Oracle Business Analytics:
Procurement and Spend Analytics with
Spend Planning on Oracle Engineered Systems
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Executive Overview

Business Analytics systems are required to get fact-based insight to compete effectively and user expectations are escalating rapidly. Yet, Procurement is a business function that traditionally is underserved by enterprise BI and EPM investments, and procurement professionals often are forced to manage suppliers, spending, and expenses on spreadsheets or with basic systems. Pre-built analytic and planning applications, delivered quickly and cost-effectively with in-memory performance and enterprise scale are necessary. This white paper examines the advantages of pre-built analytic and planning applications for procurement, delivered on optimized Oracle Engineered Systems, and how they can be a foundational element of a vibrant, growing analytic capability that will pay ongoing dividends.

Introduction

Across industries, companies are facing increased pressure to minimize costs and achieve greater efficiencies. For the Procurement function, this means ensuring expenditures on direct and indirect materials, as well as the number of vendors who provide them, are carefully controlled. Effective procurement and spend management helps ensure that revenue targets are met by properly anticipating customer demand and ensuring that there is adequate inventory to fill orders, while simultaneously optimizing spend to decrease costs and increase profitability.

Oracle Procurement & Spend Analytics enables procurement professionals throughout the organization to get a clear picture of direct and indirect spend, control material and component costs, and manage suppliers. Oracle Spend Planning leverages data and analysis from Procurement & Spend Analytics, together with collaborative inputs from stakeholders, to generate detailed, accurate forecasts for indirect spend, optimize spend using what-if models, and demonstrate bottom-line improvements.

Oracle Procurement & Spend Analytics is part of Oracle BI Applications, a family of pre-built analytic applications that integrate with Oracle ERP, HCM, CRM, and industry applications. When Procurement and Spend Analytics is joined with other BI Applications, like Financial Analytics, Supply Chain and Order Management Analytics, Manufacturing Analytics, Project Analytics, HR Analytics or

<table>
<thead>
<tr>
<th>Acronyms Defined</th>
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<tbody>
<tr>
<td>BI = Business Intelligence</td>
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<tr>
<td>CRM = Customer Relations Management</td>
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<td>ERP = Enterprise Performance Management</td>
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<tr>
<td>ETL = Extraction Transformation Load</td>
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<tr>
<td>HCM = Human Capital Management</td>
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<td>KPI = Key Performance Indicator</td>
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<td>SCM = Supply Chain Management</td>
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CRM Analytics, you can ensure that rich operational and management insights drive all sourcing initiatives, customer, supplier, and financial decisions, resulting in lower costs, increased revenue, and greater profitability.

As the #1 vendor in Business Analytics and the #1 leader for Enterprise Performance Management, and one of the largest providers of business applications, Oracle is uniquely able to offer the industry’s most complete and integrated range of enterprise analytic and performance management solutions that deliver true business value.

This white paper introduces the benefits and challenges of spend analysis and planning. It then discusses how an integrated solution consisting of Oracle Engineered Systems, Oracle BI Foundation technology, and pre-built applications for spend analysis and spend planning delivers distinct advantages such as:

- 5X to 100X faster interactivity, leading to better visibility, decisions, and accuracy
- 6X to 10X faster planning cycles
- 2.5 to 3.5X quicker development cycles, resulting in faster time to value, lower risk, and lower TCO.

The Business Problem and Challenges: Why Spend Analytics and Planning?

The core job of procurement professionals is to manage suppliers and to control and optimize material, component, and indirect costs.

The following need to be addressed:

- **Control material and component costs.** Direct spend savings fall immediately to the bottom line in the form of improved margins.

- **Control indirect spend.** Indirect spend represents 50-90% of third party spend depending upon the industry, yet remains an untapped opportunity to improve the corporate bottom line. Yet it is a significant challenge to any procurement team to predict demand for indirect purchases.

1 A.T. Kearney 2010 Indirect Procurement Survey.
• **Quantify supplier performance.** Analyze detailed, transaction-level data to understand the factors driving supplier performance.

• **Manage suppliers more effectively.** Improve performance by identifying the worst-performing suppliers in terms of schedule adherence or pricing inconsistencies.

• **Ensure timely payments to suppliers.** Optimize cash flow through detailed accounts payable and procurement analysis.

• **Demonstrate savings.** Procurement teams must demonstrate savings delivered to the business.

• **Rapidly develop detailed spend plans.** Predefined models and integration into enterprise data sources make spend planning quick.

• **Predict spending amounts and patterns over time.** This is the essential information to begin shaping future purchases to leverage favorable prices, discounts, and supplier performance.

• **Optimize Spend.** With projected purchase demand in hand, procurement teams have the right information to begin optimizing spend in the product categories that will yield the greatest savings.

• **Plan and analyze collaboratively.** Oracle Spend Planning isn’t just for procurement teams. It also helps department managers rapidly create detailed indirect spend projections. By forecasting purchases at the product level, managers can build more accurate budgets, and ensure spend plans align with execution plans.

Today, companies realize that the information locked in enterprise and legacy systems is incredibly valuable. Being able to analyze this information, combined with other corporate data sources is essential to drive the business forward based on facts, rather than intuition, and this information is the vital foundation for any planning activities. For procurement professionals, clear, trusted insight in suppliers, the purchasing process, and financial outcomes is essential. Although most organizations have been investing in reporting, query tools and data warehouses for a long time, many struggle to achieve broad deployment.

Why has this been such a challenge?

First, it’s hard to build these systems and they require specialized skills. It’s hard to build analytic applications, to integrate necessary technologies, to extract data from ERP and other enterprise systems, to conform and model the data, to define best practice business metrics and Key Performance Indicators (KPIs), to create what-if scenarios and procurement planning models, and to make all that compelling and easily usable by a range of business users. And those are just the basics.

Second, users are bringing whole new sets of expectations to analytics around relevance, ease of use, and responsiveness.

**Traditional Build-Your-Own Business Analytics and Planning Systems Impose Constraints**

Traditionally, analytic and planning applications have been a build-your-own affair, with each company independently collecting requirements, extracting data, combining that data in a data warehouse, and
then providing users query and reporting tools to build their own analyses. Planning “applications” are often a complex collection of interlinked spreadsheets.

- It is difficult for business users to voice their requirements for analytics. They don’t know what is possible or what peer businesses are doing. Requests for requirements are often answered with “don’t know” or “give me everything.”
- Extracting data from complex transactional schemas of ERP, CRM, HCM SCM and other enterprise applications, consolidating and integrating data from heterogeneous systems and applications, and reconciling and validating data quality are all specialized skills and the work takes time. Skilled data architects, data warehouse designers and ETL programmers are needed to build from scratch.
- Many organizations completely lack any planning applications and an enterprise-class planning platform, relying instead on complex spreadsheets, which introduce risk and diminish collaboration.
- Often a selection of tools and technologies needs to be integrated in order to fulfill the range of analytics needs. No case is truer than when both “read-mostly” analytic applications and “read-write” planning applications capabilities are needed together.
- It takes too long to create procurement forecasts with reliable data, since there often isn’t a consolidated, curated source of necessary information coming from various transactional and planning systems. Consequently, there is no ability to assess the effectiveness of plans and react quickly to changes.
- It’s difficult to evaluate alternative scenarios that use real constraints from supplier agreements, since this information is not readily available for analysis.
- Separate spreadsheet planning models hinder alignment between lines of business, finance, and procurement, and there is a lack of collaboration among stakeholders to produce and approve spend plans. This is because spreadsheet models are inherently brittle, difficult to share, and provide no workflow approval mechanism.
- As data sizes and user volumes increase, ongoing administration and performance tuning is needed, else the system can get bogged down.

New Demands for Analytic and Planning Applications

Business users have higher expectations than ever before, as they experience the “Google effect” of searches being returned instantaneously, and consumer devices like the iPhone, which are easy to use and optimized for particular functions. Based on the experience of thousands of analytics and planning implementations, both custom-built and using prebuilt analytic and planning applications, the following requirements emerge:

- **Integrate diverse corporate sources of information into an enterprise view.** The reality for almost all organizations is relevant data is stored in fragmented sources. Analytics on a particular silo of information is useful, but creating a consolidated enterprise-wide view is much more beneficial. With the consistency of an enterprise data model, business can perform analysis across subject areas,
enabling, for instance, a company to detect customer satisfaction problems are tied to delayed shipments, which are in turn caused by slow accounts payable to critical vendors.

- **Trusted metrics, following industry best practices.** Monitoring metrics and Key Performance Indicators (KPIs) is the lifeblood of performance management. A palette of pre-defined industry best practices metrics, built off curated, trustworthy data sources, and presented in understandable, easy to navigate dashboards is a base requirement. And, businesses need to be able to configure these as necessary for their specific organizations.

- **Clean, clear dashboards and reports, designed for instant understandability.** A single metric or KPI is no use without context. How does the number compare with this period last year? How has product mix preference shifted over time? What is the trend in on-time shipments and how does supplier performance affect that? These typical business questions can require complex calculations presented in well-designed dashboards that provide context, and guided analysis paths. This level of design is typically beyond the skills of most users and, even, most IT professionals.

- **Rich data visualization including location-based, geospatial views.** In order to gain the best understanding of the data being analyzed, and for people to engage their right brains, appropriate visualizations are needed.

- **Interactive, self-service exploration.** Once a problem is detected, business users want to “drill down” and perform additional analysis to uncover root cause problems. They may want also to specialize an existing report or dashboard, or to create their own analysis to reuse and share.

- **Model outcomes and run what-if scenarios.** After a problem is detected and diagnosed, then what? Businesses want to model what actions to take through scenario modeling, to answer questions like “What if I reduced the number of strategic suppliers,” or “Which areas of spend have the most opportunity for optimizing?”

- **Provide a collaborative planning environment to leverage the “Wisdom of Crowds.”** Workflow approvals,

- **See what’s happening now and what is likely to happen in the future.** As companies mature in their analytic capabilities, they desire to move beyond analyzing history—too late to affect the business results—and react in near-real time. As sophistication rises, they want to employ advanced predictive analytics to see what’s likely to happen. Advanced analytics like data mining and statistical techniques can project what is likely to happen in the future.

- **Mobile, anytime, anywhere.** Gartner estimates that 33% of BI content in 2013\(^2\) will be consumed by mobile devices. There is no doubt that demand for mobile intelligence is exploding. Today’s mobile devices

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workforce demands access to the information they need, wherever they are, securely with no additional development or compromise in functionality or form factor.

- **Combine structured with unstructured data and Big Data.** While analytics predominantly are used for structured, tabular data, there can be great business advantage to involve unstructured data that might include verbatim text in ERP or CRM systems, external social media feeds like Twitter and Facebook, or to access unstructured information stored in Hadoop.

- **Integrated technology and analysis tools.** Different users have different levels of analytic inclination and skills. Some want merely to consume pre-built analysis, and others want to develop what-if models, predictive models, or analytic applications for others to consume. Organizations’ analytic needs mature and broaden over time. Therefore, a range of analytic capabilities is needed, but in many instances, the customer’s IT department is left to integrate all the necessary technologies. Pre-integrated BI technology with a broad range of functionality for today’s and tomorrow’s requirements is preferable.

This is a challenging list that requires a variety of skills and technologies. Thus, it is hard and expensive for organizations to tackle these items on their own, or just by hiring IT consultants.

**The Solution: Oracle Analytic and Planning Applications with Engineered Systems**

In order to address both current and evolving needs of procurement organizations, prebuilt analytic and planning applications, delivered on a complete and integrated technology foundation of optimized Engineered Systems are the way to go. This combination assures the easiest, most risk free implementation, is proven to deliver strong business value, delivers speed-of-thought performance and massive scale, and is aligned with Oracle technology and applications strategies, while remaining open to work with each customer’s individual IT environment.

**Oracle Procurement and Spend Analytics**

Oracle Procurement & Spend Analytics helps organizations to optimize their supply side performance by integrating data from across the enterprise value chain, thereby enabling executives, managers, and frontline employees to make more informed and actionable decisions.

Organizations using Oracle Procurement & Spend Analytics benefit from increased visibility into corporate spend as well as the complete procure-to-pay process, with comprehensive analyses of procurement performance, supplier performance, supplier payable trends and employee expenses. Through complete end-to-end insight into the spend patterns and visibility across the procurement processes, organizations can significantly reduce costs, enhance profitability, increase customer satisfaction, and gain competitive advantage.
Oracle Business Analytics: Procurement and Spend Analytics with Spend Planning on Oracle Engineered Systems

Figure 1: Oracle Procurement and Spend Analytics dashboards surface valuable data and metrics and enable interactive analysis.

The solution enables companies to more effectively manage their procurement processes and improve business performance by:

- Providing robust supply-side information, metrics, and alerts, incorporating industry best practices.

- Analyzing detailed, transaction-level data to understand spending patterns for both direct and indirect spend, and the factors driving supplier performance and procurement costs. It includes the ability to do the spend analysis by commodities, suppliers, supplier locations, buying locations, business units, cost centers, buyers and contract usage. This enables users to identify and realize the cost savings opportunities across business units, geographic locations, products, and procurement organizations.

- Supplying timely direct and indirect spending data to all departments, reducing the time spent compiling, reconciling, and consolidating data from fragmented systems. This enables business users to spend more time analyzing, making proactive decisions, and taking action.

- Enabling organizations to have a complete picture of the performance of their suppliers, including complete supplier scorecards, supplier price performance, delivery performance, product receipt quality, on-time payment ratings, payment activity and volume, and payments due/overdue analysis.

- Monitoring and optimizing procurement effectiveness on a continual basis, to identify bottlenecks and take proactive and corrective actions to minimize impact. Example analyses include tracking unprocessed and unfulfilled requisitions, and monitoring PO input ratios.

- Analyzing negotiations, supplier responses, and the subsequent award decisions to identify trends and check if there is a margin for any savings opportunity. Predefined measures provide an understanding of demand side power of the organization and supply side power of the suppliers, and their impacts on negotiations.
• Delivering understanding of how money related to travel and expenses is being spent, through creation of a complete picture of employee expenses, including approval cycle times, expenses by expense type, and expense report status.

• Optimizing cash flow through detailed accounts payable and procurement analysis and improving performance by identifying the worst-performing suppliers in terms of schedule adherence or pricing inconsistencies.

Oracle Spend Planning

Oracle Spend Planning is a complete planning application, in the style of market leading Hyperion Planning applications and built on integrated Oracle Essbase technology. It enables procurement and line of business teams to optimize spend with rapid access to historical data, intelligent what-if modeling, and pervasive BI context to facilitate better decisions. Spend Planning includes packaged integration to Oracle ERP systems so users can create realistic plans based on real-world constraints, and ultimately purchase the right products at the right prices from the best sources.

The solution enables companies to more effectively predict their expected spend and make proactive decisions to optimize it by:

• Building intelligent forecasts rapidly, integrated with trusted sources of information. Detailed, accurate forecasts for indirect spend use historical invoice data or aggregated projections from each line of business.

• Predicting what purchases the company will make in the coming months and aggregating each business segment’s indirect purchases by product, category, and supplier to provide the essential information for procurement professionals to shape future purchases.

• Manipulating drivers to adjust projected purchase quantities rapidly, allowing procurement managers to project baseline spend quickly and focus more time on complex spend optimization.

• Ensuring leverage of favorable prices, discounts, and supplier performance.

• Optimizing spend with what-if modeling in the product categories that will yield the greatest savings. Oracle Spend Planning helps to optimize purchases with packaged what-if modeling and pervasive embedded BI context. Procurement users can quickly see which supplier agreements will be expiring soon, which suppliers have better performance ratings, and which supplier has the best overall cost for an item. Quantities can be automatically allocated to specific suppliers based on cost, or preferred supplier status.

• Ensuring compliance with Oracle ERP systems’ business rule validations, to ensure supplier agreement terms like minimum order quantities and rounding rule warnings are presented to the user to prevent creation of proposed changes that cannot be executed in the ERP system.

• Collaborating among procurement, finance, and line of business departments to create better alignment between planned purchases, budgets, and sourcing initiatives. Lines of business and finance managers can better align budgets to execution plans with spend forecasts built using Spend Planning.
Procurement teams gain earlier visibility into departmental spend, and can proactively develop strategies and sourcing initiatives to deliver greater value and savings for the company.

- Enabling companies to improve their indirect spend management processes continually by measuring results at the detailed level. Procurement leaders and executives can see what spend was planned, what savings were expected, and whether actual spend reflects those savings. This helps resolve the difficulty accounting for indirect spend savings before those savings are re-invested into the business.

![Figure 2: Oracle Spend Planning features what-if modeling with context from Oracle Procurement and Spend Analytics.](image)

Oracle BI Applications – Packaged Analytic Applications

Oracle BI Applications are complete, pre-built BI solutions that help people at all levels of an organization better understand how their business is performing. Because these applications are pre-built and pre-integrated with the leading transactional applications, they are far quicker to implement and deliver value with much lower risk. Once in place enable better decisions, confident action, and more efficient business processes, often in just weeks. Oracle BI Applications provide a single, integrated view of enterprise information, enabling greater insight and alignment across business functions.

Each BI Application includes:

- **Pre-integration with Oracle Applications** JD Edwards EnterpriseOne, PeopleSoft, Siebel, E-Business Suite, and/or Fusion applications. The BI applications understand the source schemas of business applications and provide prebuilt logic to extract data from sources systems, and then transform and load into a data warehouse data model

- **A best practices enterprise analytic data model** consisting of star schemas with conformed dimensions. This means that a customer is a customer across all the family of BI
Applications, and if several are installed together, analysis can be expanded across subject areas for an end-to-end view of corporate performance. All the major entities are covered, including Customers, Employees, Suppliers, Projects, Orders, GL entries, and many more.

- The ability to **work with multiple and disparate data sources**. BI Applications can combine data from regional instances of ERP systems, in order to get a consistent global view. As well, BI Applications can integrate data from heterogeneous systems. For example, a company might have some divisions running JD Edwards EnterpriseOne Financials while the centralized corporate instance uses E-Business Suite Financials and iProcurement. This is no problem for Oracle BI Applications.

- **Open access to all data sources**. The metadata-driven design of BI Applications allows implementers to integrate data sources for which Oracle doesn’t offer pre-built adapters. Procurement analysis often can require data sources like Ariba, third party manufacturing systems, and legacy planning systems to be combined with corporate financial, procurement, and sales forecast data.

- **Role-based reports and dashboards** for all levels of employees in most departments. Dashboards include guided navigations, to enable casual users to find the insights they need.

- **Security integration to Oracle applications**, enabling leverage of roles, profiles, and security set-ups defined in transactional applications.

- Thousands of **pre-defined metrics and calculations** across the suite of BI Applications. This provides a palette of metrics to choose from, which is much easier than collecting user requirements. If the predefined calculation of a metric doesn’t fit your business, it can easily be modified, from which point all affected dashboards and reports are automatically updated.

- **Anytime, Anywhere Mobile access**. The BI Applications are ready to deploy on iPad tablets with no further development.

With so much pre-built content, implementing Oracle BI Applications is an exercise in configuring and editing, rather than building from scratch. This has proven many times to deliver enterprise-grade analytics into production often in 6, 10, or 12 weeks, in contrast to year or longer enterprise data warehouse builds. See Figure 3.
In addition to rapid time to value, BI Applications embody analytic best practices—in the design of ETL, the data warehouse data model, metrics and KPIs, and dashboard design. In practice, it would be hard for an individual company to craft such a solution on its own.

Oracle BI Foundation – Enterprise-Class Business Intelligence Platform

Oracle Business Intelligence Foundation Suite—recognized as a category leader by all of the major industry analyst research firms—represents the underlying BI technology for all of Oracle’s packaged analytic applications, as well as business applications such as Oracle E-Business Suite; Oracle’s PeopleSoft, JD Edwards, and Siebel solutions; Oracle Fusion Applications; and Oracle’s industry applications.

BI Foundation is a comprehensive architecture, which features best-in-class technology for reporting, analysis, and performance management applications. Based on an integrated, scalable, web-native architecture, Oracle’s unified and open BI Foundation reduces cost of ownership, efficiently accesses information from heterogeneous sources, and provides an enterprise semantic layer with multiple channels of information delivery to support self-service, pervasive BI.

Uniquely, BI Foundation Suite includes Oracle Essbase, a leading multidimensional system that is necessary to perform what-if analysis and scenario modeling. On Exalytics, Essbase runs in-memory to deliver rapid load and calculation performance.

Introduction to Engineered Systems

Oracle’s engineered systems combine best-of-breed hardware and software components with game-changing technical innovations. Designed, engineered, and tested to work best together, Oracle’s
engineered systems can power the cloud or streamline data center operations to make traditional deployments even more efficient. The components of Oracle’s engineered systems are preassembled for targeted functionality and then—as a complete system—optimized for extreme performance. By taking the guesswork out of these highly available, purpose-built solutions, Oracle delivers a solution that is integrated across every layer of the technology stack—a simplicity that translates into less risk and lower costs for your business. Only Oracle can innovate and optimize at every layer of the stack to simplify data center operations, drive down costs, and accelerate business innovation.

Oracle Exalogic

Oracle Exalogic is an Engineered System on which enterprises deploy Oracle business applications, Oracle Fusion Middleware or third-party software products. Exalogic comes pre-built with compute nodes, memory, flash storage and centralized storage, all connected using InfiniBand in a high redundancy architecture delivering five-nines availability, with fault tolerance and zero-down-time maintenance.

Exalogic dramatically improves performance of Oracle Applications, Fusion Middleware and 3rd party applications without requiring code changes and reduces costs across the application lifecycle, from initial set-up to on-going maintenance, as compared to conventional hardware platforms. Oracle has made unique optimizations and enhancements in Exalogic firmware, Exalogic software, and in Oracle’s middleware and Oracles applications. These include on-chip network virtualization based on near zero latency Infiniband fabric, high-performance Remote Direct Memory Access, workload management in Oracle WebLogic server and optimizations in Oracle Coherence and Oracle Traffic Director. Exalogic includes support for a highly optimized version of the Oracle VM, which significantly outperforms comparable virtualization solutions and is an ideal consolidation platform for Oracle Applications. Templates to simplify install, deployment and configuration of Applications on Exalogic are available.

What specific technical benefits does Exalogic deliver?

Applications using WebLogic benefit from a number of optimizations for thread efficiency, faster interprocess communication and higher message throughput. An optimized work scheduler for Exalogic balances the number of threads per core available on Exalogic systems, providing better application processing efficiency. WebLogic Server has changed to use shared byte buffers instead of array copies when passing data, improving application interprocess communication performance and a 66% reduction in number of objects created. This reduces heap usage and results in fewer expensive garbage collections for Applications. WebLogic also optimizes socket calls to reduce lock contention on Exalogic, allowing fewer threads to process a larger number of message requests.

Exalogic Oracle VM can be used to sub-divide a physical compute node into multiple virtual machines to increase application deployment efficiency while maintaining application performance. Oracle VM has been engineered for tight integration with Exalogic Exabus I/O backplane using a technique called Single Root I/O Virtualization (SR-IOV) ensuring Oracle VM significantly outperforms comparable hypervisors from other leading vendors. The benefit of this approach is unmatched application performance. In an Exalogic configuration, the impact of virtualization on application throughput and latency is negligible.
Applications running on Exalogic utilize Exabus, the underlying Infiniband fabric, which provides low latency and high throughput eliminating I/O bottlenecks in every application layer. Applications components are typically deployed in more than one server and Exabus provides low latency for I/O across nodes on same Exalogic rack. Access to ZFS storage device over Exabus greatly reduces latency for log file writes and other file access operations. For applications running on Exalogic and accessing database tier on Exadata, Exabus delivers faster I/O, reduces CPU usage on both the mid-tier and DB-tier and provides higher connection pooling efficiency.

Oracle Exadata Database Machine

Oracle’s Exadata Database Machine is Oracle’s database platform delivering extreme performance for database applications including Online Transaction Processing, Data Warehousing, Reporting, Batch Processing, or Consolidation of mixed database workloads. Exadata is a pre-configured, pre-tuned, and pre-tested integrated system of servers, networking and storage all optimized around the Oracle database. Because Exadata is an integrated system, it offers superior price-performance, availability and supportability. Exadata frees users from the need to build, test and maintain systems and allows them to focus on higher value business problems.

Exadata uses a scale out architecture for database servers and storage. This architecture maintains an optimal storage hierarchy from memory to flash to disk. Smart Scan query offload has been added to the storage cells to offload database processing. Exadata implements Smart Flash Cache as part of the storage hierarchy. Exadata software determines how and when to use the Flash storage for reads and write as well as how best to incorporate Flash into the database as part of a coordinated data caching strategy. A high-bandwidth low-latency InfiniBand network running specialized database networking protocols connects all the components inside an Exadata Database Machine. In addition to a high performance architecture and design, Exadata offers the industry’s best data compression to provide a dramatic reduction in storage needs.

What specific technical benefits does Exadata deliver?

Exadata Smart Flash Cache uses Flash memory to dramatically reduce the time to read and write database and log records. The intelligence in Smart Flash Cache transparently moves active database blocks from disk to flash in real time, thus ensuring that "hot" data is in Flash memory when the next access occurs. Blocks that should not be in Flash are similarly recognized; thus maximizing the amount of space in Flash for active data.

Exadata Smart Scan speeds up data-intensive queries by leveraging the processing power of Exadata Storage Servers to scan and filter out results. By moving queries to storage instead of moving the data to the database servers, long-running reports and queries often complete 10x faster than on conventional systems.

The use of InfiniBand as the networking fabric within Exadata ensures the lowest latency for messages and the highest bandwidth for data transfers. High-speed transactions as well as data-intensive queries and reports reap the benefits.
Exadata Scale-Out Storage enables the full performance of Exadata to be realized against large and growing databases, without fear of bottlenecks. As the database size grows and storage capacity is added to Exadata, storage performance and networking bandwidth scale in equal proportion.

IORM allocates I/O bandwidth across different applications and databases, based on a prioritized allocation plan, to ensure that the most important applications get the performance they need when they need it.

Hybrid Columnar Compression dramatically reduces the storage space consumed by the database, while at the same time speeding up queries against the compressed data through reduced I/O. Compression often reduces the data storage by a factor of 10x or more, storing a petabyte scale database in 100TB of disk. Since compressed tables remain compressed in Flash memory as well as on disk, very large databases often fit entirely in Flash memory when compressed.

Oracle Exalytics

As analytic applications become more sophisticated and calculation-intensive, the use of mobile BI expands, user adoption increases, and data volumes explode making the need for speed and efficiency more important than ever. In-memory technology can dramatically accelerate analytic performance. Oracle Exalytics In-Memory Machine is the industry’s first engineered system for analytics that combines market leading BI Foundation, in-memory analytics software, and best-in class hardware engineered and optimized to work together to deliver extreme performance for Business Intelligence and Enterprise Performance Management applications. As a result, users can visually navigate and drill into information at the speed of thought, without limits on the complexity of their questions or the volume of the underlying data. Exalytics drives a new class of smarter and more powerful analytic applications that simply weren’t possible using conventional BI software and generic hardware configurations.

Oracle Business Intelligence Foundation Suite running on Oracle Exalytics has been specially enhanced to take advantage of large memory, processors, concurrency, storage, networking, operating system, kernel, and system configuration afforded by the Oracle Exalytics hardware. Oracle TimesTen for Exalytics has been specially enhanced for analytical processing at in-memory speeds. With lightening fast scan speed of up to 100 million rows/second and up to 10x columnar compression, TimesTen for in-memory analytics delivers faster reports & dashboards for departmental as well as enterprise wide consumption.

What is technically unique about Exalytics?

Exalytics is custom designed for In-memory Analytics. It packs at least a Terabyte of high speed memory and matches the memory backed by several terabytes of high-speed PCI-Flash that can support hundreds of thousands of IOPS per second as well as gigabytes of bandwidth per second. This flash layer is further backed by several terabytes of persistent hard disk storage. Exalytics also includes FibreChannel interfaces to further expand storage capacity.

In addition to memory and storage, Exalytics includes the best server processors in the market with at least 40 compute cores with several execution threads per core. Exalytics also provides numerous high speed networking options including 10Gbps and 1Gbps Ethernet. However specifically for Exadata
connectivity, Exalytics also includes two 40Gbps InfiniBand interfaces and cables to ensure unparalleled latency and throughput between Exalytics and Exadata.

Exalytics software components have been optimized tightly to match the hardware — all the way to specific hardware parts, their firmware, drivers and the operating system — a customized Oracle Enterprise Linux release with Unbreakable Enterprise Kernel. These low level optimizations have shown 3X better scalability and performance on benchmarks compared to similarly configured commodity servers. Some of the notable features that are available only on Exalytics are — columnar compression and OBIEE specific analytic functions for TimesTen, aggressive memory and concurrency optimizations in Essbase and OBIEE. These functions enable Exalytics to store more data, process queries faster, load and export data faster, and handle more users and concurrent workloads than identically configured commodity servers running commodity operating systems.

Apart from performance, the unified lifecycle experience — from install, administration, and patching are optimized throughout the stack to provide the lowest total cost of ownership for deploying analytic applications — that cannot be achieved by building the entire solution stack piecemeal from multiple vendors.

Figure 4: Engineered Systems: Exalogic, Exadata, Exalytics; Applications, Database and Analytics. The fastest, easiest path to unbeatable application performance.

References

Oracle Exadata Database Machine Brochures and Data Sheets
Oracle Tech Network Oracle Exadata Database Machine
Oracle Exalogic Elastic Cloud Overview
Oracle Analytic and Planning Applications Work Better with Engineered Systems

Oracle analytic applications (including Oracle BI Applications) and planning applications (including Oracle Spend Planning) are optimized to work with two key Engineered Systems: Exalytics and Exadata. Existing BI Applications customers can redeploy to Oracle Exalytics In-Memory Machine and Oracle Exadata without any changes, and new BI Applications implementations can deploy on Engineered Systems faster and with lower risk.

Figure 5: Oracle Procurement and Spend Analytics and Spend Planning and Oracle BI Foundation Suite run on Exalytics In-Memory Machine. Oracle Exadata Database Machine can be a data source for Exalytics and can contain the BI Applications data warehouse.

These elements comprise the integrated solution:

- Prebuilt analytic and applications content: Oracle Procurement and Spend Analytics and Oracle Spend Planning, potentially combined with additional Oracle BI Applications modules.
- Oracle’s enterprise-class Business Intelligence Platform: Oracle BI Foundation Suite.
- Oracle Exalytics In-Memory Machine: Runs the analytic and planning applications in-memory on Oracle BI Foundation Suite.
- Oracle Exadata Database Machine: The data warehouse defined by BI Applications optionally can run on Exadata.

Business Benefits of Oracle Spend Analytics and Spend Planning on Exalytics and Exadata

Benefit #1: Greater spend visibility and plan accuracy.

With the in-memory performance of Exalytics, analysis and plans needn’t be artificially simplified in order to run with acceptable performance. All the detailed data can be used. True global plans can be created, rather than resorting to fragmented geographical or divisional plans. Planning cycles can be reduced on the order of 6x, enabling more plan iterations to get to better results.
Benefit #2: Better user scalability with Exalytics economically satisfies enterprise-wide use and enables broad mobile rollouts.

Data and users always grow, and cross-enterprise analytics and planning can drive very large data sets and user counts.

On standard hardware, complex plans can overtax system resources, leading to slower planning application performance or requiring use of fragmented or simpler, less accurate planning models.

With planning applications running on Exalytics, Essbase runs in-memory and customers have seen 6x to 10x faster planning cycles, with huge gains in response time.

Exalytics for BI has been benchmarked to handle up to 40,000 enterprise users and typically support 3x the number of users on similarly configured hardware.

BI Applications on Exalytics exhibit much faster response times and, simultaneously, better user scalability. See Figure 6 for an illustration.

![Figure 6: Exalytics shows significant scalability advantage over standard hardware (the baseline). The baseline is able to scale up to 15-20 CPUs, but then throughput drops. Exalytics scales perfectly to all available CPUs and then throughput stays flat with increasing load. Benchmarks forecast that a single Exalytics box can support up to 40,000 enterprise reporting users.](image)

The additional capacity afforded by Exalytics means:

- Large user populations, such when Procurement and Spend Analytics is joined with other BI Applications to provide an enterprise-wide view of finance, procurement, supply chain, customers, employees, projects, and manufacturing.

- Planning applications can be run simultaneously in the same system, enabling seamless integration of analytics and planning, and reduced costs for hardware and system administration.

- Be ready for the projected rapid growth of Mobile BI use can grow as large as needed economically while preserving response times.
Benefit #3: Faster ETL for shorter load windows and more uptime.

Data warehouses need to be updated with refreshed data. Typically this is done at least daily, normally at night during a “load window” during which the system is not available for queries.

BI Applications’ ETL from source systems to Exadata can complete much faster, which leads to shorter load windows and more uptime. This is particularly helpful when data update volumes threaten to exceed the planned load window, intruding on users’ access to analytics. For global organizations with consolidated data, it is particularly painful to have a scheduled load window, since someone somewhere on the planet is shut out of using analytics during their business day.

Some businesses and applications demand frequent data refreshes, approaching continuous or “trickle feed” updates. Faster micro ETL from sources to Exadata, and from Exadata to the Exalytics in-memory store, enables near real time business decisions, such as 15 min updates during financial close.

Benefit #4: Project risk reduction, by choosing packaged analytics, Exalytics, and optionally Exadata.

With a successful track record of many hundreds of customers over the past eight years, packaged BI Applications have proven to be quick and sure to implement into production. It is common for production implementations of one or a few BI Apps to be completed and rolled in 6-16 weeks.

Leading integrators estimate that a custom build approach costs 2.5 to 3.5 times that of deploying prebuilt applications.

One of the greatest challenges to BI and data warehousing projects is getting the user requirements right, since business users often have great difficulty specifying what they need. Missing requirements, or over-specifying them, leads to more drawn out, longer projects.

It is far easier for business people to critique and edit rather than to specify, starting with a blank sheet of paper. With the pre-defined metrics, calculations, KPIs and dashboards that come with BI Applications, IT can quickly stand up a system for end users to see clearly what they are getting and to specify how it should be adapted to meet specific business needs.

Oracle Engineered Systems have the advantage that every customer gets the same configuration, for which all the components are engineered and optimized together, tested together, installed together, patched together and updated together. This reduces risk, complexity and time to deployment, as well as to upgrade.

BI Applications on Exalytics and Exadata are fully tested and optimized, so there is less manual configuration, less manual tuning, and a better out of the box experience.

Benefit #5: Increased user satisfaction and adoption due to improved response times.

Users abandon analytic systems if response times are inadequate. With the “Consumerization of BI” trend, expectations for lightning performance are escalating. Exalytics in-memory processing can dramatically speed up response times.
Figure 7: In a typical comparative analysis of slow-running customer dashboards, Exalytics improves response times 5x up to 720x. For example the On Time Delivery analysis reduced from 1 hour 12 minutes to 6 seconds. With this chart scale, the timings with Exalytics are barely visible. With BI Server cache additionally enabled, all these challenging queries further reduced to sub-second performance.

- Faster response time means some queries that were impossible before now return answers. Queries that were painfully slow and causing user dissatisfaction can be reduced to a few seconds or, even, sub-second.

- Response times that are more consistently sub-second means mobile users will not abandon the system, meaning the promise of anytime, anywhere insight can be realized.

- Executives are particularly impatient. Faster response times mean executives will use their own dashboards, rather than consuming only others’ analysis.

- A special case to note is acceleration of federated, multisource queries. Federated queries are useful when data is not centrally organized; however joins across large sources are slow. Exalytics can greatly accelerate federated queries.

**Benefit #6: Greater interactivity, more self-service, better visualizations**

BI Applications running on BI Foundation Suite on Exalytics delivers greater levels of end-user interactivity and self-service analysis. As an example, data visualizations such as Trellis Charts, or grids of charts, are great for quick comparative analysis. See Figure 8.
Figure 8: Dense data visualizations like Spark Lines and Trellis Charts present the results of many queries simultaneously, so comparative analysis and finding outliers is easier. At the same time, these kinds of visualizations are heavily taxing on analytic and data warehouse systems.

While highly valuable to end users, these kinds of visualizations challenge the capacity of normal analytic systems and the databases underneath them. With Exalytics, in-memory performance enables fast response time, even for these challenging visualizations that are constructed of many parallel queries. Only with an Engineered System featuring in-memory technology can these be effectively rendered, especially when there are large numbers of concurrent users.

The extra processing power of Exalytics can even be used for completely new capabilities like View Suggestions. Normal business users often have difficulty picking the best chart or visualization for their data. Think about opening a Microsoft Excel chart gallery and scrolling though the many options—most business people can barely cope. With Oracle BI running on Exalytics, the system automatically interrogates the data to understand how many values, its dimensionality (for example, is time represented), and the intention of the analysis to suggest the best visualization to use. See Figure 9.

Figure 9: The View Suggestions capability of Oracle BI on Exalytics automatically analyzes the data to be presented and suggests the best visualizations considering the size, cardinality, distribution and dimensions of the data.
With Exalytics, better visualizations and better interactivity are delivered at the speed of thought, pleasing business users and encouraging adoption.

**Benefit #7: “Future proof” against evolving analytic needs by choosing Exalytics.**

As user adoption increases and organizational maturity evolves, companies want to move beyond query & reporting and dashboards to incorporate additional analytics, including what-if analysis, scenario modeling, planning, access to Big Data, predictive analytics and data discovery. BI Applications, BI Foundation Suite, and Exalytics are ready to offer users more capabilities when they need them:

- BI Foundation Suite includes Oracle Essbase, a leading multidimensional system that is necessary to perform what-if analysis and scenario modeling. On Exalytics, Essbase runs in-memory to deliver rapid load and calculation performance. BI Applications data can be used directly to run scenarios and this capability can be linked directly into dashboards.

- In addition to Oracle Spend Planning, other pre-built applications are available on Essbase, including Hyperion Planning and Hyperion Profitability and Cost Management. These can run together on the same Exalytics solution, extending the value of the investment and enabling direct linkage between plans and actuals.

- Oracle Procurement and Spend Analytics can be extended with numerous other Oracle BI Applications. These all feature a common data warehouse data model, featuring conformed dimensions, common ETL, and common metrics and calculations. When BI Applications are co-installed, they work together. Below is a list of additional BI Applications that integrate with Procurement and Spend Analytics:

<table>
<thead>
<tr>
<th>TABLE 1. ORACLE BI APPLICATIONS TO COMPLEMENT PROCUREMENT AND SPEND ANALYTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLICATION</td>
</tr>
<tr>
<td>-------------------------------</td>
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<tr>
<td>ERP Analytics</td>
</tr>
<tr>
<td><strong>Financial Analytics</strong></td>
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<tr>
<td>Oracle Financial Analytics</td>
</tr>
<tr>
<td>HR Analytics</td>
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<tr>
<td>Supply Chain and Order Management Analytics</td>
</tr>
</tbody>
</table>
## Project Analytics

Oracle Project Analytics provides out-of-the-box, role-based dashboards that enable project managers, executives, and accountants to monitor projects and control the risks that lead to budget and schedule overruns. It enables robust analysis of important project-based forecast, budgets, cost, revenue, billing, commitments, cross-charges, profitability, resource management and sub ledger to general ledger reconciliation.

## Student Information Analytics

Oracle Student Information Analytics helps academic institutions effectively manage student information, improve operations, and achieve institutional excellence. It provides an integrated view of admissions and recruiting, student records and student financials, enabling organizations to maximize student recruiting efforts, shorten time-to-graduation, improve retention rates, identify successful and unsuccessful courses and programs, and analyze faculty workloads.

## Manufacturing Analytics

Oracle Manufacturing Analytics helps manufacturing organizations optimize their supply networks by integrating data from across the enterprise value chain. Through complete end-to-end insight into the manufacturing operations and visibility across the plants and business units, organizations can significantly reduce costs; enhance profitability, increase customer satisfaction, and gain competitive advantage.

## Enterprise Asset Management Analytics

Oracle Enterprise Asset Management Analytics provides visibility to enterprise-wide maintenance information. With pre-built reports covering Maintenance History, Maintenance Cost Analysis and Maintenance Work Orders, Oracle Enterprise Asset Management Analytics enables Maintenance Managers to maximize performance and opportunities, identify potential issues much in advance, and address them before they escalate into serious problems.

## CRM Analytics

Oracle Marketing Analytics allows your organization to obtain maximum results from your marketing investments by providing your entire marketing team with a complete, up-to-the-minute picture of customer preferences, buying behavior, and profitability. Oracle Marketing Analytics helps you to develop closer, more valuable customer and prospect relationships and improve marketing effectiveness.

Oracle Sales Analytics provides hundreds of key performance indicators to improve the effectiveness of your sales people by providing real-time, actionable insight into every sales opportunity at the point of customer contact. With more accurate sales forecasts and enhanced identification of potential problems and opportunities, Oracle Sales Analytics helps close business faster and increase overall sales revenue.

Oracle Price Analytics enables users to make insight-driven pricing decisions, to measure pricing effectiveness and to take improvement actions, informed by consistent data and the right business context. Users are armed with visibility into a single consolidated view of profitability and simple-but-sophisticated analytic tools and alerts.

Oracle Service Analytics provides organizations with a comprehensive, up-to-date overview of customer service effectiveness. It enables companies to take targeted actions to improve productivity of Service centers, reduce costs, and increase customer satisfaction.

Oracle Contact Center Telephony Analytics provides organizations with powerful insight that enables them to analyze all aspects of contact center performance. The solution provides best-practice metrics, alerts, and key performance indicators (KPIs), enabling companies to take targeted action to improve employee productivity, reduce costs, and increase customer satisfaction.
Loyalty Analytics

Oracle Loyalty Analytics is a comprehensive analytic solution that provides new levels of information richness, usability and reach to all employees engaged in the loyalty program lifecycle. This results in faster and more informed decisions that help the loyalty organization optimize its programs to drive member behavior, build value and reduce costs.

- Beyond the core Oracle BI Applications, Oracle offers more than 60 additional pre-built analytic applications for various topics and industries. Vertical industry analytic solutions are available for Consumer Goods, Financial Services, Insurance, Public Sector, Retail, Tax, Utilities, Tax, and Telecommunications. Complements to core Oracle CRM, ERP, and SCM solutions include pre-built analytics are available for: Advanced Planning Command Center, ATG Web Commerce, Demand Signal Repository, Environmental Accounting and Reporting; Government, Risk and Compliance (GRC); Manufacturing Operations Center, Primavera; Product Lifecycle; and Transportation Management. These are all developed on Oracle BI Foundation Suite and consequently can run in-memory on Exalytics.

- Oracle Endeca Information Discovery is an enterprise data discovery platform for rapid, intuitive exploration and analysis of information from any combination of structured and unstructured sources. It enables organizations to extend their existing business analytics investments to unstructured data – such as social media, websites, content systems, files, email, database text and Big Data. Oracle Endeca Information Discovery allows analysis alongside Oracle BI Foundation, and both can run on Exalytics with in-memory performance.

Choosing BI Applications on Exalytics is, therefore, not a final step. Instead, as organization needs and maturity evolves, Exalytics In-Memory Machine delivers a wide and growing variety of analytic capabilities.

Technical Benefits of Oracle BI Applications on Exalytics and Exadata

As we have seen, BI Applications and Planning Applications on Engineered Systems deliver great business value, but Exalytics has additional benefits for IT.

Benefit #1: Pre-integrated solution, saving time, cost, and headaches

- Deployment is simplified, since Exalytics configurations are pre-engineered and pre-tested. Everything is pre-determined to work together, and all runs in the Exalytics machine, eliminating complex system topologies.

- BI and Planning applications are integrated with Oracle transactional applications. Oracle BI Foundation components are all integrated together, delivering a vast array of analytic capabilities for the various users and roles. The software is integrated with the Exalytics hardware. Exalytics integrates processors, disk, and networking.

With all this pre-integration, IT can spend less on integration and more on innovation.

Benefit #2: Superior performance with less admin work
Exalytics in-memory technology, based on Oracle TimesTen In-Memory Relational Database and optimized Oracle BI Foundation, provides superior performance with less tuning.

- Unique Exalytics capabilities like Summary Advisor simplify administration
- Moving an existing Oracle BI Applications or Oracle BI implementation from standard hardware to Exalytics requires no application redesign. The data sources remain untouched
- Oracle Exalytics can be deployed in existing IT environments by itself or in conjunction with Oracle Exadata and/or Oracle Exalogic to enable extreme performance and best in class user experience. Based on proven hardware, software and in-memory technology, Oracle Exalytics lowers the total cost of ownership, reduces operational risk and provides unprecedented analytical capability for workgroup, departmental and enterprise wide deployments.
- Can separate Business or BI team from DW operations -- BI team or can deliver performance without needing corporate Enterprise DW to be tuned.

Benefit #3: Built for the Enterprise

Mindful that Exalytics becomes a powerful enterprise resource, it is designed with enterprise needs in mind:

- Exalytics is designed with high reliability hardware and redundancy where required.
- Systems can be clustered for high availability.
- Scalability is superior. With a single Exalytics system benchmarked for up to 40,000 enterprise users capacity, it easily supports thousands of concurrent users. Since Exalytics scales users and queries linearly without sacrificing response times, there is built-in capacity to handle bursty usage, such as when all the field employees want to begin using the system at 9:00 am on Monday morning, or during critical periods like financial close.
- As users move to consume analytics by mobile devices, tolerance for sluggish response decreases, and at the same time frequency of usage tends to increase. Without a sizeable backend IT environment, user expectations cannot be met. Exalytics scalability provides the headroom to address growing expectations of mobile users.
- Subcapacity licensing is available, so if an Exalytics machine is too powerful for initial needs, a quarter, a half, or three-quarters can be configured and licensed, enabling partial use of the compute capacity but full use of the memory. This enables users and applications to grow over time.
- Quick Essbase backup/restore -- don't have to take Essbase down for extended periods

With these attributes, Exalytics fits well into the corporate data center.

Benefit #4: Not limited to the memory on board

Exalytics does away with the traditional limitation of desktop in-memory analysis tools and fully in-memory data warehouses. Classically, when the application and data size outgrow physical memory, you’re done. There is nothing to do but get a bigger, more expensive machine, or compromise on the analysis you can do.
With Exalytics, users get speed-of-thought interactive visual analysis with no limits. Exalytics intelligently caches the hottest data in-memory using full available RAM and compression. For data not available in-memory, Oracle Exalytics transparently ships the queries to underlying data sources, enabling analysis over any size data and even Big Data stored in Hadoop.

**Benefit #5: TCO**

So many of the business and technical benefits contribute to lower Total Cost of Ownership. To review, some of these are:

- Rapid, sure deployment of pre-built BI Applications and Engineered Systems, leading to fast time to value and earlier accrual of benefits.
- Lower development and deployment costs, due to the pre-built content of BI Applications and integration with Oracle transactional applications.
- Lower ongoing database administration costs to maintain performance, due to the Exalytics performance optimizing in-memory technologies.
- Cost savings through environment consolidation. For Exadata, its can combine OLTP and data warehouse databases on a single Exadata system. For Exalytics, any combination of Oracle BI, Essbase, and Endeca Information Discovery can run and work together. Individual instances of Essbase or OBI can be combined into larger single systems.

**Conclusion**

Investment in analytics, to gain fact-based insights from data locked in CRM, ERP, HCM and SCM systems and to optimize enterprise performance is one of the leading priorities for a growing number of organizations. The Procurement function has been an area that traditionally has been underserved. However, custom building this is risky, slow, and costly, particularly when forward-looking planning is needed in addition to historical analysis.

A better solution is pre-built analytic and planning applications leveraging powerful BI technology all running on Engineered Systems. This combination is compelling and delivers a long list of business and technical benefits:

- Greater spend visibility and plan accuracy.
- Increased user satisfaction and adoption due to improved response times
- Faster ETL for shorter load windows and more uptime
- Better user scalability economically satisfies bursty use and enables broad mobile rollouts
- Project risk reduction and faster time to value
- Greater interactivity, more self-service, and better visualizations
- “Future proof” against evolving analytic needs
- Pre-integrated solution, saving time, cost, and headaches
• Superior performance with less admin work
• Not limited to the memory on board
• Consolidation
• Lower Total Cost of Ownership