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Tax Data Analytics Additional Information



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What is Tax Data Analytics?

"Tax data analytics" is data and analytics applied to the tax domain. But let's first step back and understand what "data analytics" is independent of our (tax) application area. [According to Investopedia](#), data analytics is: "... the science of analyzing raw data in order to make conclusions about that information. Many of the techniques and processes of data analytics have been automated into mechanical processes and algorithms that work over raw data for human consumption."

4 types of data analytics:

1. Descriptive analytics describes **what** has happened over a given period of time.
2. Diagnostic analytics focuses more on **why** something happened. This involves more diverse data inputs and a bit of hypothesizing. Did the weather affect beer sales? Did that latest marketing campaign impact sales?
3. Predictive analytics moves to **what is likely going to happen** in the near term. What happened to sales the last time we had a hot summer? How many weather models predict a hot summer this year?

4. Prescriptive analytics suggests a course of action. If the likelihood of a hot summer is measured as an average of these five weather models is above 58%, we should add an evening shift to the brewery and rent an additional tank to increase output."

Gartner describes the 4 types graphically. Note the relationships:

How can we
make it happen?



Data analytics also includes cleansing and transforming all kinds of "soft" and "hard" data, such as customers' comments about products and services and sales data by quarter. Data analytics also goes by lots of names, including big data

analytics, data science, data mining, and business intelligence – but they all refer to how companies leverage qualitative and quantitative data to make better decisions.

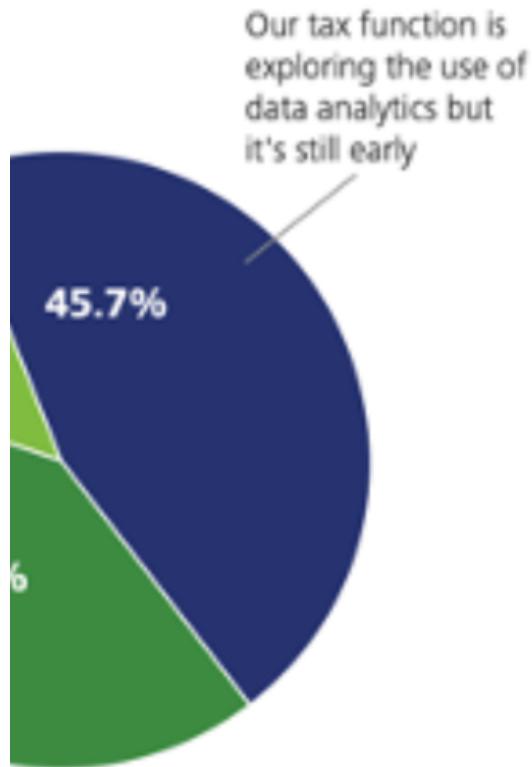
Application of Data Analytics

Applications of data analytics are everywhere. Here's a list of application areas:

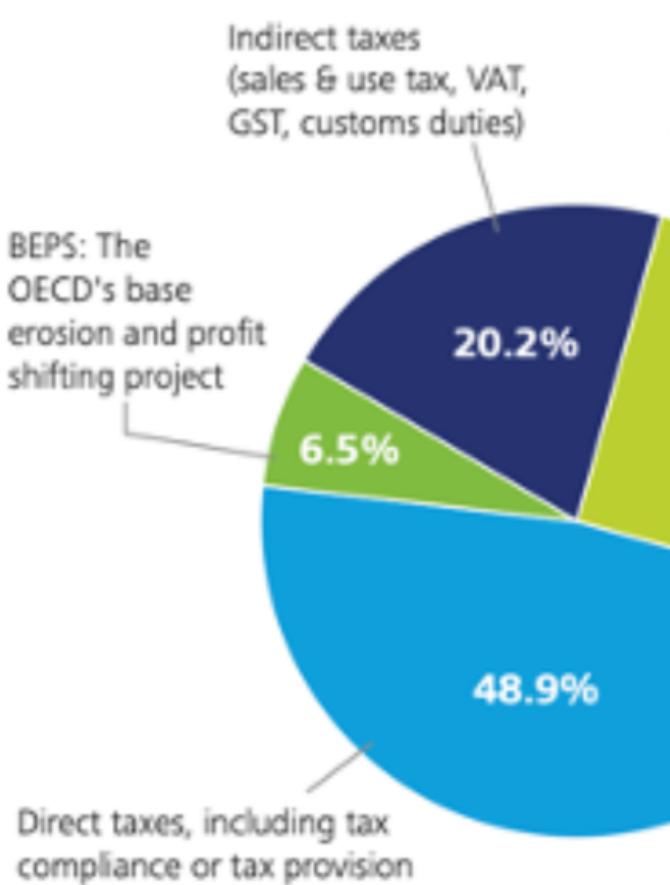
<p>Market analysis customer and analytics targeting ntations</p>	<h3>Finances & Frauds Services</h3> <ul style="list-style-type: none">❖ Compliance and regulatory reporting❖ Risk analysis and management❖ Fraud detection and security analytics❖ Credit risk, scoring and analysis❖ High speed arbitrage trading❖ Trade surveillance❖ Abnormal trading pattern analysis	<h3>Web and Media</h3> <ul style="list-style-type: none">❖ Large-scale clickstream analysis❖ Ad targeting, placement and optimization❖ Abuse and click-fraud detection❖ Social graph analysis and user segmentation❖ Campaign management and personalization
<p>ences optimization gram analysis y supply- ment analysis</p>	<h3>Telecommunications</h3> <ul style="list-style-type: none">❖ Revenue assurance and price optimization❖ Customer churn prevention❖ Campaign management and customer loyalty❖ Call detail record (CDR) analysis❖ Network performance and optimization❖ Mobile user location analysis	<h3>E-commerce</h3> <ul style="list-style-type: none">❖ Cross-channel marketing and personalization❖ Event analytic and fraud detection❖ Recommendation engines and user segmentation❖ Right offer at the right time❖ Next best offer and upselling

But the key for Vertex is the application of data analytics to tax. [Deloitte asks the right questions:](#)

What describes your tax function's focus?



Are you using tax analytics to address tax areas? Choose your top area in



There are opportunities here as the tax industry adopts data analytics. The key is the identification of the right data, models and application areas – [as identified by Deloitte:](#)





Tax data analytics can bring huge amounts of data to analyze every aspect of the tax process. Tax dashboards can be developed to track and predict transactions. Techniques like data visualization can be used to inform tax processes and analyses and to optimize tax infrastructures.

Data analytics is experiencing a new level of effectiveness due to our ability to gather, clean, and integrate data, analyze it in real time and describe, explain, predict and prescribe tax events. The integration of data and the application of emerging technologies makes tax ripe for application. The opportunities are endless – as our competitors are also discovering.

Data Analytics Methods, Tools & Techniques

The data analytics field is surrounded by all sorts of methods, tools and techniques. Understanding the range and power of these methods, tools and techniques is essential to the successful design and development of tax data analytics applications at Vertex.

So what do they include? Note that the methods, tools and techniques are organized, integrated and applied around the four major types of data analytics which include descriptive, diagnostic, predictive and prescriptive analytics.

For descriptive analytics, where the objective is to understand what's happening, some methods, tools and techniques include the basic statistical techniques that enable the collection, organization and presentation of data about a company's processes and activities. In a real sense, descriptive analysis enables diagnostic, predictive and prescriptive analytics. Some of these methods, tools and techniques include central tendency, dispersion measures, mean, median, mode and standard deviation. Uni-variate analysis which describes the distribution of one variable feeds bivariate and multivariate

descriptive analysis which involves the relationships between and among variables expressed as cross-tabulations, scatterplots, contingency tables, correlation and covariance, among other data relationships. Note that all of these methods, tools and techniques have been available in software packages for decades, so there's no reason to think about actually calculating any of this manually.

For diagnostic analytics, there are methods, tools and techniques that enable the examination of relationships among variables including the analysis of variance, correlation, factor analysis and time series analysis.

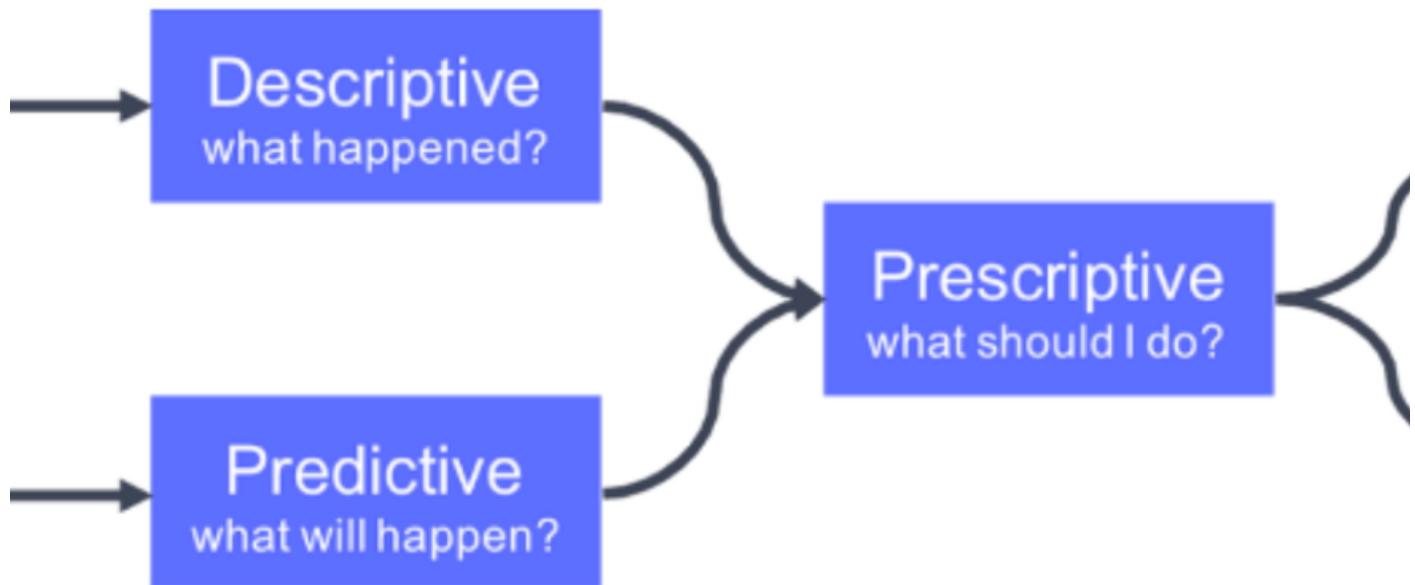
Much of the analysis that diagnostic analytics enables falls under the category of "data mining," which assumes the development of "data lakes" where qualitative and quantitative data lives. It's here that data analytics professionals use online analytical processing (OLAP) tools. Some of the most popular methods, tools and techniques include clustering, pattern detection, correlation and regression. Again, all of these methods, tools and techniques are easily available from lots of software applications such as Tableau, QlikView and statistical platforms like R, SPSS, MATLAB and Mathematica.

The methods, tools and techniques **for predictive analytics** up the game. They're intended to forecast events and conditions enabled by all of the data analytics methods, tools and techniques. Note that the 4 types of data analytics build upon each other. Predictive analytics represents the half-way point (followed by prescriptive analytics). Some of the methods, tools and techniques include linear regression models, logistic regression, probit regression, decision trees, discrete choice models, random forests, time series models and machine learning.

For prescriptive analysis, the methods, tools and techniques include many of the methods, tools and techniques we use for diagnostic and especially predictive analytics, including linear programming, sensitivity analysis, goal programming, nonlinear programming, optimization heuristics, simulation modeling, integer programming and machine learning.

So how does it all work? Data analytics requires data which is collected, cleaned and organized in enabling ways. The real work starts here. Structured and unstructured data is deposited in data lakes and data warehouses which enable descriptive, diagnostic, predictive and prescriptive analytics.

Here's the big picture ([from Customer THINK](#)) that summarizes data analytics:



Over Broadway

Conducting Data Analytics Projects

[The steps necessary to implement analytics projects include:](#)

1. Understand the Business Objective

Identify the key objectives that the business is trying to achieve ... examine the overall scope of the work ... the stakeholders are seeking.

1. Data Acquisition, Understanding & Exploration

Identify various data sources which could be logs from web servers, social media

data, data from online repositories, data streamed from online sources via APIs, web scraping, or data that could be present in ... excel or can come from any other source. What makes a great data project is mixing and merging data from as many data sources as possible.

1. Data Cleaning & Preparation

To perform any analytical activity on any data it needs to be in a structured format. This step is known as Data Cleaning or Data Wrangling.

1. Data Modeling

Build models to test your data and seek out answers to the objectives. Using different statistical modeling methods, determine which is more suitable for your data. Common models include linear regressions, decision trees, and random forest modeling, among others.

1. Validation & Interpretation

Ensure that data is properly validated and interpreted. Did the models work properly? Does the data need more cleaning? If not, you may need to go over the previous steps again. The interpretation of data is designed to help people make sense of numerical data that has been collected, analyzed, and presented.

1. Model Deployment & Visualization

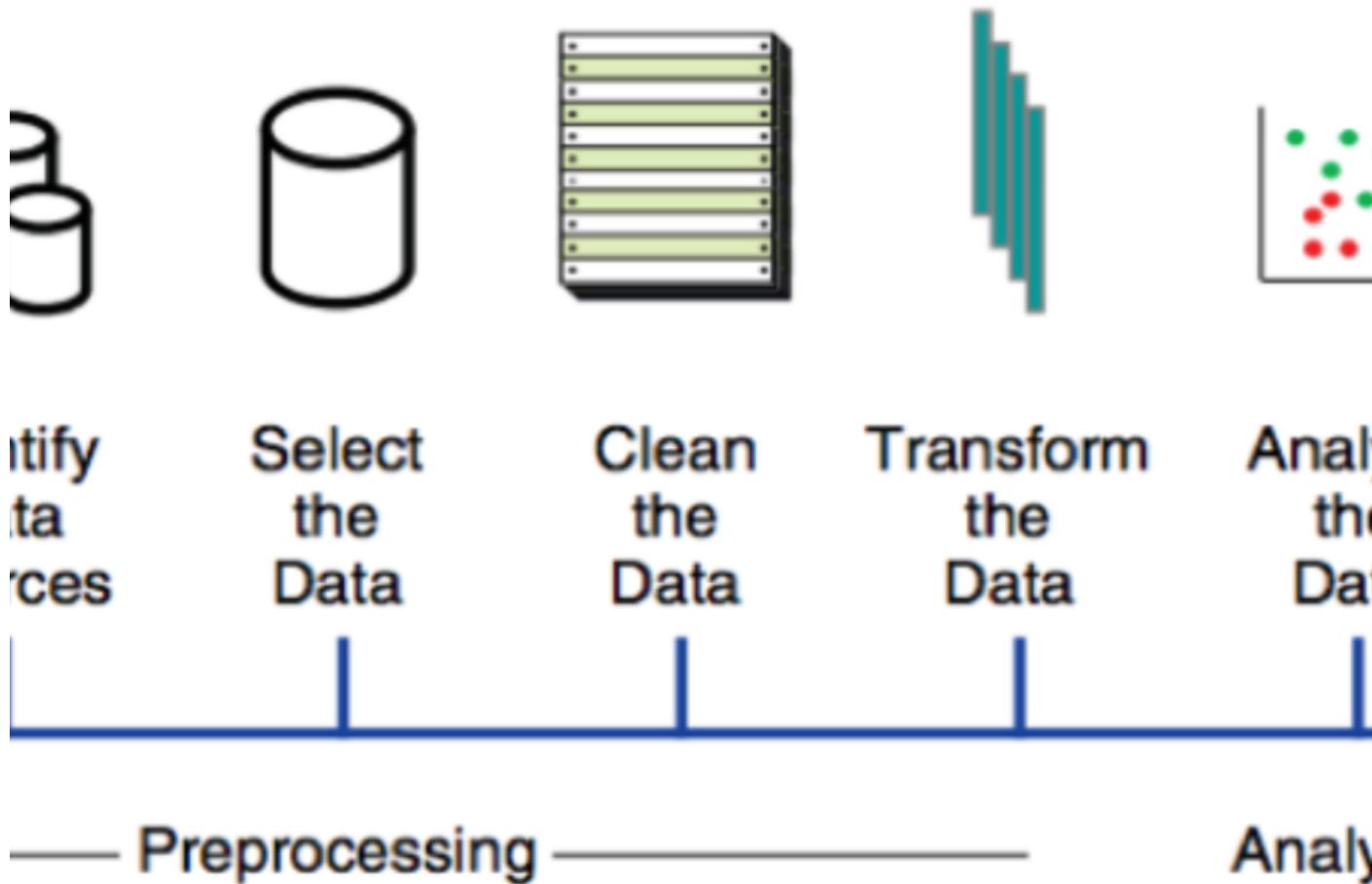
When you're dealing with large volumes of data, visualization is the best way to explore and communicate your findings."

Summary

As you can see, data is a huge part of any analytics project. Without the right data, the project will fail. Stakeholder support is also critical. Knowing which analytical method to select is another key competency. As the following figure indicates, "pre-processing" consumes most of the project's time and resources, but the payoff comes from data analysis using a variety of methods, tools and techniques. Increasingly, artificial intelligence and machine learning are driving the analysis process. AI and machine learning is one of the six emerging

technology baskets in our sights.

SAS uses the following graphic to talk about the analytics priceless model



Major Data Analytics Vendors

There are a huge number of data analytics vendors. Here's a [picture of the vendor landscape](#):

Vertical Apps



PREDICTIVE
POLICING



bloom**reach.**
GET FOUND.

Providers



Operational Infrastructure

COUCHBASE

TERADATA

10gen | the MongoDB company

HADAPT

Business Intelligence

ORACLE | Hyperion®



Microsoft | Business Intelligence

IBM COGNOS

Sas **MicroStrategy**

GoodData

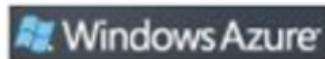
Stru

OR

My



Infrastructure As A Service



Data Analytics Start-up Activity

The analytics space is constantly evolving. The amount of IR&D, corporate venture capital and private equity venture capital spending in data

science, big data, data analytics and related areas is huge – and growing every year. [Crunchbase](#), among other sources, report that hundreds of billions of dollars are invested in big data analytics start-ups every year. In [predictive analytics](#) alone, there are hundreds of new companies. There are a few – [like Sota Solutions, Prog-nostic, Terracotta and Prevedere](#) – that deserve special attention. [VentureBeat](#) reports lots of others. The [leading data analytics companies are listed everywhere](#).

Tracking investments in data analytics start-ups is informative and important. We know that AI and machine learning methods, tools and techniques are the focus of today's investments in data analytics. [But there are other methods, tools and techniques receiving special attention:](#)

- NoSQL Database
- R Programming
- Data Lakes
- Predictive Analytics
- Apache Spark
- Prescriptive Analytics
- In-memory Database
- Blockchain
- Hadoop Ecosystem Tracking this activity can inform efforts for piloting emerging technology within the data analytics family.

Sources

- [Data Analytics: What It Is, How It's Used, and 4 Basic Techniques](#)
- [What is Data Analytics? - Definition from WhatIs.com](#)
- [Data analysis](#)
- [Big Data Analytics: What it is and why it matters](#)
- [Big Data Analytics: What it is and why it matters](#)
- [Big Data Analytics: What It Is, How It Works, Benefits, And Challenges](#)
- [Predictive analytics](#)
- [Prescriptive analytics](#)
- <https://www.investopedia.com/terms/p/predictive-analytics.asp>

- [Top 10 Predictive Analytics Tools & Software, By Category | TA](#)
- https://www.amazon.com/s?k=Data+Analytics&i=specialty-aps&srs=13270229011&ref=nb_sb_noss_2
- https://scholar.google.com/scholar?q=Machine+Learning+%26+Data+Analytics&hl=en&as_sdt=0&as_vis=1&o_i=scholart

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