Internal Audit Analytics

Take Advantage of your Data

Thursday, May 15, 2014

ISACA Rhode Island Chapter
2014 Annual General Meeting

Strictly Private and Confidential
“The transformational change occurring in organizations today is dependent upon adopting insight from data ... **Everyone is now an analyst.**”

*Data Science Central*

“Last year people stored enough data to fill 60,000 Libraries of Congress...”

*The Economist*

“...Data volume will double over the next two years”

*Gartner*

“90% of the world's data was created in the past two years”

*IBM*
Today’s Agenda

Audit analytics today

Value and benefits

Advanced audit analytics tools and techniques

Implementing a successful program

Future of advanced audit analytics

Closing
Audit Analytics today
What are we hearing?
2013 PwC State of the profession survey

Analytics are widely viewed as important

81%

Data analytics are important to improving the quantification of issues

85%

Data analytics are important to strengthening audit coverage

74%

Data analytics are important to gaining a better understanding of risks

Yet few are using analytics regularly

31%

Data analytics are used regularly

And most intend to, yet lack a plan

71%

Plan to expand use of data analytics but do not have a well developed plan
What are our clients saying?

“My audit budget is finite, yet I am expected to increase coverage”
“Our auditors spend too much time on non value-add activities”
“We are missing the forest for the trees”
“We need to fundamentally improve audit quality and value”
“We can’t hire or keep the best people”
“We need to better align with compliance and risk”
“We need to better understand risk”
Characteristics of analytics today

**Analytics:** discovery and communication of meaningful patterns in data

**Big data:** collection of large and complex data sets

- **Visualization**
- **Trending & comparisons**
- **Dashboarding**

**Data**
- Financial, Operational
- Structured, Unstructured, Internal, External

**Speed and portability:** available anytime, anywhere
Leading industry technology solutions
Major vendors within the audit analytics space

To have an effective audit analytics program for a complex organization, there is no “one size fits all” for technology. An analytics toolbox is necessary to bring the highest value.

Core Technological components and Key Vendors

Analytics
- ACL
- SAS
- Lavastorm
- IDEA Data Analysis Software

Visualization
- Spotfire
- Qlikview
- Tableau

Data Management
- Microsoft SQL Server
- Oracle
- MySQL
- Netezza

Monitoring
- ACL
- NICE ACTIMIZE
- Oversight Systems
- IDEA Data Analysis Software
Demonstration: Travel and Entertainment Expense

Building analytics employs a methodical, risk-based approach

1. Understand Process and Data
   Bridging the gap between IT and Business
   Work with analytic technology to understand related business process and associated data

2. Risk Assessment
   Profile Analytics
   Identify risks in the process and indicators of areas where IA can conduct further inquiry

3. Controls Testing
   Rules-based Analytics
   Develop rules based testing to test for specific controls identified in the first two areas

4. Results Delivery
   Dynamic Dashboarding
   Collaborate with the client to finalize the results for ease of use and through documentation and training
Value and Benefits of Analytics
Why is this so important today?

*Company expectations:* Maximizing the use of technology to increase coverage, quality and business impact, while managing a finite audit budget

*Competitive landscape:* Competitors continue to strengthen their capabilities and seek new talent

*Value/Relationship:* Insights open the door for deeper discussion on issues and develop/strengthen relationships

*Talent development and appeal:* Effective integration of analytics will strengthen the business skills of auditors

*Audit/Business Partnership:* Innovation and resulting methods could be ultimately transitioned into the business

*Regulatory Expectations:* Audit need to get stronger assurance and quantifiable results
Technology is changing how we audit...

Emerging Trends

- **Data Discovery and Presentation**: Gaining effective insight through advances in visualization capabilities ("Audit by sight")

- **Agile Analytics**: Alternative modeling and analytic techniques that can tackle audit objectives in hours instead of weeks

- **Unstructured Data Integration**: Emerging methods to collect, organize, structure and search massive amounts of data not found in traditional databases

- **Enhanced Audit Management**: Collaborative project management technology integrated into Audit Planning, Execution, and Reporting

Outcomes

- **Increased Risk Coverage**
- **Efficient Audit cycle time**
- **Insight in Real-time or “Right-time”**
- **Manage Risk / Return**
- **Build a Learning Organization**

PwC
### What are the major benefits?

#### What are the benefits?

1. Increase coverage, quality, and business impact
2. Establish competitive advantage in industry
3. Create deeper discussion on issues and develop/strengthen relationships
4. Strengthen the business and technical skills of auditors
5. Cultivate an audit/business partnership

#### Quantifiable:
- Development saved compared to traditional BI
- Audit hours saved (fieldwork review)
- Expenses minimized
- Revenue found

#### Quantifiable but not Always Tracked to Amounts:
- Audit coverage
- New policies enacted
- Audit user base adoption and expansion
- Audit procedures refined

#### Qualitative:
- Higher quality management conversations
- Risk focused testing
- Visual focus on trends and outliers
- Adoption by broader IA dept
Advanced audit analytics tools and techniques
Combining an Internal Audit Program with Advanced Analytics

1. Foundation
- Comprised of risk-based planning, stakeholder feedback, proprietary tools and methods, and talent.

2. Planning
- An Internal Audit Plan that are aligned with your stakeholder needs

3. Fieldwork
- A consistent and repeatable approach that ensures no surprises

4. Reporting
- A balanced view that helps stakeholders better understand the underlying business risks.

5. Quality
- Actionable recommendations, mitigated risk and improved controls

Execution (Fieldwork)
- T&E Risk Analytics
- Country Risk Analytics
- Audit Results Profiling

Audit Planning
- Risk Assessment
What are the major themes we are seeing in our most successful clients?

- **Self Service Capabilities w/ Visualization**
  Technology and methodology mix that enables the broader IA group

- **Audit Lifecycle Enablement**
  Use of analytics and technology through the audit lifecycle from Scoping to Execution

- **Collaboration**
  Integrated working environment where audit team knowledge is easily shared

- **Balanced Talent Mix**
  Creativity-enabled team with a balance of IA, Technology and Industry/Business

- **Data Connectivity**
  Direct access into enterprise-level data resources
Implementing a successful program
The Data Conundrum Global Webcast Survey Results

**Biggest Challenges with Analytics**

- Developing a sustainable methodology and process: 41.2%
- Acquiring deep analytical skills and capabilities: 31.2%
- Adopting an effective structure: 14.8%
- Selecting the right tools and technologies: 12.8%

**Additional Challenges**
- Vision, Strategy & Roadmap
- Managing Data
- Business Buy-in
- ROI
Measure your success

**Level 0**
**Initial / Developing**
- Capability limited to very few individuals
- Inconsistent effectiveness
- Limited audit or business value

**Level 1**
**Relevant**
- Limited but growing capabilities
- Ad hoc activities resulting in unpredictable and inefficient performance
- Success based on individual competence

**Level 2**
**Consistent**
- Capabilities developed and adopted
- Capabilities used to drive audits
- Defined goals and standardized processes and tools

**Level 3**
**Integrated**
- Capabilities are well developed and practiced with appropriate governance
- Data sources are readily available
- Activities begin to become repeatable and CM metrics are developed
- Core analytics skillsets within 5-10% of department

**Level 4**
**Embedded**
- Scale is achieved for department specific teams
- Improvement methodologies are implemented
- Monitoring occurring for metrics and controls
- Data sources are readily available
- Activities begin to become repeatable and CM metrics are developed
- Core analytics skillsets within 5-10% of department

**Level 5**
**Transformational**
- Analytics risk models being adopted by the business
- Analytics changing auditor behaviors
- New value propositions
- Alignment and cross-leverageable platform across lines of defense
- Game changing to audit delivery and value

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Industry current state

Audit and business impact

Low

High
Achieve Impactful Results

Audit, Risk and Compliance

• What SOX controls are most consistently being checked by Ext Audit and how effective is the change management?
• Who are the top earners in commissions?
• What safety measures are in place to prevent IP leakage?
• How effective are the Business Continuity plans?
• What patents are most vulnerable?
• How effective are current retail strategies?
• What regional tax laws may leave us with the most exposure?
• What cost cutting initiatives have performed best?
• Who are our top spending units by region/product/
• What major investments are not on track?
• How are new payment methods affecting revenue?

Business Improvement

• Who are my most important customers?
• What distributors are adding the most value?
• What are our competitors doing in the retail environment and how can we be better?
• How are we maximizing revenue streams?
• Who is maximizing internal resources?
• What major development silos exist and how can we effectively integrate?
• What areas are giving us sustainable margin growth and what attributes can be replicated?
• What major acquisitions have most effected margins?
• How effectively are we managing revenue streams?
• How effectively are Marketing dollars being spent and

Process Assurance

Financial

Risk Management

Margin Analysis and Guidance
Answer challenging business questions

Audit, Risk and Compliance
- Are my Agents currently providing the level of service that matches their licensure?
- What SOX controls are most consistently being checked by Ext Audit and how effective is the change management?
- Who are the top earners in commissions?
- What safety measures are in place to prevent IP leakage?

Business Improvement
- Are there any outliers in Mortgage Lending that may be receiving policy benefits outside of the normal parameters?
- What Mergers and Acquisitions should be monitored at a detailed level?
- What are the critical bottlenecks within the supply chain?
- Who are my most important customers?

Operational
- How can I ensure the quality of data and the accuracy of my transaction monitoring for AML?
- What regional tax laws may leave us with the most exposure?
- Who are our top spending units by region/product/division?

Financial
- Who are my top commissions earners?
- What areas are giving us sustainable margin growth and what attributes can be replicated?
- How effectively are we managing revenue streams and backlog?
- How effectively are Marketing dollars being spent?
- What are my key conversion and upsell metrics within the sales org?
Example: Sales Commissions

Who are my highest commissions earners and what might they be doing to game the system?
**Example: AML**

How can I ensure the quality of data and the accuracy of my transaction monitoring for AML?
Future of advanced audit analytics:

Integrating Big Data and Traditional Data to drive predictive analytics
**Definition of Big Data**

*Big data* is *high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making – Gartner*

<table>
<thead>
<tr>
<th>Volume</th>
<th>The vast quantity of information available – often hundreds of terabytes or even petabytes of data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity</td>
<td>The speed at which data must be stored and/or analyzed – in some cases, up to ten of thousands of transaction per second.</td>
</tr>
<tr>
<td>Variety</td>
<td>The huge variation in types and sources of data – from highly structured files to unstructured text and video and audio information.</td>
</tr>
</tbody>
</table>
**Integrating big data and traditional data for predictive analytics**

*Big Data analysis does not replace other systems. Rather, it supplements other analytic solutions, data warehouses, and database systems essential to financial reporting, sales management, production management, and compliance systems.*
Example: Employee turnover prediction based on HR analytics

Utilization, rating, engagement survey, demographics, employees’ dependent information and other HR policies related to bonuses and recruitment were key drivers of employee flight.

A predictive algorithm based on historical employee data was developed...

...key outcomes:
- flight risk probabilities for current employees
- deeper analysis through heat maps and probability of attrition.
**Approach comparison**

Our approach using analytics provided significant up-lift to the organization and demonstrated tangible benefits over traditional audit approaches.

<table>
<thead>
<tr>
<th>Risk Assessment</th>
<th>Traditional</th>
<th>Using Analytics</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• Broader interviews with business stakeholders • High level review of processes</td>
<td>• Focused discussions on anomalous areas and regions • Targeted, risk driven assessments that result in clear objectives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Testing</th>
<th>Traditional</th>
<th>Using Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Sample 25 transactions • Review is limited to process level coverage</td>
<td>• Analyze 100% and sample only high risk anomalies • Identify instances of potential fraud and policy violations by their specific criteria</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Repeatability</th>
<th>Traditional</th>
<th>Using Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Insight with minimal reusability and heavy manual editing</td>
<td>• Leave behind scripts and dashboard for on-going monitoring by business</td>
</tr>
</tbody>
</table>

### Travel and Entertainment

<table>
<thead>
<tr>
<th>Issue/Category</th>
<th>Traditional</th>
<th>Using Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airfare booked through T&amp;E</td>
<td></td>
<td>285 employees totaling $79.77K</td>
</tr>
<tr>
<td>Whole Dollar expenses($15-$25)</td>
<td></td>
<td>3,121 employees totaling $849K</td>
</tr>
<tr>
<td>High Mileage Users</td>
<td></td>
<td>5 employees spending ~$30k on Mileage</td>
</tr>
<tr>
<td>Non CA Sales Using $0.55 Rates</td>
<td></td>
<td>119 Employees totaling $53K</td>
</tr>
<tr>
<td>Emp w. 5% Activity Under Receipt Limit</td>
<td></td>
<td>3,981 Employees totaling $3.2M</td>
</tr>
</tbody>
</table>

### Accounts Payable

<table>
<thead>
<tr>
<th>Issue/Category</th>
<th>Traditional</th>
<th>Using Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate Payments</td>
<td></td>
<td>35 invoices accounting $1.3 M</td>
</tr>
<tr>
<td>Duplicate Vendors</td>
<td></td>
<td>8K duplicate pairs</td>
</tr>
<tr>
<td>Vendors matching HR</td>
<td></td>
<td>102 Vendors and Employee matched</td>
</tr>
<tr>
<td>Late Payments</td>
<td></td>
<td>61K invoice $2.1 B</td>
</tr>
</tbody>
</table>
## Retail Store Loss Prevention Audit

*Use data analytics to forecast future loss patterns*

<table>
<thead>
<tr>
<th>Business Issues</th>
<th>Action</th>
<th>Results</th>
</tr>
</thead>
</table>
| • Large disparity in store theft and shrinkage across a national chain of retail stores | • Design and execute a pilot:  
  — Gather attribute data from both traditional data and big data sources  
  — Profile the information for key data elements within the attributes resident in stores (with low and high)  
  — Create/support hypothesis to identify data elements for key attributes prior to loss increase and decrease  
  — Develop analytics to accurately predict loss | • Effectively predicted loss attributes and model outcomes based on changes in key attributes.  
• Proactive deployment of loss mitigation solutions to increase bottom line. |
| • Inability to forecast which stores are likely to have an increase in theft or shrinkage and proactively mitigate | | |
| • Sought a fact based model to predict loss prevention leveraging key attributes:  
  • Store  
  • Location  
  • Workforce  
  • Economic  
  • Customer  
  • Multimedia messages | | |
Retail Store Loss Prevention Audit
Shrinkage % - High Level Analytic

Analysis focuses on the top X% of the stores account that account for the most shrinkage, suggesting rapid root cause analysis for worst offenders.

Remaining stores account for balance of shrinkage, indicating a more nuanced approach for the remaining activity.
Enhancing the Data Model using attributes

Data Categories for Modeling

Customer Attributes
Economic and Demographic Attributes
Store Location Attributes
Store Layout Attributes
Workforce Attributes
Email and Suggestions

Sample of Store Layout

Sample of Email Recommendations
This PwC Loss Prevention analytic model went to the next level to provide predictive outcomes. The model predicts shrinkage outcomes across 1,000+ retail locations and has six reliable early warning variables, along with their relative significance...

The model generates significant store level targeting lift compared to client's existing index.
Closing
Questions and Answers

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Appendix
Our Guide to Internal Audit

**Information Management**

01 Identify Data Sources
Review and identify data sources between source systems, reporting data and application level data

02 Define Frequency
Define data source required on an on-going basis (daily, monthly, quarterly) and data needed for one time needs

03 Repeatability
Develop both manual and automated processes to reduce burden in gathering data

**Analytics Skills and Tools**

04 Define Organization
Define concentric circles of core team, analytics champion and department wide skill set uplift

05 Choose Technologies
Review of and identify data sources between source systems, reporting data and application level data

06 Create Training
Create programs and incentives to develop analytical mindset and competencies across organization

**Data Oriented Culture**

07 Develop Methodology
Develop execution and quality standards for analytics across audit planning and controls testing

08 Enablement
Ensure technology tools within department align to methodology and support ability to track methodology adherence

09 Share Wins
Define ‘success metrics’ and communicate and share wins across department to shift culture
How Do I Get Started? (1/4)
Building a Team - Key Characteristics

It is important to understand the intersection between technology and organizational team decisions as they are core-components driving many decisions.

01 Define Organization
Define concentric circles of core team, analytics champion and department-wide skill set uplift

02 Choose Technologies
Review of and identify data sources between source systems, reporting data and application level data

03 Create Training
Create programs and incentives to develop analytical mindset and competencies across organization

Core Analytics and Data capabilities

Internal Audit Background

Business specific knowledge
How Do I Get Started? (2/4)
Information Management – Enterprise Systems

A key to success in Internal Audit analytics is understanding what data sources exist and how to efficiently leverage them.

### Key Access Points

<table>
<thead>
<tr>
<th>Source Systems</th>
<th>Data Warehouses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Systems</td>
<td>Application</td>
</tr>
</tbody>
</table>

### Key Data Areas

<table>
<thead>
<tr>
<th>Compliance</th>
<th>Risk</th>
<th>Finance</th>
<th>Supply Chain</th>
<th>Systems</th>
<th>Unstructured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance</td>
<td>Enterprise</td>
<td>Planning and analysis</td>
<td>ERP</td>
<td>Entitlement</td>
<td>Documents</td>
</tr>
<tr>
<td>KYC</td>
<td>Credit</td>
<td>Tax management</td>
<td>CRM</td>
<td>Security</td>
<td>Social Media</td>
</tr>
<tr>
<td>AML</td>
<td>Market</td>
<td>Record to report</td>
<td>Shipping and Logistics</td>
<td>OS/Network</td>
<td>Email</td>
</tr>
<tr>
<td>Fraud</td>
<td>Operational</td>
<td>Procure to pay</td>
<td>-</td>
<td>IT Control</td>
<td>-</td>
</tr>
</tbody>
</table>

### Keys to Success

- Support from Information Technology
- Documentation for repeatability
- Cross leverage across audits
- Consistent audit checks

<table>
<thead>
<tr>
<th>Geographies</th>
<th>Lines of business</th>
<th>Legal entities</th>
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01 Identify Data Sources
Review of and identify data sources between source systems, reporting data and application level data

02 Define Frequency
Define data source required on an ongoing basis (daily, monthly, quarterly) and data needed for one time needs

03 Repeatability
Develop both manual and automated processes to reduce burden in gathering data
How Do I Get Started? (3/4)
Information Management - What to track

Take advantage of the data that IA and your program produces as part of the analysis

01 Identify Data Sources
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- Project Tracking Interface
- AX Backend Data
- Prior Analytic Results
- Audit Resource Management
- Issues Data
- Audit Planning Data
- Org GRC Tools
- Compliance & Surveillance
How Do I Get Started? (4/4)
Methodology and Sharing Wins

A successful IA analytics program requires a **cultural shift** in the thinking of how auditors audit.

### Key methodology components

<table>
<thead>
<tr>
<th>01</th>
<th>Develop Methodology</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Develop execution and quality standards for analytics across audit planning and controls testing</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>02</th>
<th>Create Awareness</th>
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<td></td>
<td>Ensure technology tools within department align to methodology and support ability to track methodology adherence</td>
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<th>Share Wins</th>
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<td>Define ‘success metrics’ and communicate and share wins across department to shift culture</td>
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- **Quality Control**
- **Data Acquisition**
- **Documentation**
- **Tools and Techniques**
- **Retention Requirements**
- **Data maintenance**
- **Analysis Standards**
- **Procedures**
Auditing with IMPACT (1/4)

**Identify the Questions**
- Risk assessment and scoping
  - Clear objectives
  - Business buy-in
  - Reasonable Targets

**Master the data**
- Convert data to information
  - Initial Data Samples
  - Owner Insights
  - Validate data quality
  - Choose the best analysis tool

**Perform Test Plan**
- Execute tests and summarize results
  - Develop hypothesis
  - Prepare summary
  - Adjust scope as needed

Adapted from “Win With Advanced Business Analytics: Creating Business Value From Your Data” by Jean Paul Isson and Jesse S. Harriott
Auditing with IMPACT (2/4)

Address and refine results
Present findings informally
- Discuss current results
- Adjust testing as needed
- Obtain Clear feedback

Communicate Insights
Formally report the results
- Formally present findings
- Provide complete transparency
- Translate results to audit reporting

Track Outcomes
Make plan for ongoing use of data analytics
- Agree on recurring impact
- Define plan
- Ensure the solution is sustainable on an ongoing basis

Adapted from “Win With Advanced Business Analytics: Creating Business Value From Your Data” by Jean Paul Isson and Jesse S. Harriott
Success with Audit Analytics and IMPACT (3/4)

HR Analytics: Fortune 500 Manufacturing

Analyze HR data for hundreds of thousands of employees to identify unusual patterns, and compared data against the US Death Registry list to identify incorrect or fraudulently entered SSN values

Fed Regulatory Document Extract: Fortune 500 Financial Services

Create application to identify auditable data points and amounts within a word document. Original process took multiple months/auditors to extract

Major Investigation triggered

Hours Saved 250+
Success with Audit Analytics and IMPACT (4/4)

Audit Risk Assessment Platform:
Fortune 500 Technology
Create platform designed to enhance and refine the current scoping procedures to get data driven answers based on Key Risk Indicators.

Process redefined; 400 hours saved per year

Trade Assessment:
Fortune 500 Financial Services
Analyze securities trade data for Futures and Forex trading to identify unusual activity and policy violation

Split Trade Violations
100+
What are the key elements of Data Visualization?

- Sorting
- Pattern Recognition
- Categorization
- Outlier Detection
# Leading industry technology solutions

Example Visualization Platform Assessment

<table>
<thead>
<tr>
<th>Major Takeaway</th>
<th>Spotfire</th>
<th>Qlikview</th>
<th>Tableau</th>
<th>Microsoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Connectivity¹</td>
<td>High</td>
<td>High</td>
<td>Highest</td>
<td>High</td>
</tr>
<tr>
<td>Data Interactivity and Visualization</td>
<td>High</td>
<td>Highest</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Modeling / Statistical Analysis</td>
<td>Highest</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Scaliability</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Learning Curve²</td>
<td>Short</td>
<td>Medium</td>
<td>Shortest</td>
<td>Low</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Low</td>
<td>High</td>
<td>Highest</td>
<td>Medium</td>
</tr>
<tr>
<td>Cost³</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Lowest</td>
</tr>
<tr>
<td>LOE to Implement⁴</td>
<td>Medium</td>
<td>Lowest</td>
<td>Low</td>
<td>Lowest</td>
</tr>
</tbody>
</table>

1. Ability to connect a variety of data sources
2. Includes developer and business user learning curve
3. Cost includes upfront installation costs and recurring maintenance fees
4. Level of effort and time to implement
Examples of analytics across industries

**General Banking:**
- AML
- FATCA
- Dodd Frank

**Asset Management:**
- Trading
- Corporate compliance

**Payer:**
- Claims payment/fraud
- Supplier & spend
- Asset resource optimization

**Provider:**
- EPIC Implementation
- Readmissions Controls
- Revenue Integrity
- Post Payment

**Retail:**
- Loss prevention (Shrinkage)

**Investment Banking:**
- Trade cancel corrects
- Trade Suitability

**Retail Banking:**
- Consumer Compliance

**Insurance:**
- Claims
- Premiums
- Licensing
- Compensation

**Pharmaceutical:**
- Clinical trials
- Sunshine Act
- Vendor Oversight
- Medicaid
- Misbranding

**Power & Utility:**
- Capital and O&M
- Revenue
- Construction
- Safety
- Reliability

**Oil & Gas:**
- Partner Discount Analysis

**Telecom:**
- Billing system Rec.

**Accounts Payable:**
- Duplicates
- FCPA

**Expenses:**
- Policy Exceptions
- Trending

**Payroll & HR:**
- Compensation
- Recalc and Trending

**Financial Reporting:**
- Financial performance
- GL reconciliation
- Close process

**Information Systems:**
- Network Access
- Segregation of Duties
- Data Leakage

**Fraud & Abuse:**
- FCPA

**Risk Assessment:**
- Key Risk Indicator Mapping
- Complexity Analysis

**Audit Quality Analytics:**
- Auditable Entity Profiling
- Key Risk Indicator Profiler

**Audit Planning:**
- Risk Scoping and Analysis
Selecting “Pilot” advanced analytics audits

Financial

- Expense reports
- SOX
- Revenue financial controls
- Marketing Spend Analysis
- Material Pricing
- New Supplier Profiling
- Cost Allocation Reperformance
- Obsolesence

Operational

- Prepaid replenishment
- Buyback - reverse logistics
- Service contracts - large vendors
- IT spend reduction
- Supply Chain Movement ($ & Time)
- Special pricing
- Integration (PMI)
- Procurement
- Business dealers
- Customer retention
### Sample cost reduction analytics

**Targeted analytics designed to identify and quantify opportunities for cost reduction**

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
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</table>
| Duplicate Payments           | - Create a prioritize list of duplicate payments looking at several key data fields (e.g. Invoice Number, Date, Amounts, Vendor)  
                              | - Identify duplicate check numbers paid in the disbursements data                                                                          |
| Lost Discounts                | - Identify and quantify discounts that were available and not taken based on payment terms, invoice date and payment date                  |
| Targeted Contract Compliance  | - Identify volume based rebates not taken                                                                                                   |
|                               | - Identify inaccurate pricing compared to agreed-to contract terms                                                                          |
| Early Payments                | - Reveal early payments and associated working capital impact                                                                             |
| Vendor Term Rationalization   | - Identify vendors paid with incorrect or inconsistent vendor terms                                                                        |
| VAT Overpayment               | - Identification of Value Added Tax (VAT) Overpayments for applicable territories                                                             |
| Employees in the Vendor Master| - Identify employees that have set-up vendor accounts and quantify payments made                                                             |
| Search for Fictitious or Unusual Vendors | - Using a proprietary risk scoring matrix, identify those suppliers that do not fit the ‘usual’ profile                                    |
| Spend Analysis and Opportunity Assessment | - Perform vendor normalization and spend classification  
  | - Identify category cost savings opportunities based on spend volume, vendor dispersion, and benchmark comparisons |

**Identified $2.7M in duplicate payments (.5% of total invoices analyzed) for a Fortune 50 Multinational**

**Identified $3M in annual cost avoidance for a large Multinational through inaccurate vendor payment terms**

PwC
Big Data: A new way of doing business

How can Big Data help?

Effectively used, Big Data can transform data into insights and intelligence, delivered when and where they’re needed to make and implement better strategic and operational decisions.

What types of data does Big Data encompass?

**Structured** data refers to information with a high degree of organization, such that inclusion in a relational database is seamless and readily searchable by simple, straightforward search engine algorithms or other search operations.

**Unstructured** data refers to information with a low degree of organization. Usually refers to information that doesn’t reside in a traditional row-column database or does not have a pre-defined data model.

**Demographic** data may tell you your target customer is male, married, between ages 35 to 45 and makes on average $100,000 per year.

**Psychographic** data may show you your customer prefers road trips over cruises and is afraid of flying.

Big Data market growth

- $5.1 billion (2013)
- $32.1 billion (2015)
- $53.4 billion (2017)
The 3 Lines of Defense

- **1st Line of Defense**: Control Design & Implementation
- **2nd Line of Defense**: Risk and Compliance Oversight
- **3rd Line of Defense**: Independent Assurance

**Level of Risk**

- Senior Management
- Risk
- Compliance
- Internal Audit
- External Audit
- Regulator

**Management Controls**

- Governing Body/Board/Audit Committee
- Senior Management

**Risk and Compliance Oversight**

- Control Design & Implementation
- Risk
- Compliance

**Independent Assurance**

- External Audit
- Regulator