methodologies within diverse fields of business knowledge, problem solving, decision engineering, and decision management, and others disciplines in which the data discovery and visualization technology is being used.
- Ensuring **user adoption and acceptability** to enable new data discovery and visualization techniques to be widely used within an organization. The advantages and proper use of data discovery and visualization tools need to be communicated effectively to all the potential users.
- Ensuring **continuous evaluation** and comparison with previous and parallel systems to enable the continuity and improvement of the data discovery and visualization solution.

In addition, rather than solving these problems individually, it is more important to have an integrated approach or initiative that can provide global solutions to address challenges (despite the difficulty that might represent in the short term). The reality is that the vast majority of these types of solutions need to be effectively integrated within a larger number of solutions, including databases of different flavors, enterprise software solutions, automated analysis tools, and many others. Data discovery and visualization solutions need to fit within a comprehensive BI or data management solution.

Organizational benefits

Data discovery and visualization tools have to keep revolutionizing the BI market in a very significant way—facilitating the provision of self-service BI capabilities. A widespread trend in this area is the simplification of business intelligence—empowering knowledge workers to use data as needed and effectively reduce and simplify processing time from data collection to decision making.

In this sense, some of the clear benefits of these types of tools can be reflected in many aspects of both traditional and modern BI processes. They play an important role in the following:

- Increasing operational efficiency.
- Increasing effectiveness for detecting/responding to business changes.
- Increasing collaboration for identifying business opportunities.
- Increasing means for measuring/monitoring business productivity.

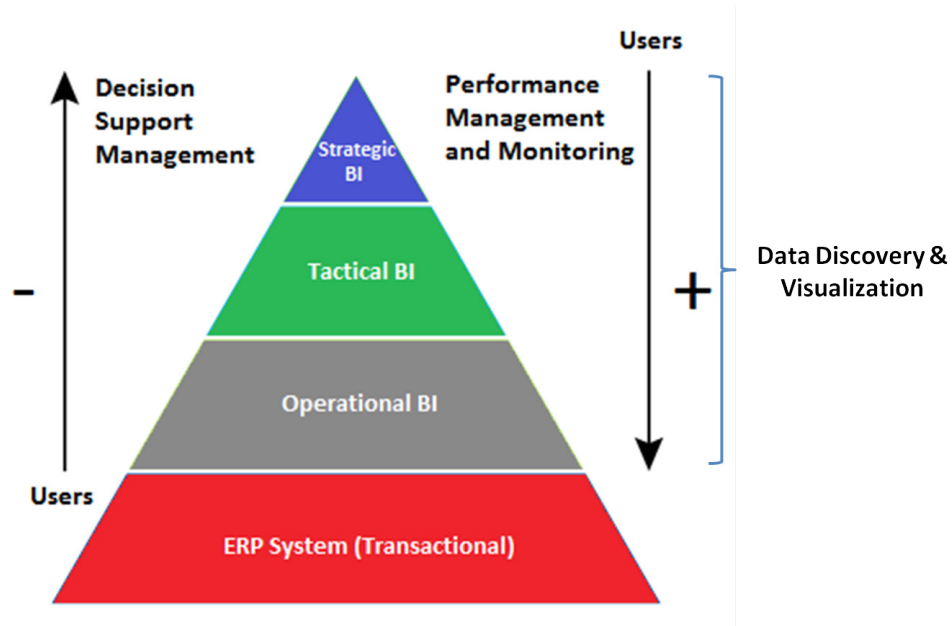


Figure 8. Data discovery and visualization solutions are key players in encouraging the use of data analysis in all stages of the business

The increasing adoption of data discovery and visualization technologies, along with other automated analytics techniques such as predictive and machine learning, are encouraging the so-called datification phenomena. Described by Kenneth Cukier and Viktor Mayer-Schönberger in articles such as [The Rise of Big Data](#), these phenomena denote the organization's ability for processing data from all types of sources and all types of formats as being limited only by the creative and analytic abilities of its users. This represents a real shift to the traditional approaches to data in BI and analytics.

Trends

As data discovery and visualization technologies have evolved in many business and industries, some clear trends have emerged as important factors driving the adoption of these tools. Below is a list of important trends based on my observations of the industry:

- **Mobile.** Continuous increase of usage of data discovery and visualization tools within mobile devices—enabling users to consume data independently of the device (figure 9).
- **Self-service plus automated analysis.** An increase in the merging of automated (mainly predictive analysis and machine learning techniques along with other techniques) within self-service and interactive visualizations—granting access of advanced analytics tools to a wider and inexperienced user audience while closing gaps within some analytics processes (figure 10).

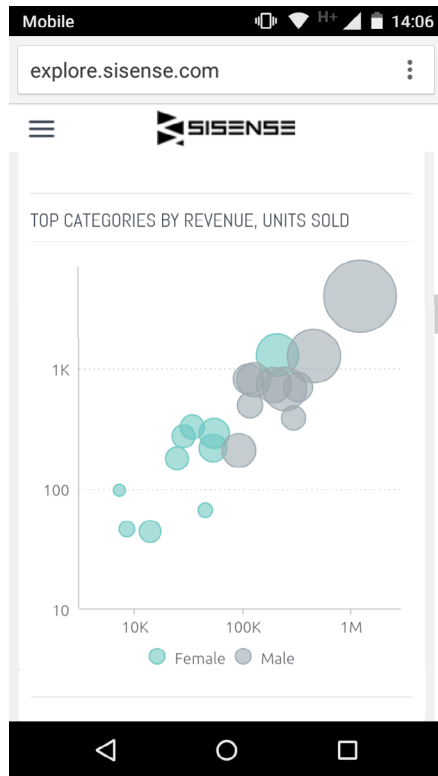


Figure 9. Data discovery and visualization on a mobile device (courtesy of Sisense)

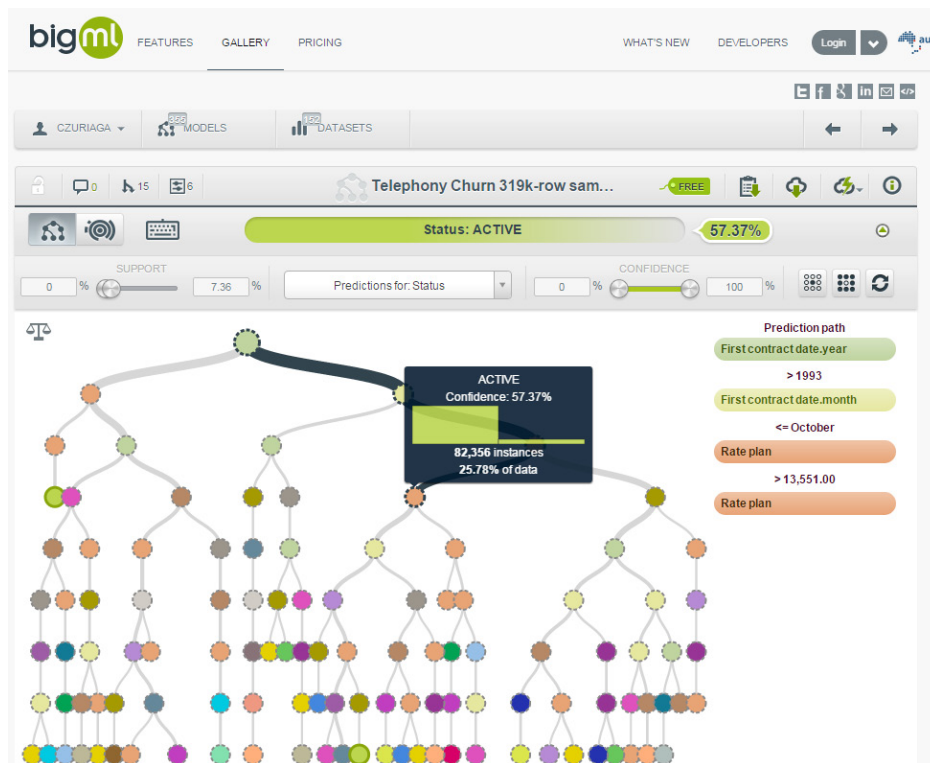


Figure 10. Data discovery and machine learning via BigML (partial image; [full image available](#), courtesy of BigML)

- **Guidance tools.** The incorporation of tools for helping users through the process of analysis (guided analysis). This can range from automatic recommendation of graphs based on the type of data to the selection of a specific predictive algorithm based on a best practice scenario. Many software providers of data discovery tools are increasingly offering these guidance tools in their software packages.
- **Story telling.** Many software providers are expanding the capabilities of data visualization tools beyond the ability to show data in an effective way—to enabling users to build a full story about or scenario around the data. From creating connected series of visualizations to full-blown slide-like presentations, some data visualization products seek to empower users by enabling them to build the full story behind the data (figure 10).
- **Data mashups.** The need for faster elaboration of analytics processes has created a need for new and diverse sources of data. In some cases, data needs to be analyzed on the spot without having a rigorous data quality and profiling process. One example of this would be for sampling or analyzing a very recent event. More and more software providers are enabling the collection of data from both conventional and “unconventional” sources to produce new visualizations in real time. This creates mashups of data visualized in real time. These collections of data can help organizations gain immediate insight into emerging trends and business opportunities.

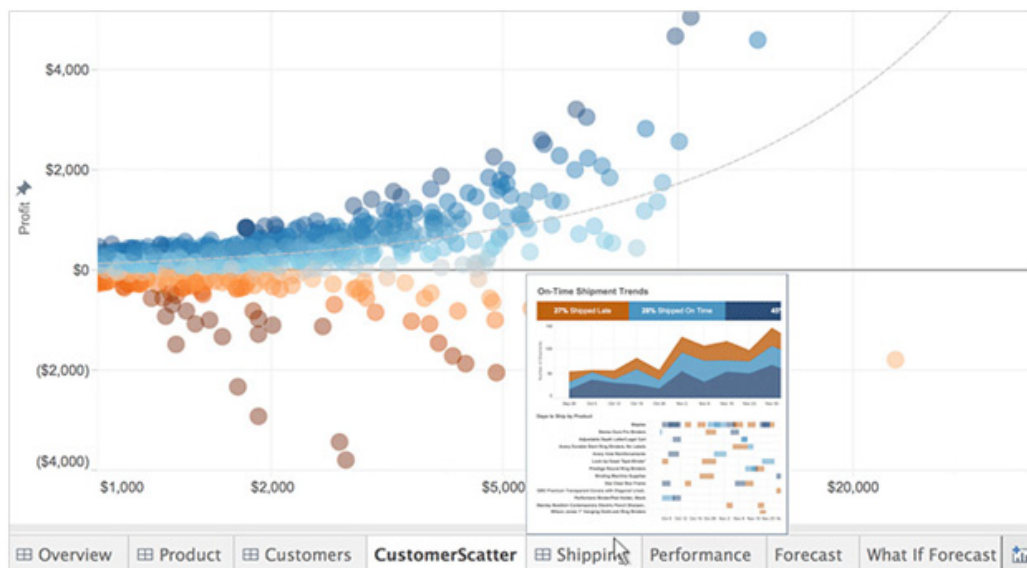


Figure 11. Tableau's storytelling capabilities in preview thumbnails (courtesy of Tableau)

Other trends currently being adopted by some organizations include the incorporation of even more advanced analytics capabilities such as cognitive computing techniques. The case of IBM Watson is an example that can have a huge potential impact over the analytics and business intelligence market.

Watson Analytics, an advanced analytics solution offered by IBM, is what the company calls a “smart data discovery” solution. It uses a mix of analytics techniques and methods such as predictive analytics, machine learning, and advanced cognitive techniques like neural networks and artificial intelligence to automate the process that goes from collection, through analysis, to insight. The potential of Watson resides in the system’s ability to start the analytics process via a simple query, even a simple question in natural language.

The tool has the potential to be applied in multiple scenarios and use cases. For example, Watson Analytics can help companies to expedite their risk management strategies. In this case, it can help a utilities company, for example, reduce employee turnover, number of accidents of a fleet, or asset downtime by analyzing data in real time and detecting failure patterns within the company.

These and other cases are just a few of the large number of potential applications of technologies such as IBM Watson Analytics. Other relatively new offerings include CognitiveScale and the manufacturing-based solution SaffronStreamline. CognitiveScale delivers cognitive applications in the cloud via its Cognitive Cloud Fabric offering. And SaffronStreamline applies and combines semantic connection and raw statistical frequency techniques to offer systems that adapt as new data is received.

While a significant number of new and innovative solutions are already having a large impact on the market, new offerings are taking the software industry for surprise and rapidly evolving the data discovery and visualization market. Without a doubt, we are far from hearing the last word on these types of solutions.

DATA DISCOVERY AND VISUALIZATION SOLUTIONS

This buyer's guide provides a comparison of the general capabilities of 10 vendors of data discovery and visualization solutions that are considered to be innovative.

Besides some general considerations on the vendor solutions featured, including geographic coverage, licensing and pricing schemas used, and whether the solution complies with established regulations, this guide also explores some of the most important capabilities to consider when evaluating data discovery and visualization solutions, including data security and data movement as well as integration with big data sources.

These vendors have extensive functional coverage and/or have a strongly marketed presence in the cloud BI and analytics software space. This is by no means an exhaustive set of all vendors that exist in the market. Not all solutions currently available in the market can be included here due to space limitations.

Please note that the information provided here is intended as a guide only, and is meant as a starting point for software evaluation. To determine whether a particular solution meets your organization's specific requirements, you will need to conduct a more comprehensive evaluation and comparison analysis (and consider factors such as reliability of partner network, implementation, and maintenance and support services, among others).

Data Discovery and Visualization Solutions		InetSoft	Qlik	GoodData Corporation	Microsoft
Criteria		Style Intelligence	Qlik Sense	Analytics Distribution Platform	Power BI
Region Served	North America	S	S	S	S
	Central and South America	S	S	T Via TOTVS	S
	Asia-Pacific	S	S	S	S
	Europe, the Middle East, and Africa	S	S	S	S
Delivery Mode	On premise	S	S	NS	S
	SaaS (multitenant/virtual)	NS	S Free version only	S	S
	PaaS (hosted via a public cloud provider)				
	Amazon AWS	S	S	NS	NS
	Google Cloud Platform	NS	S	NS	NS
	Red Hat OpenShift	NS	S	NS	NS
	Rackspace	NS	S	S	NS
	Windows Azure	NS	S	NS	S
	Other	NS	S	T GoodData operates its own private cloud; hardware is provided by Rackspace	NS
Licensing and Pricing	Subscription-based				
	By user/role	S	S Perpetual, not subscription	S	S
	By node/server	S	S Perpetual, not subscription	S	NS
	Consumption-based				
	By data storage/access	NS	NS	S	NS
	By processor/data usage	S	NS	NS	NS
Security	Encryption of data at rest and data in transit	S	S	S	S
	Role/User-based security	S	S	S	S
Data Movement	Data is hosted within internal repository	NS	S	S	NS
	Data is passed from the source to the BI app	S	S	S	S
Analysis	OLAP services	S	S The associative model—not cube based—delivers unrestricted exploration and discovery	S	S
	In-memory analytics capabilities	S	S	S	S
	Operational analytics/BI capabilities	S	S	S	S
Advanced Analytics	Predictive analytics	T	T	S	S
	Data mining	T	S	A Via Vertica and connection with R	S
	Machine learning	NS	NS	S	S
	Text/Sentiment analytics	T	T	S	S
Data Visualization & Discovery	Interactive visualization	S	S	S	S
	Visual drill-down/up/across	S	S	S	S
	Chart and visual recommendations	S	S	S	S
	Reporting and analysis	S	S	S	S
	Dashboarding	S	S	S	S
	Metrics and KPI creation on the fly	S	S	S	S
	Sorting and ranking	S	S	S	S
	Addition of unstructured data	T	T	S	S
	Enterprise data search	NS	S Global search within BI app across all dimensions	S	S
	Geospatial capabilities	T	S	S	S
	Collaboration over data and analysis	S	S	S	S
	Microsoft Office integration	S	S	S	S
	Storytelling features	NS	S	S	S
	Guided discovery	NS	S	S	NS
	Data preparation	S	S	S	S
	Metadata management	S	S	S	S
	Data quality	NS	S	S	NS
	Data integration	S	S	S	S
	Offline capabilities	NS	S Qlik Sense Desktop for Windows	NS	S
Big Data Integration	Hadoop	S	S	S	S
	Hive	S	S	S	S
	HBase	T	S	S	S
	Cassandra	T	S	S	S

S Supported | A Supported with additional application | T Supported with third-party provider (partner) | NS Not supported

BI, business intelligence; KPI, key performance indicator; OLAP, online analytical processing; PaaS, platform as a service; SaaS, software as a service.

Data Discovery and Visualization Solutions		Dundas	IBM	IBM	SAP
Criteria		Dundas BI	Cognos Business Intelligence	Watson Analytics	SAP Lumira
Region Served	North America	S	S	S	S
	Central and South America	S	S	S	S
	Asia-Pacific	S	S	S	S
	Europe, the Middle East, and Africa	S	S	S	S
Delivery Mode	On premise	S	S	NS	S
	SaaS (multitenant/virtual)	NS	S	S	S
	PaaS (hosted via a public cloud provider)				
	Amazon AWS	S	NS	NS	S
	Google Cloud Platform	S	NS	NS	NS
	Red Hat OpenShift	NS	NS	NS	NS
	Rackspace	S	NS	NS	NS
	Windows Azure	S	NS	NS	S
	Other	NS	NS	NS	S SAP HANA Enterprise Cloud
Licensing and Pricing	Subscription-based				
	By user/role	S	S	S	S
	By node/server	NS	NS	NS	NS
	Consumption-based				
	By data storage/access	NS	NS	S	S
	By processor/data usage	NS	NS	NS	NS
Security	Encryption of data at rest and data in transit	S	S	S	S
	Role/User-based security	S	S	S	S
Data Movement	Data is hosted within internal repository	S	S	S	S
	Data is passed from the source to the BI app	S	S	NS	S
Analysis	OLAP services	S	S	NS	T
	In-memory analytics capabilities	S	A	S	S
	Operational analytics/BI capabilities	S	S	NS	A
Advanced Analytics	Predictive analytics	S	A	S	S
	Data mining	NS	A	S	A
	Machine learning	NS	NS	NS	A
	Text/Sentiment analytics	NS	A	NS	A
Data Visualization & Discovery	Interactive visualization	S	S	S	S
	Visual drill-down/up/across	S	S	S	S
	Chart and visual recommendations	NS	S	S	S
	Reporting and analysis	S	S	S	S
	Dashboarding	S	S	S	S
	Metrics and KPI creation on the fly	S	A	NS	S
	Sorting and ranking	S	S	S	S
	Addition of unstructured data	T	NS	NS	S
	Enterprise data search	S	NS	NS	A
	Geospatial capabilities	S	S	NS	S
	Collaboration over data and analysis	S	S	S	A
	Microsoft Office integration	S	S	S	A
	Storytelling features	S	NS	S	S
	Guided discovery	S	A	S	S
	Data preparation	S	NS	S	S
	Metadata management	S	S	NS	A
	Data quality	A	A	S	S
	Data integration	S	S	NS	S
	Offline capabilities	NS	S	NS	S
Big Data Integration	Hadoop	T	S	NS	S
	Hive	S	S	S	S
	HBase	T	NS	NS	T
	Cassandra	T	NS	NS	T

Data Discovery and Visualization Solutions		SAP	Sisense	Tableau	Panorama Software
Criteria		BusinessObjects Business Intelligence	Sisense	Tableau Server, Desktop, Online	Panorama Necto
Region Served	North America	S	S	S	S
	Central and South America	S	S	S	T
	Asia-Pacific	S	S	S	S
	Europe, the Middle East, and Africa	S	S	S	S
Delivery Mode	On premise	S	S	S	S
	SaaS (multitenant/virtual)	A SAP HANA Enterprise Cloud	NS	S	S
	PaaS (hosted via a public cloud provider)				
	Amazon AWS	S	S	T	S
	Google Cloud Platform	NS	NS	NS	NS
	Red Hat OpenShift	NS	NS	NS	NS
	Rackspace	NS	S	NS	NS
	Windows Azure	S	S	NS	S
	Other	NS	S	NS	S
Licensing and Pricing	Subscription-based				
	By user/role	S SAP HANA Enterprise Cloud & AWS via Decision First	NS Scalable annual pricing	S	S
	By node/server	NS	NS Scalable annual pricing	NS	S
	Consumption-based				
	By data storage/access	S Concurrent sessions	S	NS	NS
	By processor/data usage	S In old license	S	NS	NS
Security	Encryption of data at rest and data in transit	S	S	S	S
	Role/User-based security	S	S	S	S
Data Movement	Data is hosted within internal repository	S Lumira Server	S	NS	NS
	Data is passed from the source to the BI app	S	S	S	S
Analysis	OLAP services	S	NS	S	S
	In-memory analytics capabilities	A SAP HANA optional	S	S	S
	Operational analytics/BI capabilities	S	S	S	S
Advanced Analytics	Predictive analytics	A Via SAP HANA	S	T	S
	Data mining	A Via SAP HANA	S	T	NS
	Machine learning	A Via SAP HANA	NS	NS	S
	Text/Sentiment analytics	A Via SAP HANA	T	T	NS
Data Visualization & Discovery	Interactive visualization	S	S	S	S
	Visual drill-down/up/across	S	S	S	S
	Chart and visual recommendations	S	S	S	S
	Reporting and analysis	S	S	S	S
	Dashboarding	S	S	S	S
	Metrics and KPI creation on the fly	S	S	S	S
	Sorting and ranking	S	S	S	S
	Addition of unstructured data	S	S	NS	S
	Enterprise data search	A	S	S	S
	Geospatial capabilities	S	S	S	S
	Collaboration over data and analysis	A	S	S	S
	Microsoft Office integration	S	T	S	S
	Storytelling features	S	T	S	S
	Guided discovery	S	S	S	S
	Data preparation	S	S	S	S
	Metadata management	A	S	S	S
	Data quality	A Via SAP Data Services	NS	S	S
	Data integration	A Via SAP Data Services	S	T	S
	Offline capabilities	S	S	S	NS
Big Data Integration	Hadoop	T Via Apache HIVE	S	S	S
	Hive	A Via SAP HANA	S	S	S
	HBase	T Via Apache HIVE	A	S	S
	Cassandra	T Via Apache HIVE	A	S	NS

S Supported | A Supported with additional application | T Supported with third-party provider (partner) | NS Not supported

BI, business intelligence; KPI, key performance indicator; OLAP, online analytical processing; PaaS, platform as a service; SaaS, software as a service.

ASSESSING YOUR DATA MANAGEMENT AND DISCOVERY READINESS

From small to medium businesses (SMBs) to large corporations, one of the biggest challenges today is the “data management and discovery” aspect of an organization. In many organizations, data comes from an increasing number of (and increasingly disparate) sources. These sources can be enterprise resource planning (ERP) systems, customer relationship management (CRM) applications, workforce automation systems, etc.

Today, organizations are generating an increasing amount of data. This is because they are generating more data transactions, and there is more interaction between systems—both internal and external to the organization. To be able to discover and visualize data properly, companies need to effectively manage their data. Most of the time, an organization’s inability to manage its data as needed reflects difficulty (or impossibility) with obtaining a snapshot of the business at any given moment. But it also has to do with being unable to obtain the necessary insight for planning and taking action. The end result is that the decision-making process, business performance, and the ability to predict and forecast are all impeded.

While organizations are eager to grow, they may risk losing control over the business and its infrastructure if the proper measures are not in place for expanding their corporate applications. This is especially pertinent for those applications that enable data discovery and analysis as well as the creation of frameworks for strategic planning and decision improvement. Regardless of the number of triggers present in your organization for improving data discovery and visualization technologies, it is necessary to address three fundamental questions:

- Where do you stand in regard to properly handling data?
- What are your urgent data management needs?
- How do you evolve from reactively to proactively handling your organization’s data?

To answer these questions, it is important to consider the maturity level of your data management infrastructure and strategy. This will help you to describe, explain, and evaluate the growth cycle of your current BI infrastructure across the different stages of the data management process. It will therefore serve as the basis for establishing how your data discovery and visualization capabilities can evolve and for addressing specific high-priority needs.

The data readiness assessment questionnaire included in this guide provides a quick overview of some of the criteria to consider when assessing the maturity of your current data management and discovery platform solution. It can help you determine how well your organization is dealing with data for analysis, discovery, and visualization.

For each BI element, identify the closest match to your organization's profile and add the corresponding number of points (indicated under each question). Tally your total score, and then refer to the legend below this grid for your results.

Phase		√	Value
Data Management	Data is stored and collected from source systems (ERP systems, CRM applications, etc.) with no integration		2
	Data is collected from enterprise systems (ERP, CRM, etc.) and copied into special repositories (data marts)		2
	Data is collected from source systems (ERP, CRM, etc.) into a more sophisticated repositories (data warehouses, enterprise information management [EIM] systems)		6
	Data is collected from source systems (ERP, CRM, etc.) and there is a corporate data management strategy (data warehouses, enterprise information management [EIM] systems, data marts) in place to serve different business needs		8
Data Collection	Data is collected by a combination of manual and automatic processes		2
	Data is collected mainly using automatic extraction, transformation, and loading processes		6
	Data is collected from a wide variety of sources, both historical and real time (social media sources, business activity monitoring [BAM] systems, etc.)		8
	Data is collected in different formats (structured, unstructured)		10
Data Quality	No data quality and cleansing strategy		2
	Basic data quality and cleansing strategies are applied for basic validation		2
	Reliable data cleansing and data quality processes are in place		6
	Robust data cleansing and data quality processes are in place		8
	Corporate data quality strategy is in place		10
Common BI Functionality	Spreadsheets are the main tool for data manipulation and analysis		2
	Extensive use of spreadsheets, combined with other applications, for data manipulation and analysis		2
	Infrequent use of spreadsheets (i.e., for specific tasks only)		10
	Basic use of reporting and analysis tools		2
	Reporting tools are commonly available for information delivery		6
	Extensive use of reporting and analysis tools for information delivery and data research		8
	Basic use of online analytical processing (OLAP) cubes and interactive data analysis tools		2
	Extensive use of OLAP cubes and interactive data analysis tools		6
	Dashboards and scorecards display business metrics and basic key performance indicators (KPIs)		2
	Use of dashboards and scorecards to display business metrics and basic KPIs		6

Phase		√	Value
Data Discovery & Visualization	Data is available for analysis using traditional batch processes, with significant latency (several hours, days) between time of collection and time to analysis		2
	Data is available for analysis, with minor latency (several minutes, a couple hours) between time of collection and time to analysis		6
	Data is available for analysis, with minimal latency (a couple minutes, seconds, real time) between time of collection and time to analysis		8
	Users (mostly business) have basic access to discovery and visualization tools for performing interactive analysis of data only for informational purposes (basic data sampling)		2
	Users (business, decision makers) have access to discovery and visualization tools for performing interactive analysis of data with direct impact on decisions		6
	Users (business, decision makers, and data scientists) have extensive access to discovery and visualization tools for performing interactive analysis of data with direct impact on decisions as part of a decision-support process		8
	Data discovery and visualization tools generally work in isolation from other advanced automated analytics features (if these advanced tools exist)		2
	Data discovery and visualization tools are embedded within other advanced automated analytics features and used as part of the decision-making process		6
	Data discovery and visualization tools are embedded within other advanced automated analytics features and are essential to the decision-making process		10
	Data discovery and visualization are used sparsely across the organization—mostly at individual levels		2
	Data discovery and visualization tools are used narrowly within specific business units		6
	Data discovery and visualization tools are part of each individual business unit of an organization		8
	Data discovery and visualization tools are an essential component of the BI platform and strategy of an organization		10
Advanced BI	Use of predictive data analytics		2
	Use of forecasting techniques and tools		4
	Use of industry vertical-specific predictive analytics		6
	Use of data, text, and Web mining		8
	Extensive use of planning and budgeting applications		2
	Performance management strategy is in place, including balanced scorecards, etc.		4
	Performance is managed at or near real time		6
	It's possible to view the performance of specific business processes		8
	It's possible to manage performance at all levels of the organization		10
	Total		

30 or less points—Usable Data

There is a basic or no formal implementation of BI processes. Data is collected and treated in raw form, and there is lack of data quality, which frequently causes frustration. The information generated is often not of adequate quality to guide the organization's business strategies or business performance improvement. It mainly serves for accountability purposes.

31 to 50 points—Reactive Data

There is a basic or more formal BI process in place, and data is treated with a basic and systematic approach. Still, data flows too slowly to be useful information. The organization's BI process is limited to reacting to actual and/or historical conditions. Data is gathered from internal sources, which does not reflect all the levels of information required for improving the performance of the business.

51 to 90 points—Proactive Data

There is a more robust BI strategy in place. The cycle from data collection to information generation is automatic, and many of the processes for this purpose have already been established and improved upon. Organizations are now starting to do more than just review historical information. They can analyze scenarios, do basic predictions and forecasting, and implement new technologies for these purposes. Organizations at this stage have come to realize the importance of data as a valuable asset, and are frequently working to deploy data-related initiatives (data quality, corporate data management, and data discovery and visualization).

91 or more points—Strategic Data

Organizations at this stage already have a robust BI process in place. Data management initiatives are a common part of the corporate life. These types of organizations are now mainly looking for ways to tighten all levels of leadership—from operational to strategic—and are putting special emphasis on aligning their data strategies with their tactical and strategic goals. There is a search for initiatives that will let them use information as a real competitive advantage by processing data in real time and gathering information from external sources such as social media channels. Organizations at this stage are trying to solve corporate issues such as big data handling and information governance.

Please note that the information provided here is intended as a guide only, and is meant as a starting point for a self-assessment. To perform a complete assessment of the data management capabilities of your organization, you will need to conduct a more comprehensive evaluation.

TEC Resources

TEC Analyst Reviews

Dundas: [BI Software with Intuitive, Interactive Data Visualization and Analytics](#)

Dundas: [TEC Certification Report: Dundas BI for Business Intelligence](#)

IBM: [Data Visualization: When Data Speaks Business](#)

IBM: [IBM Analytics for Higher Education: Increasing Student Retention and Growing](#)

Tableau: [Version 9.0 Expands Tableau's Analytics and BI Reach](#)

Related White Papers

[A New Generation of Business Analytics: Beyond BI and Data Discovery Tools](#)

[Making Big Data Actionable: How Data Visualization and Other Tools Change the Game](#)

[The Next Stage in Creating the Value-added Finance Function: Turning Data into Insight and Business Actions](#)

Business Intelligence Software Evaluation Tools

Note: The tools below are for general BI software solutions, some of which may include data discovery and visualization applications.

Request for Proposal (RFP) Templates

[Get detailed, customizable enterprise software feature lists for your BI software evaluation](#)

Software Evaluation Reports

[Get side-by-side comparisons of BI enterprise software solutions](#)

In-depth Software Evaluation

Use TEC's online software evaluation system, TEC Advisor, to see how BI software solutions address your company's unique business requirements. **[Start your online evaluation now.](#)**

Five Essentials to Selecting the Best Software Solution for Your Company

Software selection is among the most important decisions companies ever have to make. Technology is not just a framework for business processes but a tool that can be used to improve processes, increase competitive advantage, and better the bottom line.

Denis Rousseau, Director of Project Delivery, Selection Services, at Technology Evaluation Centers (TEC), has helped dozens of companies with their software selection projects in a career spanning more than 25 years. He has developed five guiding principles that he says can make or break success in enterprise software selection.

1. Examine your motives

The first step in a software selection process is to closely examine the rationale for acquiring a new software solution. “The very first question to ask—and make sure really gets answered—is ‘why are we acquiring a new system?’ Is it because of expansion at the manufacturing plant, getting rid of an old system because it no longer suits your needs, or because of a recent acquisition? If you can’t make a real business case for it, the process later on won’t work,” says Rousseau.

This is a critical stage in software selection, because it allows for the most important foundations—clarity and commitment. A unified focus with clear objectives. When this decision is made well and communicated to the right people, you empower the process from the beginning and set off on the right foot.

2. Make it a business decision, not an IT decision

Upper management commonly misperceives software selection as the territory of the information technology (IT) department alone. But assigning the work chiefly to IT without involving all affected departments can mean the final selection decision is both uninformed and unsupported by the final users: the very worst scenario for what amounts to a very big decision.

To avoid strong resistance during software implementation, or even worse, having to make a “bad fit” software system mesh with your business processes, it’s wise to realize from the outset that software selection needs to be a holistic business decision with high-level sponsorship. That means all C-level executives and implicated department managers need to be involved from the start, including in the initial decision to move ahead.

3. Deploy the right team

Rousseau has identified three key roles to fill when starting the enterprise software selection process in earnest: a *sponsor*, a *project manager*, and *internal subject matter experts*.

Every software selection project needs a sponsor. He or she should come from a level of management that has influence over all the areas of the organization that will be supported by the new system. This may be a C-level executive if the solution is to be used to standardize business processes in a smaller company. Or it may be the head of a specific division if the solution will involve limited operations. The sponsor will add visible support to the selection process, and can help to work out any higher issues that arise.

The software selection process also requires a dedicated *project manager* to oversee the process from start to finish. The project manager may come from within the organization or be brought in from the outside. He or she is responsible for ensuring the appropriate resources are identified and assigned to different phases of the project, tasks are coordinated in a logical manner, milestones are achieved as anticipated, and emerging issues are promptly addressed. Communicating the project plan and their role within the overall plan to all participants is key.

Lastly, Rousseau emphasizes that you must spend time identifying the people in your company who are *subject matter experts (SMEs)*—knowledgeable staff with a deep understanding of how the business works on a daily basis. He recommends casting a wide net when identifying these SMEs, as they may include senior staff with years of inside knowledge of the business as a whole, or junior employees with the vision to imagine how new software may create efficient change.

With their specific expertise in company processes, these stakeholders play a key role in the crucial requirements-gathering phase. “People who actually understand the business processes best need to be involved at the start, respected as opinion leaders, and conceived of as the future power users of the solution,” says Rousseau.

4. Let your business requirements write the map

In the beginning stages, the only criteria appropriate to consider are the features and functions needed to support the relevant business processes. Everything else is secondary, including cost, cautions Rousseau. “There’s no point purchasing a solution in your price range if it doesn’t do what you need it to. Focus first on defining your business requirements to the exclusion of all else.”

Rousseau emphasizes that the thoroughness of the requirements-mapping phase is crucial to success, and that this is where most companies fall short. “You have to establish a basis for comparison which includes critical deal-breaking items. It’s the small details that can make a system entirely unsuitable,” says Rousseau, recalling the case of a coffee producer who selected an accounting solution without realizing it could not handle their unique accounting-periods calendar.

Taking inventory of business processes and establishing subsequent requirements sounds simple but can be surprisingly difficult, especially from the inside. Experts in business process management and software selection can shorten the time it takes to elicit clarity from SMEs and other stakeholders, which brings us to the last of Rousseau’s essential guidelines.

5. Match the sales proficiency of software vendors with software selection expertise

Much like commercial real estate or mergers and acquisitions, enterprise software selection should be understood as a unique area of specialization with its own experts, methodologies, and sets of tools. Software vendors are highly specialized sales professionals who should be met with equal proficiency on the buyer’s side.

Would you allow someone without any experience to do your materials selection and purchasing for you? Probably not. “Just the same,” says Rousseau, “don’t leave software selection to someone without the necessary experience to be efficient and effective the first time around. Consider who is in charge of your next software selection initiative, and if they don’t have extensive experience in this area, look to get them the help they need.”

That help may come in several forms. Software industry analysts can shed light on what’s available and trending in software application areas, and can tailor to specific industries and verticals. Tools like decision support systems are available to focus your selection process and define your business requirements. And selection consultants come armed with incomparable expertise in selection methodology, vendor tactics, and best practices for optimal outcomes.

“Don’t leave software selection to someone without the necessary experience to be efficient and effective the first time around.”

Denis Rousseau, Director of Project Delivery, Selection Services, Technology Evaluation Centers

As Rousseau concludes, “Software selection is a high-stakes gambit. I’ve seen costly disasters and fantastic successes. But you can significantly improve the risk-to-reward ratio if you think carefully about your motives, involve the right staff, let your business requirements lead, and bring in some form of expertise to even the playing field.”

Read more about TEC’s [approach to software selection and assessment](#).

To learn more about our enterprise software evaluation and selection services, visit the [TEC website](#) or [email us](#).

“Software selection is a high-stakes gambit. But you can significantly improve the risk-to-reward ratio if you think carefully about your motives, involve the right staff, let your business requirements lead, and bring in some form of expertise to even the playing field.”

Denis Rousseau, Director of Project
Delivery, Selection Services,
Technology Evaluation Centers



CASEBOOK

Easy Data Discovery with Smart Data Transitions

Data animations and transitions

What does your data communicate? Can you see the correlations and insights hiding in your data? Visual analytics tools that let you explore data, rather than simply view it, result in a better understanding of the underlying data as well as providing opportunities for deeper insights. Smooth, animated data transitions makes interactive data analysis and visualization even easier, allowing users to easily follow data changes and quickly see data correlations and trends.

In their visualization study, “Animated Transitions in Statistical Data Graphics,” Jeffrey Heer and George G. Robertson of the University of California, Berkeley (2007) conducted two controlled experiments to assess the efficacy of animated transitions. They found that participants significantly preferred animation over static transitions and that appropriately designed animated transitions significantly improve graphical perception of analysis. Their study provides strong evidence that, “with careful design, animated transitions can improve graphical perception of changes between statistical data graphics.” In their study they noted that, “overall, subjects were highly enthusiastic about animated data graphics, and felt that it facilitated both improved understanding and increased engagement. The vast majority of participants wanted to use animated data graphics in their own analysis and presentation.”

Data discovery and animation in data visualization

Data discovery allows you to quickly and easily analyze your data in a meaningful way. Data discovery is typically easier when the data is visualized (rather than when the data is in a tabular display, row by row). The discovery process is powered by interactions such as filter, sort, drill-down/up, zoom, etc. These interactions help you to understand how the data behaves under different scenarios and ultimately enables you to gain insight and draw some conclusions.

Data animations enable you to easily convey changes over time or the transitions between states and help to show a full data process and path where it is difficult to express with static graphics or text alone. The concept of data animation has been known for a while in the data visualization space but is often used only for the sake of making the data visualization look a bit more visually appealing (“sexy”) rather than contributing to the data discovery process. Oftentimes, users would like to make sure that gauge needles can be animated just because it looks “cool.” Often after they start using the animation on the visualizations they “get tired” of those animations as the “cool” effect is not as exciting as it was at first; now it’s just a waste of time as they need to wait until the animation is done loading the data so they can see the actual data value. The data transitions in Dundas BI are designed to allow the user to comprehend each type of change made to a visualization when the data changes. These real-time, animated changes are readily visible, greatly enhancing data analysis. Dundas BI data transitions ensure that users quickly understand the relationship between the current and previous views without effort, see trends more easily, and present their data more effectively.

Data discovery becomes much smarter with animations and transition changes added to your data visualization, including

- Change the axes of the chart
- Reorder the data or filter the data
- Change the data or re-visualize the data

Each data transition is independent and allows users to explore and interact for an in-depth data discovery and analysis.

Dundas BI features a canvas-like environment where users can drag and drop measures, dimensions, or predefined metric sets and then customize for discovery. The visual discovery environment within Dundas BI includes an intuitive drag-and-drop dashboard designer to provide visual data discovery. To make visualizations more immediately explorable, the “Re-visualize” button and visualizations menu in Dundas BI provides the ability for users to sort, filter, and drill up and down, with best-practice animations that visually show the user the impact of changing dimensions within visualization outputs.

“Data transitions can readily support your data discovery by helping you better understand the effect of the interaction you applied to your data.”

How data transitions enable data discovery

At Dundas we believe that data transitions, if applied correctly can do much more than just add cool effects to your data visualizations. Data transitions can readily support your data discovery by helping you better understand the effect of the interaction you applied to your data. A well-known example is the illustration by Hans Rosling of “200 Years That Changed the World.” In this example, Rosling uses interactive animations to visualize how all the countries of the world have developed since 1809, showing the change in life expectancy and income per person over the last two centuries. Rosling demonstrates how moving the data points over time can help the user better understand the trend changes that may be too complex to spot compared to a single image or a series of static images. See [200 Countries, 200 Years, 4 Minutes](#).

“A good data visualization will let you interact directly with that data, drill down into its details, see it from multiple perspectives, and draw your own conclusions.”

Data transitions in Dundas BI

In Dundas BI, transitions are built-in and designed to easily allow the user to identify and comprehend each type of change made to a visualization when the data changes. Data transitions are applied by default on any data interaction users may apply. Each interaction will drive a transition that helps the user better understand the data changes he/she just triggered, for example, a drill down. A drill down breaks the data into distinct categories. For example, when the user selects a certain time period and point showing data at the quarter level and wants to drill down to see the data at the month level, instead of having the chart show the data across all the months of the selected quarter at once or using a random animation, Dundas BI chart is using smart transition that will display the changes to the user in stages:

Stage 1: The user notices that higher number in the third quarter and wants to drill down into it to break it down.

Stage 2: The user will notice the data points change by having all the non-selected quarter data points disappear and having the selected quarter data point split into 3 different points (one for each month of that quarter). This helps the user notice what the selected data points represent (in this case 3 different months).

Stage 3: The axis range will now change to reflect the appropriate range of the new data points (the 3 months). This is important as the user may start by viewing data at the one level that could, for example, range in the millions and then drill down into another level that ranges in the thousands. Having the transition done in stages rather than at once will help the user notice the range change and better grasp the magnitude of the data points.



Similar concepts apply for other data interactions:

Drill Up—The data points will be joined to form one data point that reflects the level change and appropriate grouping at the new level.

Sorting—The data point movements are staggered or spread out slightly to allow the eyes a better chance to follow each movement.

Filtering a Trend—Newly added data points will show in order to reflect the trend changes over time.

Re-visualizing from a Stacked Bar to a Side-by-side Bar Chart—The stacked bars will split up into the different series but keep the grouping cluster, helping support the user's understanding of the different series and the overall group they belong to.

Visual encoding such as shape, color, and size can be used to visually differentiate data dimensions. It's important that users clearly understand why a change is happening, and what is changing, so that the data transition is easily followed and data discovery is enhanced.

Benefits of animated data transitions

- Improves perception of changes between statistical data graphics
- Helps tell the story of data changes through time in a meaningful way
- Improves user interaction and understanding
- Enhances visual presentation and communication of the cause-and-effect relationships

A good data visualization will let you interact directly with that data, drill down into its details, see it from multiple perspectives, and draw your own conclusions. Interactive visualizations offer different ways to segment, filter, zoom, aggregate, analyze, and extract the data; they make it possible to view the data set from different perspectives or scales simultaneously.

"In a visualization, animation might help a viewer work through the logic behind an idea by showing the intermediate steps and transitions, or show how data collected over time changes. A moving image might offer a fresh perspective, or invite users to look deeper into the data presented" according to Danyel Fisher in *Animation for Visualization: Opportunities and Drawbacks*.

Built-in transitions, like in Dundas BI, provide the exploring user a better understanding of the data when conducting data discovery. They help explain a point vividly and dramatically. The user clearly sees what is transforming without having to think about it. The eyes will just follow the changes, helping the mind better identify the true impact of your data interactions and resulting data values.

Dundas BI's powerful visualization capabilities include best-practice animations and data transitions to illustrate how data changes as metrics and dimensions are adjusted. With these built-in data analytics tools along with the ability to easily design and customize interactive data visualizations, dashboards, and reports, users are empowered to analyze, collaborate, and present their data, information, and results more thoroughly, effectively gaining deeper insight, and, ultimately, improving business performance.

About Dundas

Dundas Data Visualization is a leading, global provider of Business Intelligence (BI) and Data Visualization solutions. Dundas offers easy to use self-service, single BI experience allowing users to connect, interact and visualize powerful dashboards, reports and advanced data analytics for any data, on any device. Our flexible BI platform is fully supported by a consultative and best practice solutions approach. For over 20 years, Dundas has been helping organizations discover deeper insights faster, make better decisions and achieve greater success. www.dundas.com





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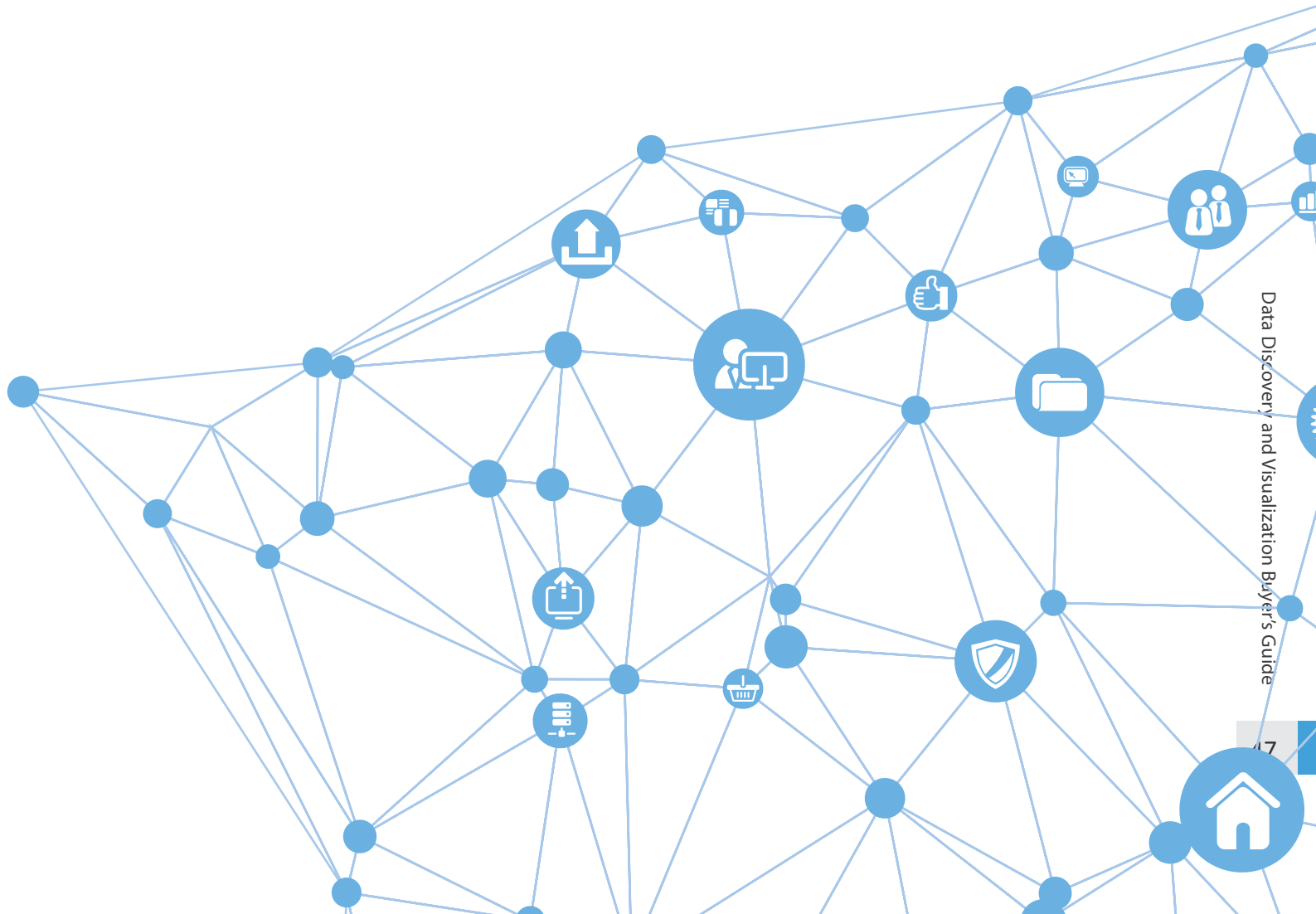


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Prior to joining TEC, García was a senior project manager and senior analyst developing BI, DWH, and data integration applications with Oracle and SAP BusinessObjects. He has also worked on projects related to the implementation of BI solutions for the private sector, including the banking and services sectors. He has had the opportunity to work with some of the most important BI and DWH tools on the market.

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