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The Forrester Wave™: Advanced Data Visualization (ADV) Platforms, Q3 2012

by Boris Evelson and Noel Yuhanna, July 17, 2012

KEY TAKEAWAYS

Buyers Have A Plethora Of -- Often Overlapping -- Choices When Considering ADV Technology Options

ADV platform choices range from enterprise BI vendors to subspecialty vendors providing niche data visualization solutions addressing a single subject domain or various industry vertical solutions. Leverage the results and evaluation methodology in this and other relevant BI Forrester Wave evaluations to short-list your ADV platform providers.

ADV Is About More Than Technology; It's About The Right Visual Design

Until recently, technology created major roadblocks for successful ADV applications. Now the majority of vendors offer function-rich, robust, scalable platforms based on open architecture, so firms tend not to make architectural and design mistakes. Multiple design and implementation best practices are now crucial to successful ADV applications.

The Forrester Wave™: Advanced Data Visualization (ADV) Platforms, Q3 2012

Seven Leaders, Six Strong Performers, And Two Contenders Compete For Share Of The ADV Market

by Boris Evelson and Noel Yuhanna
with Stephen Powers, Holger Kisker, Ph.D., Jeffrey S. Hammond, Sanchit Gogia, Mike Gualtieri, Brian Hopkins, and Shannon Coyne

WHY READ THIS REPORT

Enterprises find advanced data visualization (ADV) platforms to be essential tools that enable them to monitor business, find patterns, and take action to avoid threats and snatch opportunities. In Forrester's 29-criteria evaluation of ADV vendors, we found that Tableau Software, IBM, Information Builders, SAS, SAP, Tibco Software, and Oracle led the pack due to the breadth of their ADV business intelligence (BI) functionality offerings. Microsoft, MicroStrategy, Actuate, QlikTech, Panorama Software, SpagoBI, Jaspersoft, and Pentaho were close on the heels of the Leaders, also offering solid functionality to enable business users to effectively visualize and analyze their enterprise data.

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Notes & Resources

Forrester conducted demo-based evaluations in Q4 2011, interviewing 14 vendor companies: Actuate, IBM, Information Builders, Jaspersoft, Microsoft, MicroStrategy, Panorama Software, Pentaho, QlikTech, SAP, SAS, SpagoBI, Tableau Software, and Tibco Software. We also surveyed four to 32 customers per vendor.

Related Research Documents

The Forrester Wave™: Self-Service Business Intelligence Platforms, Q2 2012
June 12, 2012

The Forrester Wave™: Enterprise Business Intelligence Platforms, Q4 2010
October 20, 2010

The Forrester Wave™: Open Source Business Intelligence (BI), Q3 2010
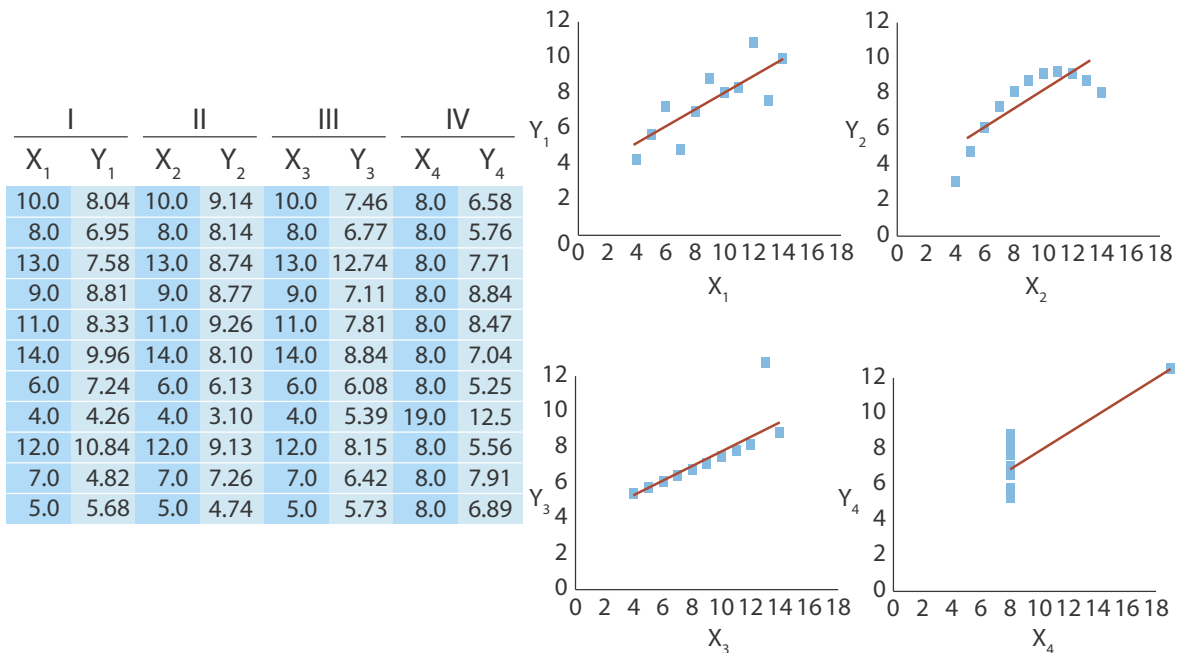August 10, 2010

ADV IS A CRITICAL COMPONENT OF BUSINESS INTELLIGENCE

As one of the industry-renowned data visualization experts Edward Tufte once said, "The world is complex, dynamic, multidimensional; the paper is static, flat. How are we to represent the rich visual world of experience and measurement on mere flatland?"[1] Indeed, there's just too much information out there for all categories of knowledge workers to visualize it effectively. More often than not, traditional reports using tabs, rows, and columns do not paint the whole picture or, even worse, lead an analyst to a wrong conclusion. Firms need to use data visualization because information workers:

- **Cannot see a pattern without data visualization.** Simply seeing numbers on a grid often does not convey the whole story — and in the worst case, it can even lead to a wrong conclusion. This is best demonstrated by Anscombe's quartet where four seemingly similar groups of x/y coordinates reveal very different patterns when represented in a graph (see Figure 1).

- **Cannot fit all of the necessary data points onto a single screen.** Even with the smallest reasonably readable font, single-line spacing, and no grid, one cannot realistically fit more than a few thousand data points on a single page or screen using numerical information only. When using advanced data visualization techniques, one can fit tens of thousands (an order-of-magnitude difference) of data points onto a single screen. In his book *The Visual Display of Quantitative Information*, Edward Tufte gives an example of more than 21,000 data points effectively displayed on a US map that fits onto a single screen.

- **Cannot effectively show deep and broad data sets on a single screen.** Fitting in and analyzing hundreds or thousands of columns of attributes (dimensions in BI speak) is an enormous challenge. Imagine a typical drug trial conducted by a pharmaceutical company where each patient has thousands of attributes: physical, psychological, genetic, behavioral, etc. Analysts looking for patterns, dependencies, and correlations typically need to run the data through complex statistical models before they can find a pattern or correlation. Building such models and running them through millions of rows of data can be time-consuming and can tax even the most advanced software and hardware resources. But in a technique often used in the pharma industry, reducing each data point in a column to a single pixel and color-coding pixels according to their value ranges can let an analyst relatively easily visualize and identify a pattern and then quickly zoom in to research the details.

Figure 1 Anscombe's Quartet Shows How Hard It Is To See Patterns Without Data Visualization

I		II		III		IV	
X_1	Y_1	X_2	Y_2	X_3	Y_3	X_4	Y_4
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.5
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

Source: F.J. Anscombe, "Graphs in Statistical Analysis", American Statistician, February 1973

HOW IS ADV DIFFERENT FROM EARLIER GENERATIONS OF DATA VISUALIZATION?

Many corporations have effectively used — and will continue to use — traditional business graphics, such as bar charts and pie charts. At the next level, modern technologies have enabled the use of more dynamic and interactive business graphics, such as real-time dashboards and charts that update automatically as the data changes. (These new technologies also include new types of displays that make the high resolution necessary for ADV possible.) Now, through ADV, potential exists for nontraditional and more visually rich approaches, especially in regard to more complex (i.e., thousands of dimensions or attributes) or larger (i.e., billions of rows) data sets, to reveal insights not possible through conventional means. Forrester differentiates ADV from static graphs and charts along six capabilities, as follows:

- **Dynamic data content.** These visualizations, linked to data sets (databases), update as the data changes. Static visualizations produced in most office documents typically do not have such functionality.

- **Visual querying.** This is the ability to query and re-query data simply by manipulating visual portions of graphs or charts (clicking on a column to drill into details, for example) or by using visual instrumentation (drop-down lists, push buttons, tabs, etc.).

- **Multiple-dimension, linked visualization.** A typical single chart or graph cannot display more than a few dimensions (attributes such as region, time, etc.) at a time. To visualize and analyze data by multiple dimensions or attributes, one typically needs to display and dynamically link several graphs, charts, or panels. Navigating through a dimension in one panel automatically updates all visualizations on all other panels.

- **Animated visualization.** If a particular dimension, such as time, has hundreds or thousands of values (as in daily values over multiple years), manually clicking through every day is not practical. Launching an automated, animated scroll up and down such a dimension is a more practical approach.

- **Personalization.** What is intuitive and obvious to one analyst may not be obvious to another. Also, to address privacy and risk issues, many organizations have different levels of access to data for different user groups and individual users. ADV tools must be automatically personalized based on users' access or authorization levels, locality, and personal visualization preferences.

- **Business-actionable alerts.** Even data visualizations often cannot lead an analyst to a conclusion if there's too much information to comprehend on a single screen. In an example cited earlier, with more than 21,000 data points on a single screen, an analyst cannot identify a certain condition unless the software can generate visual alerts (such as color coding, flashing, etc.). Also, if an analyst is not looking at the visualization when a certain condition is triggered (most complex rules may require a platform based on complex event processing [CEP] or business rules engines [BREs]), he or she can program an ADV application to automatically notify an appropriate person with an email or a text message.[2]

EVALUATE ADV PLATFORMS' FUNCTIONAL AND TECHNICAL CAPABILITIES

Navigating the ADV landscape requires evaluating significantly more features than the six key ADV capabilities described in the previous section. In this research, Forrester identified numerous functional and technical capabilities businesses need to architect, design, build, and implement ADV applications. However, as you venture down the ADV road, Forrester recommends paying at least equal attention to ADV best practices as you do to technology. In other research, Forrester has identified multiple such practices including screen layouts, data-to-ink ratios, appropriate use of text and labels, using similar sequencing of objects, using parallel scales, minimizing the use of color, showing causality, and many more.

Evaluate The Functional Capabilities Of ADV Platforms

While multiple technology options support various ADV features, the reverse is not true. Therefore, Forrester recommends starting your evaluation of ADV platforms by defining your requirements for the following functionality:

- **Graphs galore.** Most ADV presentation types or media can be classified as graphs. Most of these display quantitative information in a 2D or 3D plane with x and y axes. Forrester identified more than thirty graph types, including arc, area, box, box and whisker, bubble, bullet graphs, candlesticks, cluster analysis, diagrams (node link, radial node link, Cartesian node link, adjacency, enclosure), funnel, Gantt, heat maps, hierarchies, histograms, horizon graphs, indented tree, Marimekko, matrix, network, overlapping sets, parallel coordinates (II coordinates), Pareto, rose charts, quantile-quantile (Q-Q) plots, relationship diagrams, scatter plots, scatter plot matrix (SPLOM), stacked graphs, stem and leaf plots, spider/radar diagrams, and x/y plots.

- **Tufte's microcharts.** Companies use microcharts, a special type of graph (also known as spark lines), to show a time-series graph in each row on a tabular report. Invented by Edward Tufte, who described spark lines as "data-intense, design-simple, word-size graphics," microcharts are often used in dashboards that require highly condensed forms of data displays such as a grid of financial-instruments data with a time-series microchart of each instrument's performance over time.

- **Cockpit gauges.** Various gauges and meters are a relatively recent addition to ADV presentation types. These usually present measures compared with a related measure or a target (such as actual revenue versus revenue target). In this research, we identified seven gauge and meter types: bulb/LED lights, clocks, dials, funnels, pyramids, street lights, and temperature gauges. While there's some debate in the ADV market on the usefulness of the gauges (some say they take up valuable screen real estate without adding clear value), for some a picture is still worth a thousand words.

- **Visual query.** Visually and dynamically querying, exploring, and analyzing data is much more than just pulling data from a database (usually equivalent to selecting rows of data via SQL or MDX queries or just importing from spreadsheets). In this research, we identified eight ways that ADV tools allow users to visually manipulate data: drill across (to another dimension), drill down and up (up/down hierarchies), drill through (to another source, to another dashboard, or to a detailed report), filter, group, pivot, rank, and sort.

- **Visual exploration.** Analyzing information based on a new hierarchy not already built into the data model or based on entities and attributes whose relationships are not defined in a data model is a realm of specialized tools. These tools are often based on nonrelational or nondimensional data models (such as an associative index, for example). They can also help address the I-don't-know-what-I-don't-know quagmire.

- **Geospatial representations.** ADV can make information more consumable and easier to comprehend by overlaying data over geographical maps or architectural drawings. In addition to analyzing relationships between variables, geospatial representations also support analysis of spatial relationships (e.g., location, area, distance, etc.). We identified about a dozen types of

geospatial ADV representations such as: architectural layouts, areas and polygons, geographical maps, store maps (floor plans, shelf layouts), and other types of maps (flow, choropleth, graduated symbols, cartograms, and routes). Some tools even have the ability to create customized geomaps — for example, having the Indian subcontinent appear next to North America (NA) if an enterprise considers NA and India a single sales territory.

■ **Modes of interaction.** We have identified two ways that ADV applications usually let users interact with the data: via instrumented or visual manipulation. In instrumented manipulation, a user manipulates data and visualizations via standard graphical user interface (GUI) (e.g., Windows, Apple iOS, etc.) controls such as push buttons, radio buttons, checklists, pull-down menus, scroll bars, etc. Visual (or gestural) manipulation usually requires a touchscreen interface for manipulating visual objects with a mouse cursor by directly pointing, clicking, selecting, dragging, dropping, or lassoing. Visual/gestural manipulations that require a touchscreen interface are so-called multitouch operations such as pinch and zoom, rotate, and flick (native functionality on Apple iOS devices such as iPads and iPhones). Some ADV vendors with 3D visualization capabilities can also rotate visualization by three (x, y, z) axes.

■ **Storyboarding fit for client and boardroom-level presentations.** This functionality allows multiple visualizations, panels, and dashboards to be displayed in a sequence (similar to PowerPoint presentations) typically used as a visual aid in presentations.

■ **Data latency.** Latency is typically more of a capability of the underlying database management system (DBMS) technology rather than an ADV tool itself. It determines how often you can update a data model that supports ADV. Relational and multidimensional database updates typically have hourly, daily, weekly, or monthly batch update cycles depending on business requirements, data volumes, and platform and application scalability. Most advanced DBMS and extract, transform, and load (ETL) tools allow batch cycles with latency measured by minutes (often referred to as microbatches), usually driven by change data capture (CDC) technologies. Near-real-time (seconds) or truly real-time (subsecond) updates (often required for ADV applications in capital markets for trading applications or in oil and gas or manufacturing industries for device monitoring) are typically the realm of specialized in-memory data streaming technologies (sometimes referred to as business activity monitoring [BAM] or CEP) that do not involve disk-based DBMS.

■ **Data granularity based on your requirements.** Granularity determines the level of detail of transactional data that you can drill down to in an ADV application. The more details that are available, the larger the DBMS that underlies an ADV application becomes and the longer batch update cycles are. Our survey revealed widely varied levels of granularity usage patterns.

Make Sure That The ADV Platform Meshes With Your Technical Architecture

Technical architecture is a key differentiator for ADV tool capabilities. Forrester identified eight categories of ADV technical architecture capabilities through posing the following questions:

- **What analytical engines does the ADV platform support? How does it access and process data?** Even on 64-bit servers, practical limitations for a report or a dashboard result set, especially when many users are simultaneously using an application, are less than a few hundred gigabytes (GBs). If an underlying data model or a report data set is larger than what can fit into a single RAM space, an ADV application needs to access data from a variety of sources and rely on the power of those data engines to perform data manipulation and analysis.

- **Is there an intermediate storage platform?** To speed up ADV processing and provide ADV operations not supported by the source DBMS, some vendors choose to first extract the data from its sources and then store or persist it in an intermediate store (disk or in-memory based). This intermediate storage can also be the place where all of the necessary data transformations take place.

- **How is the in-memory data model managed?** If an ADV vendor uses in-memory intermediate storage, you need to ask yourself three questions. Can the vendor handle models that are larger than what would fit into a single RAM space? Typically, you can achieve this by swapping (paging) chunks of memory to a disk. Can you update an in-memory model row by row, or do you have to reload the whole in-memory model as a batch process? What is the tradeoff between the size of the in-memory model and the number of simultaneous users? Because both data and users compete for the same RAM space in the in-memory architecture, there is indeed a tradeoff.

- **What types of data can the ADV platform analyze?** ADV applications can typically handle structured (structured databases, spreadsheets) and semistructured data (XML). Accessing and processing unstructured data such as text typically requires some kind of keyword parsing, text mining, or semantic entity extraction capabilities. ADV applications also process another type of data: state of a process (for example, number of claims in a queue). This typically requires extracting the process state from BPM applications.

- **Does the ADV platform support write-backs?** ADV applications often allow users to analyze multiple what-if scenarios. Creating such scenarios based on existing data is a commodity feature of most ADV tools. As long as one can cut visualization by different dimensions, one can analyze multiple cause-and-effect scenarios. But building what-if scenarios based on new data (creating new budgeting scenarios, for example) requires write-back capabilities or updating the underlying database or an online analytical processing (OLAP) cube in real time.

- **What platform/technology is the ADV output based on?** We identified the following types of rendering technologies: Adobe Flash/Flex, Microsoft Silverlight, Ajax/JavaScript, Java or JavaFX, Dojo, GWT, ExtJS, jQuery, ASP.Net Ajax, Oracle ADF, and SVG. The trend is to consolidate all of these rendering technologies under the new platform-independent HTML5 standard. However, even if an ADV vendor supports HTML5 today, desktop operating systems (OSes) and browsers are still a couple of years away from being fully HTML5 compliant. Until then, make sure to ask whether a vendor supports all of the other platform-specific rendering technologies.

- **What, if any, ADV-specific programming language is used?** In addition to standard rendering formats described previously, some ADV vendors use programming languages specifically designed for ADV: prefuse, processing, Protovis, and visualization toolkit SDK (VTK).

- **What are the ADV platform's integration capabilities?** In addition to providing software development kits (SDKs) with application programming interfaces (APIs) for customization and integration with other tools, some ADV tools provide out-of-the-box integration with portals, metadata, and BI platforms, though the level of integration offered varies among solutions. Portal integration typically requires compliance with JSR-168/268 and WSRP standards, which gives an ADV application full functionality and interactivity when displayed in a portal. The ability to import and export metadata to and from other BI tools requires compliance with CWM and XMI standards or OEMing metadata adapters from Meta Integration.[3] Additionally, integration with a larger BI platform depends on how seamlessly data can be moved between data warehouses (DWs), ETL outputs, BI reports, and ADV applications.

ADV PLATFORMS EVALUATION OVERVIEW

To assess the state of the ADV platforms market and see how the vendors stack up against each other, Forrester evaluated the strengths and weaknesses of top ADV platform vendors.

Evaluation Criteria: Current Offering, Strategy, And Market Presence

After examining past research, user need assessments, and vendor and expert interviews, we developed a comprehensive set of evaluation criteria. We evaluated vendors against 29 criteria, which we grouped into three high-level buckets:

- **Current offering.** We evaluated vendors against 11 criteria that focus on core and advanced ADV functionality. We also scored vendors according to the results from a survey of four to 32 customers per vendor.

- **Strategy.** We reviewed each vendor's strategy and considered how well each vendor's plans for product enhancement position it to meet future customer demands. We also looked at the financial and human resources the company has available to support its strategy and analyzed its go-to-market pricing and licensing strategy.

■ **Market presence.** To establish each product's market presence, we combined information about the vendor's financial performance, installed customer base, number of employees across major geographical regions, partnership ecosystem, and horizontal and vertical industry applications.

Evaluated Vendors: Richness Of ADV Functionality And Market Presence

Forrester included 15 vendors in the assessment: Actuate, IBM, Information Builders, Jaspersoft, Microsoft, MicroStrategy, Oracle, Panorama Software, Pentaho, QlikTech, SAP, SAS, SpagoBI, Tableau Software, and Tibco Software. While Oracle chose not to provide full information for its ADV solution (Oracle Business Intelligence Suite Enterprise Edition), we included it in the Forrester Wave™ based on our knowledge from past analysis and publicly available information so as to provide a complete picture of the competitive landscape. Each of these vendors has (see Figure 2):

■ **Broad ADV functionality.** We included vendors that could demonstrate the significant majority of ADV features described in this document.

■ **The ability to query databases using SQL and MDX.** While other querying technologies such as XQuery and DMX are available, SQL and MDX are the most widely used querying technologies in large enterprises.

■ **A self-contained, complete, fully functioning ADV environment.** We focused on ADV tools not technologically or functionally tied or limited to particular functional or horizontal applications (enterprise resource planning [ERP], supply chain management [SCM], etc.). To be included in the evaluation, the tool had to be a self-contained, complete ADV environment or platform that does not necessarily have to be embedded in another application.

■ **Sufficient market presence and interest from Forrester clients.** We included vendors with at least 100 in-production customers present in more than one major geographical region. We also focused on vendors that Forrester clients frequently mention or ask about in the context of ADV (measured as more than 25 inquiries over the past 12 months).

Figure 2 Evaluated Vendors: Product Information And Selection Criteria

Vendor	Product name	Version	Release date
Actuate	ActuateOne	11 SP4	Q2 2012
IBM	IBM Cognos Business Intelligence	v10.1	October 2010
Information Builders	WebFOCUS	7.7.03	November 2011
Jaspersoft	Jaspersoft BI Enterprise	4.5	December 2011
Microsoft	• Excel 2010 (includes PowerPivot) • SharePoint 2010 • SQL Server 2012 (includes SSRS, SSAS, and Power View)	• Microsoft Office 2010 • SharePoint Server 2010 • SQL Server 2012	April 2012
MicroStrategy	MicroStrategy	9.2.1A	September 2011
Oracle	Oracle Business Intelligence Suite Enterprise Edition	11g	Q4 2011
Panorama Software	Panorama Necto	11	May 2011
Pentaho	Pentaho Business Analytics	4.5	April 2012
QlikTech	QlikView	11	November 2011
SAP	SAP BusinessObjects	4.0 Feature Pack 3	April 2012
SAS	SAS Enterprise Business Intelligence	4.31	July 2011
SpagoBI	SpagoBI	3.2	November 2011
Tableau Software	• Tableau Desktop • Tableau Server	7	January 2012
Tibco Software	Tibco Spotfire Analytics	v4.0	November 2011

Source: Forrester Research, Inc.

Figure 2 Evaluated Vendors: Product Information And Selection Criteria (Cont.)

Vendor selection criteria

Broad ADV functionality. We included vendors who could demonstrate the significant majority of ADV features outlined in the Current Offering criteria.

The ability to query databases using SQL and MDX. While other querying technologies such as XQuery and DMX are available, SQL and MDX are the most widely used technologies in large enterprises.

A self-contained, complete, fully functioning BI environment. We focused on ADV tools not technologically or functionally tied or limited to particular functional/horizontal applications (enterprise resource planning [ERP], supply chain management [SCM], etc.) These tools must be self-contained, complete BI environments or platforms that do not necessarily have to be embedded in other applications.

Sufficient market presence and interest from Forrester clients. We include vendors with at least 100 in-production customers present in more than one major geographical region. We also focused on vendors that Forrester clients frequently — more than 25 inquiries over the last 12 months — mentioned or asked about in the context of ADV.
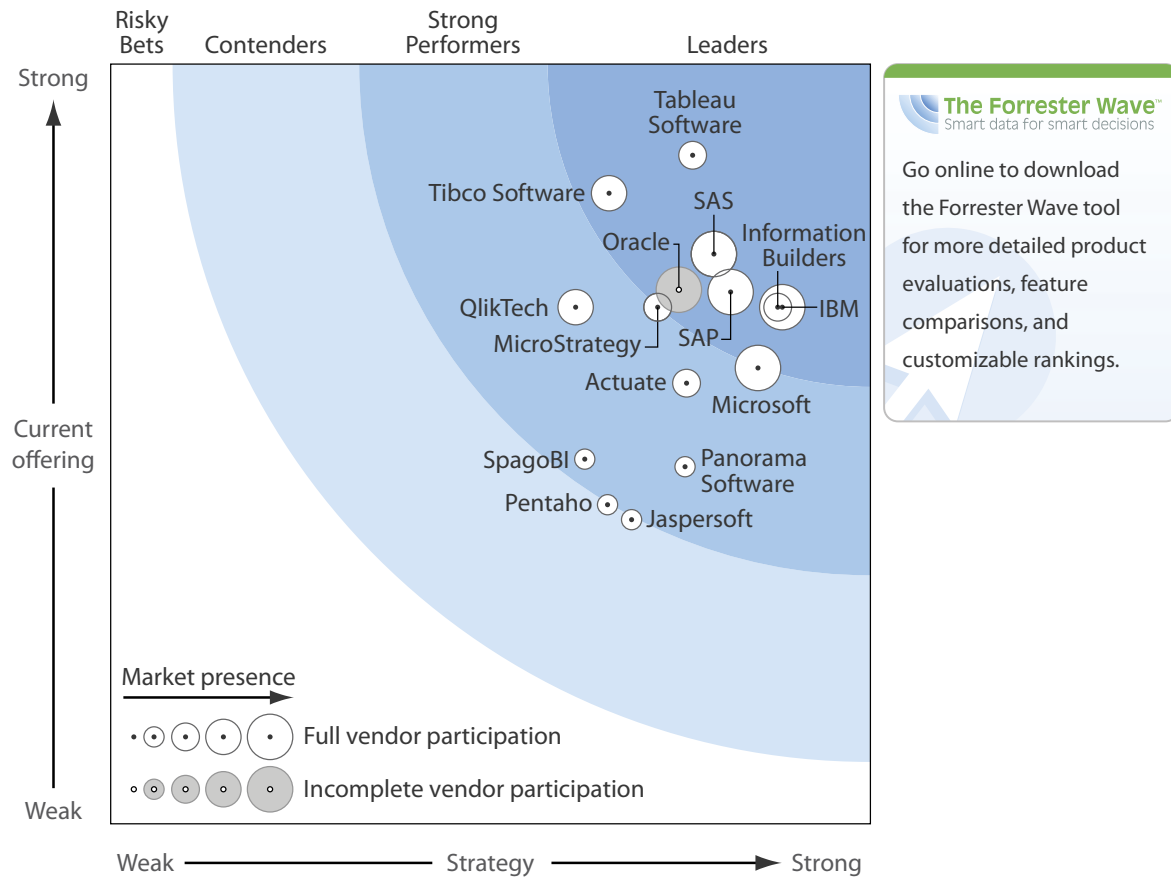
Source: Forrester Research, Inc.

THE WORLD IS NO LONGER FLAT — ADV OPTIONS ARE BROAD *AND* DEEP

The evaluation uncovered a market in which (see Figure 3):

- **Tableau Software, IBM, Information Builders, SAS, SAP, Tibco, and Oracle lead the pack.** These vendors demonstrate significant capabilities and a good balance of ADV features across most requirements. If a vendor from this list is already an enterprise's preferred BI platform provider, there's often little to no reason to look elsewhere for another specialized ADV tool.

- **The Strong Performers offer competitive options.** Watch your backs, Leaders: Strong Performers Microsoft, MicroStrategy, Actuate, QlikTech, SpagoBI, and Panorama Software are hot on your heels. In many specialized situations where certain features — such as the vendor independence that open source software (OSS) brings to the table or more emphasis on data analysis and exploration versus reporting — have specific importance, these vendors can even outshine and outperform the Leaders.

- **Jaspersoft and Pentaho lack some ADV features but are worthy alternatives for frugal buyers.** Few BI implementations use all or even most of the features of their BI tools and platforms, as evidenced by numerous conversations with Forrester clients. Therefore, getting 60% to 80% of the ADV functionality at a fraction of the cost (Jaspersoft and Pentaho software subscription costs are indeed among the lowest in the industry) may make a lot of sense for frugal buyers.[4]

This evaluation of the ADV platform market is intended to be a starting point only. We encourage readers to view detailed product evaluations and adapt the criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool.

Figure 3 Forrester Wave™: Advanced Data Visualization (ADV) Platforms, Q3 '12

Figure 3 Forrester Wave™: Advanced Data Visualization (ADV) Platforms, Q3 '12 (Cont.)

	Forrester's Weighting	Actuate	IBM	Information Builders	Jaspersoft	Microsoft	MicroStrategy	Panorama Software	Pentaho	QlikTech	SAP	SAS	SpagoBI	Tableau Software	Tibco Software
CURRENT OFFERING	50%	2.90	3.40	3.40	2.00	3.00	3.40	2.40	2.10	3.40	3.50	3.75	2.35	4.40	4.15
Customer feedback	10%	3.00	3.00	4.00	2.00	1.00	1.00	5.00	2.00	5.00	2.00	2.00	3.00	5.00	4.00
Animations	10%	3.00	3.00	4.00	1.00	3.00	3.00	1.00	1.00	3.00	3.00	5.00	1.00	5.00	5.00
Autosuggestions	10%	0.00	0.00	0.00	1.00	2.00	4.00	0.00	0.00	0.00	1.00	5.00	1.00	5.00	2.00
Geospatial integration	10%	2.00	4.00	2.00	1.00	1.00	2.00	1.00	3.00	2.00	4.00	3.00	3.00	4.00	2.00
In-memory model management	10%	3.00	4.00	5.00	3.00	3.00	3.00	1.00	1.00	4.00	5.00	3.00	1.00	5.00	5.00
Multiple dimensions	10%	3.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	3.00	4.00	5.00
Exploration or data discovery	10%	3.00	3.00	5.00	1.00	5.00	3.00	3.00	1.00	5.00	4.00	3.00	1.00	4.00	5.00
Semantic layer	10%	5.00	4.00	3.00	4.00	4.00	5.00	3.00	5.00	3.00	5.00	5.00	5.00	5.00	5.00
Storyboarding	5%	5.00	5.00	4.00	1.00	5.00	5.00	5.00	1.00	1.00	3.00	3.00	3.00	5.00	4.00
Types of visualizations	10%	3.00	5.00	3.00	3.00	3.00	5.00	3.00	3.00	5.00	5.00	5.00	3.00	4.00	5.00
Visual querying	0%	3.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00
Write-back	5%	3.00	3.00	2.00	1.00	3.00	3.00	1.00	1.00	3.00	1.00	2.00	2.00	1.00	3.00
STRATEGY	50%	3.79	4.42	4.39	3.43	4.26	3.60	3.12	3.27	3.06	4.08	3.97	3.78	3.83	3.28
Commitment	40%	4.00	4.50	4.50	3.50	4.50	3.50	3.00	3.00	2.50	4.50	4.50	4.00	4.00	3.00
Pricing and licensing	10%	4.20	4.94	4.06	4.46	3.34	2.04	2.04	4.88	2.44	2.04	0.94	5.00	4.60	2.84
Transparency	5%	3.00	3.00	4.00	1.00	3.00	4.00	2.00	1.00	4.00	2.00	2.00	3.00	3.00	0.00
Product direction	45%	3.60	4.40	4.40	3.40	4.40	4.00	3.60	3.40	3.60	4.40	4.40	3.40	3.60	4.00
MARKET PRESENCE	0%	2.40	4.64	2.65	1.30	4.48	2.84	1.58	1.36	3.22	4.34	4.09	1.04	2.34	3.17
Company financials	30%	2.60	3.80	2.50	2.00	3.80	4.20	2.60	2.20	4.40	2.80	3.30	0.60	3.80	3.90
Global presence and installed base	40%	2.25	5.00	3.25	1.50	5.00	2.25	1.50	1.25	3.75	5.00	4.50	1.00	2.50	2.00
Partnership ecosystem	10%	2.00	5.00	2.00	1.00	5.00	2.00	2.00	2.00	4.00	5.00	3.00	1.00	2.00	2.00
Functional BI applications	20%	2.60	5.00	2.00	0.00	4.20	2.40	0.00	0.00	0.00	5.00	5.00	1.80	0.00	5.00

All scores are based on a scale of 0 (weak) to 5 (strong).

Source: Forrester Research, Inc.

VENDOR PROFILES

Leaders

- **Tableau Software continues to set the standards for ADV.** Tableau has been the vanguard of advanced data visualization for years. In fall 2010, Tableau closed a functionality gap with the introduction of an in-memory engine for data discovery and exploration. The new capability gives two important options for business users: the ability to load an entire data set into memory and perform highly responsive data exploration or, if the data set is too big, to leave data where it is — in a relational or multidimensional DBMS — and analyze it with Tableau's patented and intuitive VizQL. Tableau does not directly compete with other vendors with broad BI platform offerings; rather, it complements fully functional enterprise BI platforms that lack ADV capabilities.

- **IBM (Cognos) offers broad and balanced ADV.** With the recent rollout of Cognos Insight, IBM is now front and center in the ADV market. The new product is based on the popular in-memory OLAP TM1 engine. It still lacks some advanced data exploration and discovery features, mostly in the realm of associative DBMS. However, for most of the business user ADV functions, it will do a fine job and really shines at what-if scenario modeling and planning use cases where write- back capabilities are essential. Cognos Insight can also consume and analyze predictive analytics output from SPSS Modeler, an advanced analytics product from IBM, allowing users to add another dimension of insight to their work.

- **Information Builders delivers ADV embedded in its robust BI and integration platform.** While Information Builders is mostly known for its large-scale BI deployments — a result of its mainframe roots — WebFOCUS also offers highly competitive ADV functionality for business users. These capabilities include intuitive InfoAssist query builder and highly interactive Active Reports. There's also a hidden gem inside WebFOCUS: the Visual Discovery product, which offers a respectable in-memory data exploration and discovery alternative to other well-known in-memory BI vendors. While this may not be an issue in most ADV scenarios, under the covers WebFOCUS is based on the FOCUS fourth-generation programming language (4GL). In some exceptional situations, some advanced routines may still need to be tweaked and optimized using FOCUS programming.

- **SAS is a top ADV choice for power users solving complex business problems.** Even though SAS Enterprise Business Intelligence is a broad BI platform that supports most BI use cases, it is mostly known for its advanced analytics. If you are already a user of SAS BI, look no further than the ADV features of SAS JMP. SAS's new Visual Analytics product also empowers users with visual self-service for big data exploration techniques and approachable analytics. SAS may not be targeting the BI platform market as forcefully as the other leading vendors — Forrester sees this vendor more in advanced analytics deals — but it definitely has all the tools and components.

■ **SAP BusinessObjects offers excellent big data ADV.** In-memory is the name of the ADV game these days when one is looking for answers at the speed of thought. Most other in-memory DBMS engines, however, have practical limitations of analyzing no more than a few hundred GBs at a time. To address this limitation, SAP now offers a highly differentiated combination of BusinessObjects Explorer and Visual Analytics with its top exploration and discovery capabilities and the SAP HANA in-memory appliance. The largest production in-memory model today is about 7 to 8 terabytes (TBs) compressed to approximately 1 TB, and SAP has tested it in its labs to scale up to approximately 80 to 100 TBs compressed to about 16 to 20 TBs. Beyond ADV, SAP still needs to close several integration gaps in its vast BI product portfolio with tighter product-to-product integration, such as a more common user interface (UI) and reusability of components.

■ **Tibco Spotfire shines with its in-memory engine and ADV graphical user interface (GUI).** Tibco Spotfire Analytics features include a highly graphical associative in-memory engine that allows for intuitive data discovery and exploration, embedded advanced analytics, as well as tight integration with Tibco's complex event processing (CEP) engine for real-time process visualizations. Tibco Spotfire should not be viewed as a direct competitor to other vendors with broad BI offerings (for example, one would not use Spotfire to create pixel-perfect complex reports) but rather as complementary technology to those BI platforms that lack leading ADV-based discovery and exploration capabilities or cloud-based ADV (Tibco offers free-for-a-year Silver Spotfire cloud service).

■ **Oracle persistently and successfully closes gaps in its ADV portfolio.** While Oracle BI Server (an OBIEE component) continues to be a leading, enterprise-grade ROLAP engine with heterogeneous data sourcing capability, Oracle Business Intelligence Enterprise Edition (OBIEE) also successfully addresses many other ADV needs. Oracle's recent introduction of Exalytics "engineered system" closes one of the gaps in Oracle's BI portfolio with in-memory data analysis capabilities with a highly visual interface. Oracle's recent acquisition of Endeca (not evaluated in the current Forrester Wave), with its inverted-index DBMS and highly intuitive faceted navigation for data discovery and exploration, has the potential to significantly boost Oracle's overall position in the ADV market.

Strong Performers

■ **Microsoft enables business users to look no further than Excel for ADV.** Microsoft has built on its broad, omnipresent, SQLServer-based BI functionality, which already includes Integration Services, Reporting Services, and Analysis Services. It now offers a very respectable PowerPivot and Power View in-memory data analysis and discovery engine.[5] Think of this as Excel on steroids. If you are already using Excel — and who isn't — look no further for your ADV platform, especially if you already have it as part of your Enterprise SQLServer and/or SharePoint license. Microsoft may only offer about 80% of the advanced BI functionality compared with other leading vendors, but what it lacks in features it more than makes up in cost-benefit ratios.

- **MicroStrategy offers ADV on an unlimited number of data sources.** For most organizations, a neatly modeled enterprise data warehouse (EDW) with all of the enterprise data already loaded and ready is not reality, so the ability to visualize data across multiple heterogeneous data sources is a top requirement. This is where MicroStrategy shines with the multisourcing capability of its battle-proven ROLAP engine. ROLAP engine has an additional benefit as well: Many Forrester clients cite lower long-term costs of BI ownership due to needing to build fewer cubes or reports. Furthermore, MicroStrategy's Visual Insight tool enables business users to visually explore data and generate insights, whether with enterprise data or a simple import of a local file on the user's desktop. However, leveraging all of ROLAP engine's powerful features can be complex and time consuming.

- **Actuate offers one of the top open source ADV platforms.** Conventionally known for its highly scalable mass report distribution and complex report writer development platform, Actuate's open source ActuateOne engine has a critical mass of business-user-friendly features to stand its ground as a respectable ADV platform. While traditionally not known for analytics, Actuate's new features include in-memory data objects for OLAP-like analysis as well as some data exploration and discovery. Aficionados of OSS can also use BIRT onDemand for instant provisioning of an ADV sandbox in the cloud.

- **QlikTech remains a pervasive and omnipresent ADV platform of choice.** QlikTech QliKView frequently and rightfully turns up on Forrester client shortlists for ADV platforms. While we did not perform benchmark testing in this evaluation, our clients often tell us that they prefer QlikTech over other in-memory engines in memory-compression and speed-of-analysis benchmarks. QlikTech was one of the first vendors to introduce associative search across the entire database, which helps address the infamous I-don't-know-what-I-don't-know problem. If you are looking for a certain value or string, all you need to do is start typing it in one place — a single search box. The associative DBMS nature of QlikTech will instantaneously identify and highlight all columns and rows with a match. QlikTech should not be viewed as a direct competitor to vendors with broad BI offerings (one would not use QlikTech to create pixel-perfect complex reports) but rather as complementary technology to those ADV platforms that lack leading discovery and exploration capabilities.

- **SpagoBI provides an OSS ADV platform that is entirely license free.** SpagoBI doesn't offer commercial add-ons to its community editions, unlike other open source ADV vendors Actuate, Jaspersoft, and Pentaho. The entire platform is free of license costs; one only pays for implementation services, maintenance, and upgrades. SpagoBI offers a highly functional semantic layer, often absent in other open source platforms and projects, and a respectable set of ADV features including geospatial analytics. SpagoBI's roots and its main client base are intertwined with its parent company, large Italian systems integrator Engineering Group (Italy). However, SpagoBI has fully productized its BI software and is now working with several implementation partners outside of Europe.

- **Panorama Software leapfrogs competition with ADV collaboration functionality.** While most other ADV vendors only scratch the surface of collaboration features with report annotations, Panorama's Necto release offers true social media collaboration with features including friending, following, and workgroup circles. Panorama Necto by itself does not offer data exploration and discovery capabilities but rather will work as a different UI on top of other exploration engines, such as Microsoft PowerPivot. Also, if Google is your choice for office productivity tools, Panorama has years of experience with OLAP (Google PivotTables) on data stored in Google spreadsheets.

Contenders

- **Jaspersoft is an OSS BI suite with a limited but growing set of ADV capabilities.** Jaspersoft BI Enterprise is a maturing platform with strong ADV capabilities such as multiple types of data visualizations and a fully functional semantic layer (in its enterprise/commercial source edition). Jaspersoft plans to boost its ADV capabilities in a future release with features such as animations, storyboarding, and geospatial analytics.

- **Pentaho is an OSS BI suite with ADV capabilities best fit for the frugal buyers.** Pentaho Business Analytics is a growing platform with progressively stronger ADV capabilities in each new version, such as multiple types of data visualizations and a fully functional semantic layer (in the enterprise/commercial source edition). Pentaho's road map includes is a plan to boost its ADV capabilities by adding animations and storyboarding and enhancing its geospatial analytics and data exploration features.

SUPPLEMENTAL MATERIAL

Online Resource

The online version of Figure 3 is an Excel-based vendor comparison tool that provides detailed product evaluations and customizable rankings.

Data Sources Used In This Forrester Wave

Forrester used a combination of three data sources to assess the strengths and weaknesses of each solution:

- **Vendor surveys.** Forrester surveyed vendors on their capabilities as they relate to the evaluation criteria. Once we analyzed the completed vendor surveys, we conducted vendor calls where necessary to gather details of vendor qualifications.

- **Product demos.** We asked vendors to conduct demonstrations of their product's functionality. We used findings from these product demos to validate details of each vendor's product capabilities.

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- ■ **Customer reference survey.** To validate product and vendor qualifications, Forrester also conducted surveys of four to 32 vendor current customers.

The Forrester Wave Methodology

We conduct primary research to develop a list of vendors that meet our criteria to be evaluated in this market. From that initial pool of vendors, we then narrow our final list. We choose these vendors based on: 1) product fit; 2) customer success; and 3) Forrester client demand. We eliminate vendors that have limited customer references and products that don't fit the scope of our evaluation.

After examining past research, user need assessments, and vendor and expert interviews, we develop the initial evaluation criteria. To evaluate the vendors and their products against our set of criteria, we gather details of product qualifications through a combination of lab evaluations, questionnaires, demos, and/or discussions with client references. We send evaluations to the vendors for their review, and we adjust the evaluations to provide the most accurate view of vendor offerings and strategies.

We set default weightings to reflect our analysis of the needs of large user companies — and/or other scenarios as outlined in the Forrester Wave document — and then score the vendors based on a clearly defined scale. These default weightings are intended only as a starting point, and we encourage readers to adapt the weightings to fit their individual needs through the Excel-based tool. The final scores generate the graphical depiction of the market based on current offering, strategy, and market presence. Forrester intends to update vendor evaluations regularly as product capabilities and vendor strategies evolve.

ENDNOTES

[1] Source: Edward Tufte, *The Visual Display of Quantitative Information*, Graphics Press, 2001.

[2] Business rules platforms are a mature technology for automating decision and policy logic and for managing fast changes to that logic to keep up with business changes. Now customers are seeking more: capabilities allowing them to employ business rules to help detect and respond to business events hiding in streams of data and to automate decision life cycles. This research reveals how well vendors are responding to these new requirements. See the July 5, 2011, "The Future Of Business Rules Platforms" report.

[3] Source: Meta Integration Technology (http://www.metaintegration.net).

[4] Many business intelligence (BI) vendors do not publish list prices. Some do not even provide list prices under NDA to their customers and prospects. Plus, BI pricing and licensing models differ greatly from vendor to vendor, keeping many BI software buyers from having a frame of reference when evaluating proposals from BI vendors. To help organizations know whether they are getting a good deal from their BI software provider, we've assembled a list of industry average BI deal prices for typical small business, medium-size business, and enterprise scenarios. Extrapolate and adjust these averages to fit your deal specifics and then use them as the starting point for BI contract negotiations. See the November 14, 2011, "Six Steps To Negotiating A Better BI Deal" report.

[5] Source: Microsoft (http://www.microsoft.com/en-us/bi/Products/OfficePreview.aspx)

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