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Data Warehouse Automation Helps Close The Data-To-Insight Gap

by Boris Evelson and Nasry Angel
August 16, 2016

Why Read This Report

Agile business intelligence (BI) platforms only partially support the iterative development of BI applications. Parts of the process, like data integration and modeling, still follow a less flexible waterfall development life cycle. In this report, AD&D pros can learn about a landscape of vendors that bring Agile options to all phases of BI application development. These data warehouse automation (DWA) platforms facilitate shorter, more iterative development cycles, foster collaboration between the business and technology management, and require fewer expensive human resources with specialized data modeling skills.

Key Takeaways

Agile BI Requires More Than Just Agile Dashboards
True agility means prototyping data models (not just dashboards and reports) quickly so business users can continuously iterate on it. AD&D pros working on BI initiatives should consider adding DWA platforms to their BI toolbox.

DWA Enables BI Self-Service For Use Cases Requiring A Data Warehouse (DW)
DWA is not a data warehouse appliance, nor data-warehouse-as-a-service (DWaaS) — it's software that automatically generates a data warehouse by analyzing the data itself and applying best practices for DW design embedded in the technology. Another name for this type of technology is "metadata-generated analytics."

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with Gene Leganza, Brian Hopkins, Noel Yuhanna, and Shreyas Warrier
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Notes & Resources

Forrester interviewed five vendor and user companies: Attunity, Birst, Magnitude Software, TimeXtender, and WhereScape.

Related Research Documents

The Forrester Wave™: Agile Business Intelligence Platforms, Q3 2015

Insight Platforms Accelerate Digital Transformation

It's Time For A User-Driven Enterprise BI Strategy

TechRadar™: Business Intelligence, Q1 2015

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Traditional BI Development Delivers Insights Through A Dropper

The famous designer and teacher Inge Druckrey said, "You can't come up with ideas if you don't see first." This principle applies perfectly to business users' relationship with data. You don't know what you don't know, and until business users can "see" or "play" with the data, they may not be able to fully articulate their business requirements. But most BI shops follow a waterfall system development life cycle (SDLC) that takes too long and is too inflexible to keep up with digitally empowered customers — and limits business involvement. There is no room in waterfall for the trial and error, exploration, or discovery essential to creating valuable business insights. One-third of enterprise users report that fast-changing analytic and reporting requirements is their firm's top challenge when orchestrating their BI strategy.[1] In response, Forrester sees application development and delivery (AD&D) pros working on BI initiatives evolving their approaches to be more agile by:

› **Empowering business users to self-author the majority of BI content.** AD&D pros can help foster BI agility by deploying highly visual and intuitive Agile BI tools. Business users — executives, managers, and individual contributors — who are already proficient in Excel can learn and start authoring content using BI tools in a matter of minutes or hours. But Forrester's data shows there's room for improvement: Only 53% of individual contributors are able to apply insights to operational processes and actions in a timely manner, compared with 61% of managers and 76% of C-suite executives.[2]

› **Embracing rapid and iterative prototyping to replace slow waterfall techniques.** No one gets BI requirements right on the first attempt. Strong anecdotal evidence shows that, at best, business users can guess no more than a quarter to a third of the data sources, metrics, and ways they are going to utilize the information before they actually see a prototype. Luckily, modern BI tools can prototype a report or a dashboard in hours or even minutes — much faster than putting requirements on paper or using outdated whiteboarding or other manual prototyping techniques.

Agile BI Tools Address Development Agility For Only Parts Of The Full BI Stack

The days of technology-management-centric BI application development are numbered. Modern BI technologies cater directly to business users. However, these tools only address developing BI prototypes and applications for (see Figure 1):

› **The top layer of the BI stack — reporting, analytics, and dashboards.** Leading Agile BI vendors like IBM, Information Builders, Microsoft, MicroStrategy, Oracle, Panorama, Qlik, SAP, SAS, Tableau Software, and TIBCO Software provide platforms where business users can self-author the majority of BI content.[3] These tools provide intuitive point-and-click and/or NLP GUIs that let users connect to a variety of data sources, automatically model the data, perform a few simple data integration functions, create metrics and KPIs, and visualize data in dashboards.[4] However, some of these tools offer all of the above functionality only for data sets that are small enough to be loaded into

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memory — usually under 100 GBs. Larger data sets require a disk-based data model and storage — technology and processes that are still the realm of technology management professionals like data modelers and database administrators.

› **The data preparation stage of the BI process.** The same business focus revolution that already happened in BI is also happening in data management via technology referred to as "data prep." AD&D pros can still use powerful, large, enterprise-grade ETL tools, like Informatica or IBM DataStage.[5] Additionally, most BI tools provide a few basic data prep features that business users can leverage. Now there's also a third option: Vendors like Alteryx, Paxata, and Trifacta provide ETL-like products that focus on business users, who can develop data prep processes feeding applications built in multiple BI tools.[6]

› **The source data discovery phase.** ETL and data curation processes require source-to-target mapping. But given the explosion of data sources, manual mapping is too slow — this is the realm of data profiling tools. These tools programmatically scan data sources and display information about them like most common values, data sparsity, data ranges, outliers, and so on. Most ETL tools — such as those from Ab Initio Software, IBM (DataStage), and Informatica — come with robust data profiling capabilities, as do the data prep tools. Newly emerging data catalog products like Alation or Waterline Data also specialize in data profiling, especially on big data sources.

FIGURE 1 Agile BI, Data Preparation, And Profiling Capabilities Of Selected Vendors

Platforms	Agile BI	User-focused data preparation	Data profiling	Representative vendors
Agile BI	Yes	Light	No	Yes
User-focused data preparation	Yes	Comprehensive	Yes	Alteryx, Datawatch, IBM (DataWorks), Informatica (Rev), Lavastorm Analytics, Paxata, Tamr, Trifacta
Agile BI with built-in data profiling	Yes	Light	Yes	Attivio, Oracle (Big Data Discovery)

DWA Tools Crack Open The Floodgates

For larger data sets and where complex transformations are required, you need a more comprehensive end-to-end BI architectural stack (see Figure 2). This typically requires integration of at least three types of development tools — ETL, data modeling, and BI — and includes nine different steps (see Figure 3). Even with Agile BI and Agile data prep tools you address only a portion of the end-to-end cycle — the rest still require the slow waterfall approach. What if AD&D pros and their BI business colleagues could run the entire cycle from a single platform and apply Agile principles? Forrester tracks five vendors in a BI category we call DWA that can automate most, not just one or two, steps of the BI development cycle (see Figure 4).[7] They are:
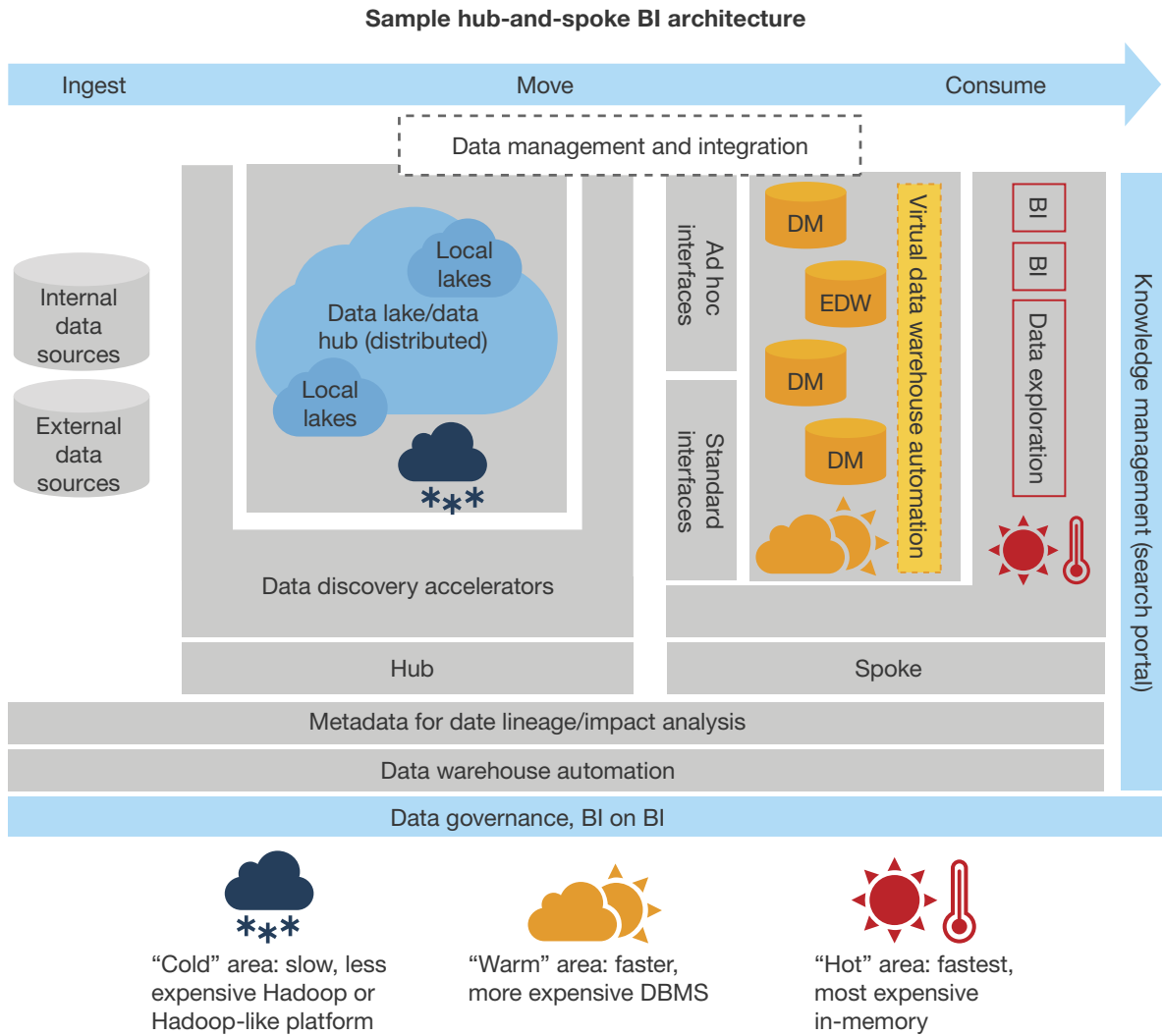
> **Attunity (Compose).** Attunity's Compose platform provides a model-driven approach for end-to-end DWA, where the data warehouse design and ETL are automatically generated from a logical data model. The architect connects the model to data sources, and Compose automatically generates ETL and all the physical data models from landing areas to the data warehouse to data marts, supporting a variety of DW design patterns. Once Attunity Compose is architected and deployed, BI center of excellence/competency center staff can use Attunity Visibility, a data usage analytics platform, to monitor and analyze performance of the DW and BI platforms for various usage patterns. As a last step in the DWA process, Attunity Compose can programmatically generate semantic layers or input files for Microsoft PowerPivot, Qlik, and Tableau Software.

> **Birst.** First and foremost, Birst is a complete insights platform that is based on a DWA architecture. Birst's DWA takes a data-driven approach — where data source definition programmatically generates the target schema. In addition to covering most requirements for self-service Agile BI and data visualization, Birst offers a few truly unique features. Its underlying ROLAP capabilities — not unique in the enterprise BI landscape, but seldom seen in Agile BI platforms — provide declarative capabilities that support metadata and data reuse versus building siloed applications. The platform also includes large enterprise performance-enhancing capabilities like multitiered caching and aggregate awareness. Additionally, unlike other cloud-based solutions, Birst does not require all data to be moved to the cloud. Instead, the platform can directly query data on-premises and combine it with analytic-ready data in the Birst cloud via query federation that supports a combination of hybrid cloud plus on-premises deployment scenarios.

> **Magnitude Software (Kalido Information Engine).** The platform offers a top-down, requirements-driven business information modeling solution, coupled with automation in all phases of DW design, build, and ongoing operation. This approach helps bridge the communications gap between technology management and business pros to ensure your DW meets the analytical needs of the business and remains current. In addition to rapid design, build, and deployment, Kalido Information Engine includes a master data management capability to enable managing hierarchies and reference data. This capability ensures that only curated data is loaded into the warehouse. Kalido extends its automation out to the BI layer and automatically generates BI semantic layers for

popular BI tools, including SAP BusinessObjects, IBM Cognos, Microsoft Analysis Services, and Qlik. Magnitude also offers expertise and prebuilt capabilities to extract data from Oracle eBusiness Suite, PeopleSoft, and JD Edwards' operational applications.

› **TimeXtender (Data Discovery Hub).** The product is composed of an ODS, a DW, and a series of templatized models for several industry verticals and popular ERP data sources including Infor, Microsoft, and SAP.[8] TimeXtender specializes in providing DWA for the Microsoft SQL server. It automates the tasks required to model and govern data. In addition to building and maintaining a warehouse, you can use it to create a data discovery hub that enables business users to access data on their own time; maintain governance, security, and control; and reduce the backlog of technology requests. TimeXtender also extends its automation out to the BI layer and automatically generates BI semantic layers for popular BI tools, including Qlik, Microsoft PowerBI and SSAS, and Tableau Software.

› **WhereScape (3D and RED).** WhereScape RED DWA is based on both top-down and data-driven approaches — the latter, where data source definitions programmatically generate the target schema, is more popular with WhereScape clients. It also offers a unique capability — its 3D product can profile and analyze data sources, a "pre-ETL" step. The vendor boasts the broadest support for database engines, including Azure SQL Data Warehouse, EMC Greenplum, IBM DB2 and Netezza, Microsoft Analytics Platform, Microsoft SQL Server, Oracle Exadata, and Teradata. Additionally, WhereScape is spearheading the big data trends and is the only DWA vendor that will generate the schema on Apache Hive or Pivotal commercial distribution.

FIGURE 2 Big Data And Business Intelligence Hub-And-Spoke Architecture

Sample hub-and-spoke BI architecture

"Cold" area: slow, less expensive Hadoop or Hadoop-like platform

"Warm" area: faster, more expensive DBMS

"Hot" area: fastest, most expensive in-memory

FIGURE 3 Multiple Platforms Are Required To Address Developing All Components Of A Full BI Stack

BI component	Source data profile and discovery
1. Data sourcing	Source data profile and discovery
2. Data curation	Data transformation, integration, cleansing, reconciliation, and aggregation
3. Staging area/ODS	A single place to stage transactional and reference data from multiple sources. Requires building and maintaining a logical and a physical data model.
4. Enterprise data warehouse (EDW)	Optimizes cross-enterprise transactional data for reporting and analysis. Keeps history, by adding a time dimension. Needs functionality to handle slowly changing dimensions (customer/product name changes). Requires building and maintaining a logical and a physical data model.
5. Data marts	Specific subject matter extension of a data warehouse. Requires building and maintaining a logical and a physical data model.
6. OLAP cubes	Models and optimizes data for instantaneous slicing and dicing — analyzing data by various attributes. Requires building and maintaining a logical and a physical data model.
7. Semantic layer	Creates business-friendly definitions (versus cryptic database objects names) for tables, columns, metrics, and key performance indicators (KPIs)
8. Metrics and KPIs	Precalculated, pre-aggregated values
9. Reports and dashboards	Summary or detailed level data organized in tabular reports, banded reports, or data visualizations

BI component	IT-pros-focused platforms	Business user self-service and agility addressed by	Percentage of total effort
1. Data sourcing	Data profiling or extract, transform, load (ETL) with built-in data profiling	Data profiling platforms	80%
2. Data curation	ETL, master data management (MDM), data quality	Data preparation platforms and BI platforms' data preparation features	
3. Staging area/ODS	Data modeling	Not addressed unless a DWA platform is used	
4. Enterprise data warehouse (EDW)	Data modeling	Not addressed unless a DWA platform is used	
5. Data marts	Data modeling	Not addressed unless a DWA platform is used	
6. OLAP cubes	Data modeling and BI with OLAP engines	Partially addressed unless a DWA platform is used	
7. Semantic layer	BI	BI platforms or a DWA platform	
8. Metrics and KPIs	BI	BI platforms or a DWA platform	20%
9. Reports and dashboards	BI	BI platforms	

FIGURE 4 Data Warehouse Automation Capabilities Of Five Key Vendors

Capability	Attunity	Birst	Magnitude
Approach	Top-down, model-driven*	Bottom-up, data-driven*	Top-down, model-driven
Data profiling	Yes	No	No
Extract, transform, load (ETL)	Native graphical user interface (GUI)-based ETL	Native GUI-based ETL tool	Native GUI-based ELT tool
		APIs to integrate with third-party ETL platforms	Third-party ETL into a staging area
		Third-party ETL into a staging area	
Logical data model	Native GUI-based modeling tool	Programmatically created	Native GUI-based modeling tool to created conceptual model
	Integration with ErWin		Logical model is programmatically created.
Physical data model	Any. Optimized for SQL server, Oracle Database, Oracle Exadata, Teradata.	Programmatically created ROLAP model	Any. Optimized for Microsoft SQL Server, Oracle Exadata, Teradata.
Slowly changing dimensions	Type 1, 2, and 3	Type 1 and 2	Type 1, 2, 3, and hybrid/Type 6 (1 + 2 + 3). Types can be changed anytime with no loss of history.
			Types can be changed anytime with no loss of history.
Build ODS/EDW/DM	ODS, EDW, DM	Star and snowflake schemas‡	Star and snowflake schemas‡
		EDW or DM	ODS, 3NF, EDW, or DM
Build aggregates/ cubes	Aggregates and cubes	Aggregates and cubes. Birst native BI is aggregate-aware.	Aggregates, cubes
	Aggregate aware-ness depends on the BI platform.†		Aggregate awareness depends on the BI platform.
Integration with BI platforms (generate BI semantic layer)	Microsoft Power Pivot, Qlik, Tableau Software	Tableau Software	IBM Cognos, Microsoft SSAS, Qlik, SAP BusinessObjects

*Model-driven approach: Create a conceptual or a logical model first, then connect it to data sources. Data-driven approach: First identify data sources, then create a logical model that best fits the source data requirements.

†An aggregate-aware BI platform automatically optimizes SQL by redirecting query with a "GROUP BY" statement to a table with precalculated aggregates.

‡Star and snowflake schemas are data models optimized for analysis; 3NF (third normal form) is a data model optimized for transaction processing.

FIGURE 4 Data-Warehouse-In-A-Box Capabilities Of Five Key Vendors (Cont.)

Capability	TimeXTender	WhereScape
Approach	Both top-down and bottom-up, model- and data-driven*	Both top-down and bottom-up, model- and data-driven*
Data profiling	No	Yes
Extract, transform, load (ETL)	Native GUI-based ETL tool	Native GUI-based ETL
	Third-party ETL into a staging area	Generates Microsoft SSIS ETL
		Generates SQL-based ELT for any RDBMS
Logical data model	Native GUI to create logical model	Native GUI-based modeling tool
	Integration with ErWin	
Physical data model	Optimized for Microsoft SQL server	Any. Optimized for Azure SQL Data Warehouse, EMC Greenplum, IBM DB2 and Netezza, Microsoft Analytics Platform, Microsoft SQL Server, Oracle Exadata, Teradata. Can generate Hadoop Hive, Impala, and Drill tables.
Slowly changing dimensions	Type 1, 2, and 3	Type 1, 2, and 3
Build ODS/EDW/DM	ODS, EDW, DM	ODS, EDW, DM
		Star and snowflake schemas‡
Build aggregates/ cubes	Aggregates, cubes	Aggregates, cubes
	Aggregate awareness depends on the BI platform.†	Aggregate awareness depends on the BI platform.
Integration with BI platforms (generate BI semantic layer)	Microsoft Power BI and SSAS, Qlik, Tableau Software	None

*Model-driven approach: Create a conceptual or a logical model first, then connect it to data sources. Data-driven approach: First identify data sources, then create a logical model that best fits the source data requirements.

†An aggregate-aware BI platform automatically optimizes SQL by redirecting query with a "GROUP BY" statement to a table with precalculated aggregates.

‡Star and snowflake schemas are data models optimized for analysis; 3NF (third normal form) is a data model optimized for transaction processing.

Deploy DWA Only When Benefits Outweigh Concerns

DWA benefits are compelling, but depending on the use case, there are also potential limitations and concerns. AD&D pros working on BI initiatives where DWA may be a good fit should consider the following benefits and cautions associated with such a strategic technology decision (see Figure 5). DWA is a great fit for organizations:

› **That are just starting on their DW journey.** DWA should be an obvious option for most new DW implementations. Why doom yourself to learning from your own mistakes when you can instead benefit from the best practices and lessons learned in architecting and deploying DWs codified in DWA tools? But there's no easy way to reverse engineer and migrate an existing DW to an automated DWA model. Forrester clients typically build DWA as a source or a target for existing DWs and migrate functionality to the new model over time.

› **Where data, not just visualization requirements, change frequently.** A global digital agency provides data as a service to its clients. Each client's requirements, including data sources, are different, and each client's marketing campaigns run on different schedules, address different customer segments, and have different effectiveness and profitability metrics. Rather than reinventing the wheel for each client, the agency's CIO chose a DWA to find a perfect middle ground between addressing different clients' requirements and keeping commonality between DW best practices, architectures, and automation. However, in certain use cases, waterfall SDLC is still the best approach for the data management steps of BI applications. For example, DWA may not be overkill for DW-based applications in highly regulated industries such as financial services or pharma. In these industries, seldom-changing data management processes such as financial accounting and regulatory reporting don't require constant DW prototyping and iteration.

› **That lack data modeling and DW operational skills.** Since DWA codifies best practices for data modeling, smaller technology management departments can also deliver a well-designed DW without the need to find scarce — and expensive — database architects. These also won't have to worry about DW operationalization, as DWA platforms come prebuilt with automation like scheduling refresh cycles, version control, and migration. A $300 million US producer of canned food products has a small IT department with only a few developers. When business requirements called for an EDW, the CIO realized that his existing team lacked the skills and he did not have budget for a staff increase. A DWA allowed the company to deploy a well-designed and operationalized EDW without additional architects.

› **That don't require constant tuning and optimization of physical data models.** The codified best practices in DWA technology may be a limitation to a much larger enterprise with big data and complex physical database tuning requirements. Since DWA autogenerates the physical data model, it leaves little room for optimization and tuning. Yes, a database administrator can always manually tune the physical model by adding indexes, aggregates, create different partition schemes. But this would break the automation cycle and insert manual steps every time there's

a change to the model. This defeats the purpose of DWA and makes iterative development and prototyping even more challenging. However, this limitation does not apply to columnar or MPP databases, which can scale even without building indexes or aggregates.[9]

FIGURE 5 Benefits And Cautions Associated With Deploying Data Warehouse Automation

	Without DW automation	**With DW automation**
Number of tools	At least four: extract, transform, load (ETL); logical data modeling; physical data modeling; BI platforms	One: combines ETL, logical and physical data modeling, and BI metadata creation
Metadata repository, semantic layer	Multiple	One metadata repository for ETL and data modeling
		Autogenerate multiple but consistent BI semantic layers
HR skills for data modeling	Relational and dimensional data modeling. Physical data design and architecture.	Not required
Agility	Only for BI and data preparation	For entire BI cycle
New implementations versus upgrading existing data warehouse (DW)	Similar approach to handling new initiatives and updating/modifying existing DW	More applicable to new implementations. Existing DW will have to use DW in a box as a source or a target and slowly migrate.

FIGURE 5 Benefits And Cautions Associated With Deploying Data Warehouse Automation (Cont.)

	Benefits of DW automation	Cautions
Number of tools	Fewer tools to purchase and maintain; easier, more Agile change management	Forces methodology and design; harder to customize and optimize
Metadata repository, semantic layer	Easier impact and lineage analysis	None
	Easier, more Agile change management	
	Consistency across multiple BI platforms	
HR skills for data modeling	Codified best practices for generating star and snowflake schemas and handling slowly changing dimensions	Forces data model design and architecture. Harder to customize and optimize.
Agility	More agile, flexible, and speedy reiterative implementation cycles	None
New implementations vs. upgrading existing DW	Clearer benefit for new implementations	Complex and long migration cycles from existing DW

What It Means

Consider A DWA Platform When All The Stars Align Just Right

DWA is an extremely useful technology — but only for a limited number of applications. Forrester has tracked this market segment for the last nine years, and it has not seen significant changes in terms of client adoption beyond steady organic growth. Additionally, business requirements that call for a NoSQL data store with schema-on-read or schema-less data exploration will limit DWA applicability in some big data use cases and applications. Still, given the limited use cases, the market has seen room for an increased number of competitors, albeit all quite small compared to the vendors evaluated in this document.[10] Therefore, AD&D pros looking to transform to a customer-obsessed operating model should not overlook the opportunity to leverage DWA tools as part of their arsenal to enable Agile self-service analytics for business users.

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Supplemental Material

Companies Interviewed For This Report

Attunity

Birst

Magnitude Software

TimeXtender

WhereScape

Endnotes

[1] Base: 3,343 data and analytics decision-makers. Source: Forrester's Global Business Technographics® Data And Analytics Survey, 2016.

[2] Source: Forrester's Global Business Technographics Data And Analytics Survey, 2016.

[3] In Forrester's 15-criteria evaluation of Agile BI vendors, we identified the 13 most significant software providers in the category and researched, analyzed, and scored them. This report details our findings about how well each vendor

fulfills our criteria and where they stand in relation to each other to help AD&D professionals select the right platform for their Agile BI requirements. See the "The Forrester Wave™: Agile Business Intelligence Platforms, Q3 2015" Forrester report.

[4] NLP: natural language processing; GUI: graphical user interface; KPI: key performance indicator.

[5] ETL: extract, transform, load.

[6] Source: Boris Evelson, "BI and data integration professionals face a multitude of overlapping data preparation options," Boris Evelson's Blog, September 9, 2015 (http://blogs.forrester.com/boris_evelson/15-09-09-bi_and_data_integration_professionals_face_a_multitude_of_overlapping_data_preparation_options).

Analysts and consumers of data both spend significant amounts of time wrangling data in order to conduct analyses and gain insights. The data in their systems lacks the context of their questions, decisions, or business actions. Enterprise architects take note: New big data environments, faster data integration, and analytic appliances aren't the answer. Your analysts need better tools to speed up data preparation efforts that ultimately lead to faster, deeper insights that matter to the business. See the "Vendor Landscape: Data Preparation Tools" Forrester report.

[7] In a 2015 TechRadar™ report, Forrester referred to these tools as "metadata-generated analytics." "Metadata-generated" is indeed the right term to describe these tools, since a developer first generates rules, models, and other metadata via a point-and-click GUI, and the tool then automatically generates computer code to create data transformations and models. However, since in the majority of the cases these tools are used to generate data warehouses or data marts, Forrester now prefers the term DWA. See the "TechRadar™: Business Intelligence, Q1 2015" Forrester report.

[8] ODS: operational data store; EDW: enterprise data warehouse; ERP: enterprise resource planning.

[9] MPP: massively parallel processing.

[10] Ajilius provides a comprehensive list of data warehouse automation products. Source: Ajilius (http://ajilius.com/competitors/).

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