Please complete an anonymous Research Survey

INFORMED CONSENT

• **Description**: The purpose of this research is to inform university curricula on the data analysis needs of Midwest employers. Your participation is greatly appreciated.

• **Benefits and Risks**: We will aggregate and report our findings, which may provide helpful insight into the data analytics practices of businesses in our community. There are no risks associated with this research.

• **Voluntary & Confidential**: All information is reported anonymously in summary form; individuals will not be identified. Participation is voluntary and will remain confidential. To withdraw, please do not return survey form.

• **Informed Consent**: By your completing this survey, you are giving your consent to collect this information for anonymous, research purposes.

**Researchers**: Contact us, if you have any questions about the research project:

• Dr. Pamela J. Schmidt, Washburn Univ., [pamela.schmidt@washburn.edu](mailto:pamela.schmidt@washburn.edu), Ph: 785-670-2052

If you are willing to assist us in our research after reviewing consent above, please complete the following survey – online by PC or by Smartphone.

**Survey Link**: [https://tinyurl.com/y95h243p](https://tinyurl.com/y95h243p)
Why Care about Data Analytics (aka, Big Data)?

At Corporate level:
• Business moves fast, must be Agile, Responsive to change
• Competitors are learning to find value in Data

As Managers:
• Business leaders make decisions:
  ❖ Evidence-Based Decision Making
• Seek new business opportunities
  ❖ Discovery patterns, trends and insights

In Own Profession:
• Seek opportunity, advancement
• Avoid obsolescence
Data Analytics: Approaches & Resources

Topics
1. What is ‘Big Data’ and Data Analytics
2. Directions in Business and Accounting Analytics
3. What can auditors expect?
4. How can Auditors prepare, and participate?
5. Data Analyst: Business, Technical Skills & Communication skills
6. Data Visualization

Historical View: Dawn of new “Data Analysis Age”

Image from ACCA & IMA “Big data: its power and perils” Nov. 2013. Access at: www.accaglobal.com/futures
IMA®: Institute of Management Accountants and is the association for accountants and financial professionals in business. ACCA is the Association of Chartered Certified Accountants and is the global body for professional accountants.
Past Paradigm: Financial Information, Internal view
Analytics Paradigm: Diverse Views Inform Business

Data used in Businesses:
per Dr. Barry Devlin, 9sight Consulting

“Up until the late 1990s, Data used in business originated internally from operational applications built by IT according to predefined business requirements…”

Today, much of the information used by business no longer originates internally
Today, much of the information used by business no longer originates internally.

Global Impact of Big Data

From ACCA & IMA “Big data: its power and perils” Nov. 2013. Access at: www.accaglobal.com/futures
Definition of Data Analytics

What is Data Analytics?

Data analytics refers to qualitative and quantitative techniques and processes used to enhance productivity and business gain.

- Data is extracted and categorized to identify and analyze behavioral data and patterns
- Analysis techniques vary according to organizational requirements.
  - Trend and pattern visualizations
  - Statistical analysis
  - Model building and fitting

Definition from Techopedia
https://www.techopedia.com/definition/26418/data-analytics

Different Analytical Methods for Different Data: Examples

<table>
<thead>
<tr>
<th>What is the change in risk profiles by age group over the past 6 months?</th>
<th>What is the typical path to purchase for a policy with increased deductions?</th>
<th>What can text based service forms tell us about potentially larger safety issues?</th>
<th>How many customers that called Customer Service expressed a frustrated tone of voice?</th>
<th>Which customers are highly influential on social media and regularly post about our claims service?</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL ANALYTICS</td>
<td>PATH / TIME SERIES ANALYTICS</td>
<td>TEXT ANALYTICS</td>
<td>RICH MEDIA ANALYTICS</td>
<td>GRAPH ANALYTICS</td>
</tr>
</tbody>
</table>
Four Types of Data Analytics to Improve Decision Making

1. **Descriptive** analytics.
   - answers the question of “what” happened.

2. **Diagnostic** analytics.
   - historical data can be measured against other data, to uncover “why” something happened.

3. **Predictive** analytics:
   - “what is likely” to happen.

4. **Prescriptive** analytics
   - Indicates recommendations or “best course of action”.

**Major difference between predictive and prescriptive:**
- Predictive analytics forecasts potential future outcomes, while
- Prescriptive analytics helps you draw up specific recommendations
View of IMA and ACCA: New Professional Hybrids

• ‘Big data analysis’ can offer accountants and finance professionals the possibility of reinvention, the chance to take a more strategic, “future-facing” role in organisations,’ says Faye Chua, ACCA’s head of future research.

• ‘It means that accountancy and finance professionals will need to bridge the gap between the IT department (that traditionally manages data and tools) and the business (that needs insight to improve processes and develop new products),’ says Davis.


Careers in Business: Changing Rapidly, Requiring Data Analysis Skills

Big Data accelerates the process by which business reimagines itself, ... so the accountancy and finance professions will have to start to reinvent themselves.

From ACCA & IMA “Big data: its power and perils” Nov. 2013. Access at: www.accaglobal.com/futures
Big Data presents opportunities and challenges to the accounting and finance profession. Examples include:

<table>
<thead>
<tr>
<th>Area</th>
<th>Opportunity</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Valuation of data assets</td>
<td>Helping companies value their data assets through</td>
<td>Big data can quickly ‘decay’ in value as new data becomes available</td>
</tr>
<tr>
<td></td>
<td>the development of robust valuation methodologies</td>
<td>The value of data varies according to its use</td>
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<tr>
<td></td>
<td>Increasing the value of data through stewardship and</td>
<td>Uncertainty about future developments in regulation, global governance</td>
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<td></td>
<td>quality control</td>
<td>and privacy rights and what they might mean for data value</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Use of big data in decision making</td>
<td>Using big data to offer more specialised decision-making support in real</td>
<td>Self-service and automation could erode the need for standard internal</td>
</tr>
<tr>
<td></td>
<td>time</td>
<td>reporting</td>
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<td></td>
<td>Working in partnership with other departments to</td>
<td>Cultural barriers might obstruct data sharing</td>
</tr>
<tr>
<td></td>
<td>calculate the points at which big data can most</td>
<td>between silos and across organisational boundaries</td>
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<tr>
<td></td>
<td>usefully be shared with internal and external</td>
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<td></td>
<td>stakeholders</td>
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<tr>
<td>3. Use of big data in the management of</td>
<td>Expanding the data resources used in risk forecasting to see the</td>
<td>Ensuring that correlation is not confused with</td>
</tr>
<tr>
<td>risk</td>
<td>bigger picture</td>
<td>causation when using diverse data sources and</td>
</tr>
<tr>
<td></td>
<td>Identifying risks in real-time for fraud detection and</td>
<td>big data analytics to identify risks</td>
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<td></td>
<td>forensic accounting</td>
<td>Predictive analytic techniques will mean changes to</td>
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<td></td>
<td>Using predictive analytics to test the risk of</td>
<td>budgeting and return on investment</td>
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<td>longer-term investment opportunities in new markets and</td>
<td>calculations</td>
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<tr>
<td></td>
<td>products</td>
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</tbody>
</table>

Big Data Analysis: What is Big Data?

The ‘3V’ model of big data:

- **Volume**: Terabytes, records, transactions, tables, files
- **Velocity**: Batch, near time, real time, streams
- **Variety**: Structured, unstructured, semi-structured

Big Data Analysis: What is Big Data?

4th “V”
Veracity (Validity)


Four V’s of Big Data
Four V’s: Data Types at High Volume and Velocity

1. **Volume**: Massive data scale, Unstructured data growing exponentially
2. **Velocity**: Rapid data flow and dynamic data systems
   - Seek real-time analysis, automated
3. **Variety**: Diverse Data Types:
   - 90% of new data will be unstructured: email, files, images, videos, IoT data streams
4. **Veracity**: Judging the accuracy or truthfulness of data without context
   - Social Media posts – social desirability, posing, self-reports
Four V’s of Big Data

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5. **5th “V”**

How will organizations leverage **Big Data** to derived **VALUE**?

---

**IoT** = “**Internet of Things**” is a system of interrelated computing devices, mechanical and digital machines or objects that have the ability to transfer data over a network without human-to-human or human-to-computer interaction.
Add:
Variability
Visualization
Change to Analytics Mind: Different Point of View

Application / Process Centric
- Define known data
- Define access and output
- Model for performance
- Collect data
- Transform and Store

Data / Analytic Centric
- Identify subject area
- Model data for relationships
- Collect and store data
- Access and cast for output
- Optimize performance for often run analytics based on business value
Analytical Architectures Evolution:

**The Data Mart Era**  
(application focused)

“Just Give Me Any Old Data – And Fast!” (Never our advocated approach!)

**The ERP Era**  
(process focused)

Collect all of our Business Data in one place.  
“Give me integrated, high quality data that enables me to optimise integrated business processes.”

**The Logical Data Warehouse Era**  
(data and analytic focus)

“Centralise the data that are widely re-used and shared - but integrate all of the data and the analytics.”

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Data Analytics Eco-System: Data Governance and Data Management

*Ecosystem data organization concepts and data zones*

Ask Business Question: Answers ‘Informed’ by Data using Analytic Methods

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© 2017 Teradata
### Characteristics of Data: What Will Accountants Use?

<table>
<thead>
<tr>
<th>Example</th>
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<td>Low-?</td>
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<td>Well Defined</td>
<td>Known</td>
<td>Unstructured, Changing</td>
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<tr>
<td>Modeled</td>
<td>On Write</td>
<td>As needed</td>
<td>On Read</td>
</tr>
<tr>
<td>Usage</td>
<td>Reports, KPI</td>
<td>Monitor, Analysis</td>
<td>Discovery</td>
</tr>
<tr>
<td>Scope</td>
<td>Corporate</td>
<td>Department, System</td>
<td>Individual→Society</td>
</tr>
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### Big Four Audit Firms’ Perspective: Transformation and Automation of Audit Function

- Continuous Audit of all data is now technically possible
- Goal: Reducing cost and staff
- Traditional Audit staff reduced
- New audit functions:
  - Data Analysis
  - Modeling
  - Predictive Analytics
  - New means of risk assessment and risk mitigation
  - ....
Audit Data Analytics: Consider ‘Refresh’ of Internal Audit

Deloitte’s Model:
Internal Audit (AI) Analytics

Source: Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”
Audit Data Analytics: Consider ...

Deloitte’s Model:
Internal Audit (AI) Analytics

1. Multidisciplinary, insights-driven audit approach
2. Core IA professionals working with:
   • data science and analytics professionals
   • calling on subject matter specialists
3. Co-developing scope, risk objectives, and approach for the internal audit
4. Internal auditors enhance effectiveness of the analytics.

Source: Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”

Refreshing the Audit Approach: Embedding Analytics

Source: Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”
Refreshing the Audit Approach: Embedding Analytics

Traditional Audit Steps
- Confirm audit objectives/scope
- Develop enhanced audit scope
- Audit commences
- Test key hypothesis
- Communicate results

Integrated Data Analysis steps
- Identify potential analytics
- Extract transform, and load data
- Analyze data; compare, profile, visualize
- Brainstorm with audit team and develop testing hypothesis
- Audit sampling, continue to support and iterate on hypothesis
- Visualize and story board results

Source: Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”
**Refreshing the Audit Approach: Embedding Analytics**

Benefits of this “Enhanced, Insights Driven Audit Methodology”

1. Perform same audit faster
   (develop key insights before field work, targets focus on important risks)

2. Perform same audit cheaper
   (more focused audit, while testing 100% of population)

3. Perform better Audits
   (Combine internal and external data for richer, more granular insights)

4. Expand skill-set with data analysis & data science
   to enhance, automate and continuously improve audit process

**Source:** Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”

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**Careers in Business & Accounting:**
Changing Rapidly, Requiring Data Analysis Skills

From ACCA & IMA. “Big data: its power and perils” Nov. 2013. Access at: [www.accaglobal.com/futures](http://www.accaglobal.com/futures)
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Data Analytics Competency Model:

Technical and Analytical Skills

- **Technical & analytical**
- Testing & validation: Defining, developing, and implementing quality assurance practices and procedures for technical solutions and validating hypotheses.
- SQL querying: Querying and manipulating data to facilitate the solving of more complex problems.
- Data modeling: Structuring data to enable the analysis of information, both internal and external to the business.
- Data analytics: Valuating data using analytical and logical reasoning for the discovery of insight, e.g. predictive modeling.
- Reporting software: Understanding of the underlying theory and application of key reporting software.
Data Analytics Competency Model:

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Business and Communication Skills

- Business & communication
  - Technology alignment
    - Understanding how technology can be leveraged to solve business problems.
  - Macro-perspective
    - Understanding of the company's business strategy, current business issues and priorities and current industry trends.
  - Business knowledge
    - Understand of business measurement of key performance indicators and business frameworks.
  - Business commentary
    - Articulation of insight to explain current and forecasted trends, their impact and opportunities for the business.
  - Soft skills
    - Communication and interpersonal skills are necessary to articulate insight gained from analysis.

Source: Deloitte “Internal Audit Analytics: The journey to 2020 - Insights-driven auditing”, Figure 3.
Big Data presents opportunities and challenges: Some Examples

1. Fraud Detection
2. Valuation of Assets
3. Management of Risk
4. Evidence-Based decision making

Data Analytics: Use in Fraud Detection
PWC Malaysia, Consulting Leader: Sundara Raj

Big Data opens up possibility of instant fraud detection and live (real-time) auditing
• Has Forensics group specializing in big data analysis
• Team creates a visualization from variety of data sources: documents, emails, text, and social media.

Big Data opens up possibility of instant fraud detection and live (real-time) auditing

- Has Forensics group specializing in big data analysis
- Team creates a visualization from variety of data sources: documents, emails, text, and social media.

- See concentrations of potential fraud
  - Example: social network of possible collusions – cross segregation of duties
  - Example: analyze emails for statements which may subvert internal controls

- Identify anomalies, unexpected patterns
- Automation to increase response time from months or weeks to days

Data Visualization to focus on potential Fraud
A closer look at the Business spend

Visual Cues to Convey Message: “Big Data Dashboard”

Drill-downs into departmental level spend help to give context to this issue.
Some Key Thoughts....

• Knowledge needed to perform Data Analytics?
  • Logic and critical thinking skills
  • Business Data Statistics
  • Relational Database experience
  • Exposure to Multiple Data types
  • Skills with multiple data analysis tools
  • Ability to synthesize information, communication skills,
  • “Tell a story with data”

• Can One Person know and do it all?
  • Usually team-based, exploring and evolving

Gartner’s Magic Quadrant 2018:
Analytics and Business Intelligence Platforms
Business Intelligence and Data Visualization Software Leaders

- Microsoft Excel with plug-ins (or standalone in “Power BI”)
- Tableau – Data Manipulation and Visualization
- Qlik View
- Sisense
- SAP Lumira
- SAS Business Analytics (Predicative Analytics)
- IBM Business Analytics

CRISP-DM*: Reference Model

CRoss-Industry Standard Process for Data Mining:

Data mining process: 6 iterative phases
1. Business understanding
2. Data understanding
3. Data preparation
4. Modeling
5. Evaluation
6. Deployment

Technology Competencies

Build your Analytics and Technology Foundation

1. Understand and use new data types from new data sources
2. Gain Data management skills: ETL: Extract/Acquire, Transform/Cleanse, Load
   - Data Governance
   - Structuring Big Data Collections: Data Warehouse, Data Lake, ...
   - Cost/Benefit of data management
3. Gain Modeling skills
   - New DIY tools: Visualization, Modeling, Statistical Analysis, ...
   - Programming support: Python, Open Source (R, Go) and collection of Big Data sets (Internal data paired with External)
4. Get experience with Data Analysis Tools

Technology Competencies

Build your Analytics and Technology Foundation, and keep building it!

Technical Skills Needed:

- Data Governance, Policy and Leadership
- Critical Thinking: Identify key question, match to data and methods to illuminate that Question.
- Programming skills
- Database knowledge (of several types of databases, data warehouse, Non-SQL database, ...)
- Statistical analysis tools and methods
- Data mining concepts and practices
- Advanced and emerging technology:
  - Artificial Intelligence, Machine Learning, Neural Networks,
Data Visualization

• The process of displaying data to provide insights that will support better decisions.
• Examples:
  • Data Visualization software
  • Dashboards
  • Story boards
Example:
Where Customers in States without Dillard’s Stores Shop

RM is Outperforming Retailer with Higher Promotional Sales Growth ($70M)
Big 4 and IMA Perspective: Key Challenges

Growing Demand for Data Analysis in job roles:
- To be competitive, Companies must leverage wealth of information
- Using new approaches, new tools and non-financial data
- Want to base business decisions on ‘Data as evidence”, fact-based
- Data Analysis is often exploratory
- No ‘one right answer’

For Practicing Accountants in this Evolving Profession: Practical Advise
- Focus on one new data type, and one new suitable skill
- Learn to match a Business Question with informative data and analysis
- Develop “Comfort with Ambiguity” and a more Exploratory Mindset
- Take time to embark on less structured, exploratory activity
Concluding Insights

**Biggest analytic gap in the job market**
- Finding analytics skills, building a team with diverse skills and backgrounds
- Do analysis and create the message to make the data come alive.

**Advice on what knowledge/skills accountants need for data analytics?**
- Critical analysis abilities, know the business, learn about data and tools
- No one tool is the solution and that tools constantly change.
- You need to understand how data is operated upon with tools.
- Understand the overall data analysis process
  - Problem seeking, match available data to inform business problem

**BIG POINT: Build on your strengths and interests!**
Excel has extensions – PowerBI is a data manipulation and visualization tool.
Free online training, try other tools

*What part of this talk did you found most interesting? Investigate that...*
Data Analytics – THE “Good News”

Diversity of Skills for Data Analytics:
  Pick an area and expand your skills and toolset
Applies Critical Thinking, Logic, & Problem Solving
  Use these abilities on the job now
Concepts and skills in High Demand in Job Market:
  Garner support from employers, if you are interested
  Extends existing hardware & software platforms, or cloud computing
Tools and Data:
  Some free tools, online training and public data sets available

In Summary: The ‘Eating an Elephant” problem:
  Parts all look different, start and approach small step at a time

Audience Questions?

Using it is the hardest part.
Growing Demand for Data Analysis skills in Business

“I’m looking for a strategy to leverage our core competencies with big data across multiple synergized paradigms. Or something that rhymes. Either way.”

IIA Chapter, Topeka KS - Feb. 5, 2019

Pamela J. Schmidt, PhD.
School of Business, Washburn University
Pamela.Schmidt@Washburn.edu